HUMMOCK HILL ISLAND DEVELOPMENT
ENVIRONMENTAL IMPACT STATEMENT
VOLUME 1

NOVEMBER 2007

ML Design architects planners interior designers

Cardno Shaping the Future

GHD

SINCLAIR KNIGHT MERZ SKM

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Great Barrier Reef Marine Park Authority

Data Layer	Currency
Dugong Sanctuary	During project

Department of Primary Industries

Data Layer	Currency
Nationally Important Wetlands	Supplied 07/2007
Queensland Wetlands	Supplied 07/2007
Fish Habitat Areas	Supplied 07/2007
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Internal Data Sets

Data Layer	Currency
Soils	During project
Cultural Heritage	During project

The following sub-consultants contributed data to this project:

Central Queensland University

Data Layer	Currency
Flora and Fauna Survey Locations	Supplied 07/2005

ML Designs

Data Layer	Currency
Precinct Plan	During project
Development Footprint	During project
Concept Plan A 2004	During project
Concept Plan B 2004	During project
Master Plan C 2005	Supplied 02/2005
Master Plan H 2005	Supplied 01/2006

Cardno

Data Layer	Currency
Catchments	Supplied 08/2007
Flow Routes	Supplied 08/2007
Stormwater Drainage	Supplied 08/2007

Tod Group and AGC WWC

Data Layer	Currency
Development Plan Circa 1993	Supplied 1993
Bore and Groundwater Data	Supplied 1993

QASCO

Data Layer	Currency
Contours	Supplied 10/2006

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List of Abbreviations

µg	microgram (one millionth of a gram)
AADT	Average Annual Daily Traffic
ABS	Australian Bureau of Statistics
ACH Act	*Aboriginal Cultural Heritage Act 2003*
ACMER	Australian Centre for Mining Environmental Research
AEMSC	Australian Explosives Manufacturer Safety Committee
AGCSA	Australian Gold Course Superintendents' Association
AGO	Australian Greenhouse Office
AHD	Australian Height Datum
ANZECC	Australian and New Zealand Environment and Conservation Council
ARI	Average Recurrence Interval
ARI	Annual Return Interval
ARMCANZ	Agriculture and Resource Management Council of Australia and New Zealand
AS	Australian Standard
ASC	Australian Soil Classification
ASFB	Australian Society for Fish Biology
ASMP	Acid Sulfate Management Plan
ASS	Acid Sulphate Soils
ASSMP	Acid Sulfate Soil Management Plan
AWQG	Australian Water Quality Guidelines
BA	Birds Australia
BCC	Brisbane City Council
BEMP	Best Environmental Management Practices
BOD	Biological Oxygen Demand
BoM	Bureau of Meteorology
BoM	Bureau of Meteorology
BPA	Environmental Protection Agency Biodiversity Planning Assessment
BPA	Biodiversity Planning Assessment
BZ	Buffer Zone
C, L, R	Consequence, Likelihood, Risk
Ca:Mg	Calcium: Magnesium ratio
CAMBA	China-Australia Migratory Bird Agreement
CG	Coordinator General of the Department of Infrastructure of the State of Queensland
CHMP	Cultural Heritage Management Plan
CHRIS	Coastal Habitat Resources Information System database
CLR	Contaminated Land Register
CO	Carbon Monoxide
CO_2	Carbon dioxide
CO_2-e	Carbon dioxide equivalents
CoG	Coordinator General

CQ	Central Queensland
CQU	Central Queensland University
CRC Reef	Cooperative Research Centre Reef
CSIRO	Commonwealth Scientific and Industrial Research Organisation
dBA	Decibels
DEH	Department of Environment and Heritage (now Department of Environment and Water Resources (DEW))
DEOs	Desired Environmental Outcomes
DEW	Department of Environment and Water Resources (Commonwealth)
DEWR	Department of Environment and Water Resources
DI	Department of Infrastructure (formally the Office of the Coordinator General)
DLGPSR	Department of Local Government, Planning, Sport and Recreation
DLGPSR	Department of Local Government, Planning, Sport and Recreation
DMR (also QDMR)	Department of Main Roads
DNRM	Department of Natural Resources and Mines
DNRW	Department of Natural Resources and Water
DO	Dissolved Oxygen
DoS	Degree of Saturation
DPA	Dugong Protection Areas
DPI&F	Department of Primary Industries and Fisheries
DSDTI	Queensland Department of State Development, Trade and Innovation
E, V, R, (NCA)	Endangered, Vulnerable and Rare under the Nature Conservation Act
EA	Environmental Authority
EHMP	Ecosystem Health Monitoring Program
EIL	Environmental Investigation Level
EIS	Environmental Impact Statement
EMP	Environmental Management Plan
EMR	Environmental Management Register
EP Act	Environmental Protection Act 1994
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Cth)
EPM	Exploration Permit for Minerals
EPP (Noise) 1997	*Environmental Protection (Noise) Policy 1997*
EPP (Waste) 1997	*Environmental Protection (Waste) Policy 1997*
EPP(Air) 1997	*Environmental Protection (Air) Policy 1997*
ERA	Environmentally Relevant Activity under the *Environmental Protection Act 1994*
ESCP	Erosion & Sediment Control Plan
ESD	Ecologically Sustainable Development
EV	Environmental Value
EVR	Endangered, Vulnerable or Rare listed species under the *Nature Conservation Act 1992* (Qld)
FHA	Fish Habitat Areas
GBRCMP	Great Barrier Reef Coastal Marine Park
GBRMP	Great Barrier Reef Marine Park

GBRWHA	Great Barrier Reef World Heritage Area
GP	Gross Pollutants
GSDA	Gladstone State Development Area
Ha	Hectare
HAT	Highest Astronomical Tide
HHI	Hummock Hill Island
HIL	Health-based Investigation Level
IAS	Initial Advice Statement
IDAS	Integrated Development Assessment System
ILUA	Indigenous Land Use Agreement
IPA	*Integrated Planning Act 1997*
IPCC	Intergovernmental Panel on Climate Change
IUCN	International Union for the Conservation of Nature
JAMBA	Japan-Australia Migratory Bird Agreement
Kg	Kilograms
kL	Kilolitre
LGA	Local Government Area
M	Metre
M, Ma (EPBC)	Migratory and Marine listed species under the EPBC Act
mAHD	Metres above Australian Height Datum
MDL	Mineral Development Licence
Mg	Milligrams
Mg/l	Milligrams per litre
MHHS	Mid-Holocene High Stand
ML	Megalitre
Mm	Millimetres
MR	Department of Main Roads
Mt (Air Quality)	Metatonnes
MUSIC	Model for Urban Stormwater Improvement Conceptualisation
NCA	*Nature Conservation Act 1992* (Qld)
NEPM	National Environmental Protection Measure
NES	National Environmental Significance as defined by the *Environmental Protection and Biodiversity Conservation Act 1999 (Cth)*
NHMRC	National Health and Medical Research Council
NLWRA	National Land and Water Resource Audit
NOC	Not of Concern species under the *Vegetation Management Act 1999* (Qld)
NOX	Oxides of nitrogen
NTA	*Native Title Act 1993* (Cth)
OC	Of Concern species under the *Vegetation Management Act 1999* (Qld)
PASS	Potential Acid Sulfate Soil
PCCC	Port Curtis Coral Coast
PIFU	Population Information and Forecasting Unit
PM	Particulate matter

QASSIT	Queensland Acid Sulfate Soils Investigation Team
QEPA or EPA	Queensland Environmental Protection Agency
QH Act	*Queensland Heritage Act 1992*
QUAKES	Queensland University Advanced Centre for Earthquake Studies
QUDM	Queensland Urban Drainage Manual
QWQG	Queensland Water Quality Guidelines
RCMP	Regional Coastal Management Plan
RE	Regional Ecosystem
RGMF	Regional Growth Management Framework
RTC	Rural Transaction Centre
RVMC	Regional Vegetation Management Code
SCMP	State Coastal Management Plan
SDA	State Development Area
SDPWO Act	*State Development and Planning Works Organisation Act 1971 (Qld)*
SLA	Statistical Local Area
SMP & SWMP	Stormwater Management Plan
SPP	State Planning Policy
SPTR	Standard Percolation Test Rate
SS	Suspended Solids
TA	Technical Advisors
TN	Total Nitrogen
TOFO	Traditional Owner Field Officers
ToR	Terms of Reference as described in Part 4 of the *State Development and Public Works Organisation Act 1971 (Qld)*
TP	Total Phosphorus
TSM	Total Suspended Matter
TSP	Total Suspended Particulate Matter
TSS	Total Suspended Solids
UN	United Nations
V (Ecology)	Vulnerable under the *Nature Conservation Act 1992* (Qld)
VMA or VM Act	*Vegetation Management Act 1999* (Qld)
VPD	Vehicles Trips per Day
VPH	Vehicles Trips per Hour
WBBRP (Social)	Wide Bay Burnett Regional Planning Unit
WMCP	Wetland Mapping and Classification Program
WQO	Water Quality Objectives
WSUD	Water Sensitive Urban Design
WWTP	Waste Water Treatment Plant

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Executive Summary

Project and Processes

Background to the Project

The proposed Hummock Hill Island project is a master planned integrated tourism and residential development to provide a high quality tourism destination for local and International visitors. The project will provide a carefully designed residential setting, with associated recreational facilities to cater for the increasing population of the Gladstone area. The project will consist of two resort hotels, a motel, camping grounds, holiday accommodation and residential development, golf course and associated sporting facilities, education precinct, a commercial and retail centre, and small scale commercial marine facilities.

On October 25, 2005, the Coordinator-General declared the project "*a significant project for which an EIS is required*" under Section 26(1)(a) of the State Development and Public Works Organisation (SDPWO) Act.

The project was referred to the Commonwealth Government and the Minister for the Department of Environment and Heritage (DEH)[1] under the provisions of the *Environmental Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act). The project was determined to be a "controlled action" by the Ministers delegate on 13 January, 2006. Controlling provisions under the EPBC Act were identified as: World Heritage, listed threatened species and communities and listed migratory species. The proposed development will therefore require Commonwealth approval under Part 9 of the EPBC Act.

The Island's coastal location lends itself to the concept of a master planned 21st Century village where residents and tourist live and interact in harmony with natural systems and are empowered to take responsibility for managing and limiting their own ecological footprint, minimising their impact on the environment. Management of water, wastewater and energy supply services will be controlled at the household and local community levels, taking advantage of a number of innovative technologies and supporting infrastructure that will reduce consumption of energy and resources. These systems have been successfully applied at the local level in the nearby towns of 1770 and Agnes Waters.

The Master Plan for the proposed Hummock Hill Island Development is presented in Figure 1.

The proposed development will provide public access to arguably the best beaches between 1770 and the Capricorn Coast. These beaches and surrounding waterways are currently only accessible to the general public by boat from Foreshores Estate to the south and the new Tannum Waters Estate on Wild Cattle Creek to the north. However, once the current access road is upgraded and the

[1] Now re-named the Department of Environment and Water Resources (DEW).

access bridge and public boat ramp are constructed residents and workers from Gladstone will be able to access the Island and surrounding waters in 45 minutes.

The Proponent

The proponent is Eaton Place Pty Ltd (ACN: 110 480 772). Principal shareholders of the proposed development of Hummock Hill Island are the Scarf and Hatsatouris' families from Sydney, NSW. Over the past 10 years their family companies and associated companies, have been responsible for major property developments in NSW, consisting of: shopping centres; home unit developments and commercial properties with a value of over $250 million.

Eaton Place Pty Ltd currently hold a Special Lease (SL)(SL 19/52155) over Lot 3 on FD841442 (1,163 Ha) located on Hummock Hill Island, 30 km south-east of Gladstone City on the Central Queensland Coast.

Objectives of the Project

In order to maximise outcomes for environmental, social and economic aspects of the project, the following development goals have been identified:

- Natural environment is maintained, protected and enhanced so that areas and features of conservation significance are retained and the human population can enjoy living in close proximity to, and in harmony with, the natural ecosystems of the Island and surrounding waters;
- Social environment will be based on a vibrant, dynamic and diverse community that has a strong environmental awareness and is committed to sustainable living and self development. Individuals and households will come to Hummock Hill Island seeking quality of life in its fullest sense and fulfilling educational and outdoor recreational experiences. Visitors will include residents of the region and will experience holiday and recreational opportunities focussed on family and outdoor activities; and
- Built environment will be appropriate to the scale of the development and the natural environmental setting. Infrastructure systems will be based on latest advances in sustainable living, but will be suitable for management and basic maintenance by the householders.

EIS Process

This Environmental Impact Statement (EIS) has been prepared under the *State Development and Public Works Organisation Act, 1971* (SDPWO Act) Project of State Significance Process to support an application for preliminary approval for a material change of use for the proposed land on Lot 3 on FD841442.

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Figure 1 - Hummock Hill Island Master Plan

HUMMOCK HILL

EATON PLACE Pty ltd

JOB NO: 4489-01-C 15/11/07 A-MP-00-03(F) SCALE: 7500 @ A0 0 50 100 200 300 600

MLDesign architects planners interior designers

The EIS contains the most significant and relevant information available to decision-makers when considering approvals for the Project, although it will not avoid the need for Eaton Place Pty Ltd to provide all information required under the relevant legislation for individual approvals. Primarily, the EIS:

- describes the existing environmental, social and economic conditions likely to be affected by the Project ;
- describes the need for the Project, nature of the Project, and its potential environmental, social and economic impacts, both beneficial and adverse;
- assesses the significance of potential environmental, social and economic impacts and proposes acceptable standards and levels of impact;
- suggests measures to mitigate or avoid any significant adverse impacts; and
- describes the outcomes of consultation with stakeholders about the Project.

Project Approvals

Although the project has been declared a Significant Project, this 'status' does not negate the legislative requirements to obtain all relevant planning and environmental approvals under State or Commonwealth legislation. The proposed Hummock Hill Island development will require a range of approvals during the detailed planning and design stages. A summary list of required approvals is provided in Section 1.7 of the EIS.

Consultation Process

Preparation of the EIS has involved a public consultation and communication process involving a range of key stakeholders, agencies and community members. Consultation has engaged 'affected persons' (which comprise near neighbours to the project and surrounding communities) and 'interested persons', as defined within the *Environment Protection Act 1994* (EP Act).

Consultation Issues and Outcomes

During the period the EIS was being prepared, approximately 2,900 community stakeholders were registered on the consultation database and 133 feedback forms were received and processed from the public. The outcomes of the engagement process also included identification of the top 20 community issues (detailed in Appendix A5 of the EIS) and numerous specific technical issues. Issues raised were considered in the EIS.

The key environmental issues of concern raised by the community regarded flora and fauna, provision of water and power, construction, traffic and transport, and project design. A number of general issues were also discussed (e.g. consultation process). Where issues have been identified, the proponent has addressed these issues and described impact mitigation measures within the relevant chapters of the EIS.

Hummock Hill

Submissions

Formal submissions are invited on the EIS in accordance with the SDPWO Act. Submissions should be in writing, signed by the submitter and an address should be provided. The submission should be addressed to:

Project Manager – Hummock Hill Island Development
Major Projects
Department of Infrastructure
PO Box 15009
City East QLD 4002
Fax: (07) 3225 8282

Project Description

Location

Hummock Hill Island is situated at the juncture of the Wide Bay and Capricorn Coasts, 65 km by road south east of Gladstone and provides a combination of warm climate, accessibility, deep water estuaries, safe beaches, clean air and a landscape that ranges from open cleared areas, re-grown vegetation and natural landscape. The Island is approximately 13 km long, 3 km wide, with a total area of 2,150 ha, of which 341 ha (12%) lies within the proposed development footprint. Around 58 ha of the land within the proposed development area is currently cleared or considered re-growth. Master planning has utilised these areas to the maximum extent possible with the aim of reducing the overall impact of the development.

The Island is separated from the mainland by Boyne Creek, a shallow tidal channel that flows into the deeper waters of Colosseum Inlet and Seven Mile Creek east and west of the Island respectively. The Island is situated within the Great Barrier Reef World Heritage Area and Great Barrier Reef Coastal Marine Park, administered by the State and adjoins the Great Barrier Reef Marine Park, administered by the Great Barrier Reef Marine Parks Authority.

Development History

Hummock Hill Island has a long history of use; firstly by a small indigenous population and subsequently for pastoral activities. A pastoral lease granted in 1870 saw the Island used for raising beef cattle and as a source of timber for construction of railways in the region. Vegetation clearing on the Island was required as a condition of Pastoral Lease renewal and large areas of the lease were cleared to comply with this condition.

The pastoral lease was rescinded in 1980 and a lease issued by the DNRW in 1991 for development of the Island for business, industrial commercial, residential, tourist and recreation purposes. Following preparation of development plans and an EIS by the Tod Group in 1993, Miriam Vale Shire Council issued a development approval for 5,000 lots, a marina, 2 golf courses and a hotel/convention centre in the mid 1996s. This approval was allowed to lapse by the original Lease holder and a further development was proposed in 1999 consisting of a hotel resort, caravan park, two golf courses, low and medium density residential, commercial science/technological precincts to support a satellite launching facility on the southern part of the Island.

An Exploration Permit – Minerals (EPM) has existed over the Island since the early 1980's to investigate identified mineral sand resources in the coastal sand deposits of which approximately 12% occur on the special lease area.

Master Plan

The proposed Hummock Hill Island Master Plan incorporates a diverse range of tourist facilities and accommodation including resort hotels, holiday units, camping grounds, holiday housing, boating facilities, golf course and recreational facilities and a town centre based around retail and educational services that will cater for a broad range of people. The proposed community will consist of an estimated 2,300 tourists and 1,600 residents (at 100% capacity) with full development of the Island achieved over a period of 16 years.

Ecologically Sustainable Development (ESD) principles have been the driver behind the design with Hummock Hill Island supporting a low impact master planned community. The development has been designed to be in harmony with the existing environment, with around 15% of the Island to be developed. The Master Plan for the proposed Hummock Hill Island Development is detailed in Section 3 of the EIS.

The master planning process has also included a detailed landscape plan that is based on the development objective of minimising impacts of the proposed development on the Islands environment and the Great Barrier Reef World Heritage Area. Landscape strategies include preserving existing habitat to the maximum extent possible, maintaining and providing linkages between areas of habitat, and developing the remaining land in a least disturbance approach. The landscaping strategy for the development will utilise existing native species present on the Island and will be tailored for each development precinct based on plant communities and species present. This will maintain the inherent character of the Island and provide an attractive holiday and residential environment.

Master planning for the proposed development has incorporated the input from a range of detailed studies including detailed fauna and flora surveys, water supply option studies, Water Sensitive Urban Design for stormwater control, geological and geomorphological investigations etc. These detailed reports are provided in the Appendices of the EIS.

Plan of Development

A Plan of Development has been prepared for the proposed Hummock Hill Island Development, consistent with the Miriam Vale Shire Council Planning Scheme and requirements of planning schemes under the *Integrated Planning Act 1997*. The Plan of Development provides specific direction on how development should occur, based on the extensive investigations undertaken for this EIS, to achieve environmental protection and a sustainable and vibrant community. It establishes Development Codes that guide any development on Hummock Hill Island, and overlays which describe constraints on development.

The Plan of Development will become part of the Miriam Vale Shire Council Planning Scheme (and future Gladstone Regional Council) and will continue to apply after completion of the initial construction period and will guide any future development. Changes to the Plan of Development

will only occur through regulated process such as those established under the existing *Integrated Planning Act 1997*. Details of the Plan of development may be found in Appendix A2 of the EIS.

The Draft Plan of Development (presented in Appendix A2 of the EIS) includes the Hummock Hill Island Plan of Development - Assessment Tables (Plan of Development) and Precinct Codes and the Hummock Hill Island Plan of Development Overlays (Plan of Development Overlays) and Overlays Code.

The overall outcomes of the Draft Plan of Development for Hummock Hill Island are that the:

- Areas of conservation significance are retained and the human population can enjoy living in close proximity to, and harmony with the natural ecosystems.
- Social environment will be based on a vibrant, dynamic and diverse community that has a strong environmental awareness and is committed to sustainable living and self development. Individuals and households will come to Hummock Hill Island seeking quality of life in its fullest sense and fulfilling educational and outdoor recreational experiences.
- Built environment will be appropriate to the scale of the development and the natural environmental setting. Infrastructure systems will be based on latest advances in sustainable living, but will be suitable for management and basic maintenance by the householders.

The Plan of Development includes a Land Use Plan which identifies five land use precincts, which are the:

- Residential Precincts, including
    - Low Density Residential;
    - Medium Density Residential; and
    - High Density Residential;
- Town and Village Centres Precinct;
- Tourist Precinct;
- Community and Education Precinct; and
- Open Space Precinct, including:
    - Golf Course Open Space; and
    - Conservation and Natural Areas.

The preliminary approval being sought for this project would establish a framework for all future works requiring assessment against the planning scheme to be assessed against the Plan of Development. This means that each stage and component of the proposed development would be assessed against the Plan of Development.

The Draft Plan of Development would be reviewed once the new IPA planning scheme has been finalised, to ensure consistency and compatibility.

Construction

The major activities undertaken for the construction of the integrated tourism and residential development and associated facilities are:

Component	Construction Activities
Upgrade of external (mainland) road network including Foreshores Road and Clarks Road	▪ Clear vegetation as required within road reserve. Vegetation to be retained for use in rehabilitation. ▪ Grade road reserve as per detailed design ▪ Install culverts and drainage systems ▪ Install road base, bitumen surface, shoulder treatments(shoulder treatments to minimise risk of sheet erosion) ▪ Reinstate remaining areas within road reserve with native vegetation compatible with road safety requirements.
Bridge over Boyne Creek	▪ Trim mangroves from construction area ▪ Excavate for bridge foundations as per design, treating acid sulfate soil as per management plan ▪ Install bridge foundations and construct roadway ▪ Reinstate disturbed areas and monitor for mangrove regeneration
Internal road network - Trans-Island boulevard and associated services Minor road network (collector and access streets)	▪ Clear vegetation as required within identified road alignment. Vegetation to be retained for use in rehabilitation. ▪ Grade road reserve as per detailed design ▪ Install culverts and drainage systems ▪ Install road base, bitumen surface, shoulder treatments (shoulder treatments to minimise risk of sheet erosion) ▪ Reinstate remaining disturbed areas within road alignment with native vegetation compatible with road safety requirements.
Power Supply - external, above ground power lines, 12 km	▪ Install poles and transmission line ▪ Install transformers and other equipment at connection point ▪ Make connection
Gas supply - external, 16.5 km	▪ Clear topsoil and set aside ▪ Excavate trench and install pipe ▪ Backfill trench ▪ Dispose of excess spoil at regional landfill or beneficial reuse (if available) ▪ Replace topsoil ▪ Stabilise surface as per road design requirements.
Power supply - internal (underground) Water and wastewater reticulation Gas reticulation	▪ Clear vegetation as required within specified alignment. Vegetation to be retained for use in rehabilitation. ▪ Clear topsoil and set aside for reuse ▪ Excavate trenches and install power/gas/water as per design. ▪ Back fill trenches ▪ Dispose of excess spoil to regional landfill or beneficial reuse if available ▪ Replace topsoil and reinstate in accordance with design (compatible with road design requirements)
Water and wastewater treatment plants, evaporation pond (18,500 m^2)	▪ Clear vegetation and strip topsoil - stockpile for later use in landscaping ▪ Conduct any excavations and remove subsoil for use at regional landfill or other beneficial reuse as available ▪ Install plant as per design ▪ Install evaporation pond as per design ▪ Use topsoil and cleared vegetation for landscaping around plant location and evaporation pond
Boat Ramp - Colosseum Inlet Boat Ramp - Boyne Channel Associated boat/trailer	▪ Remove mangroves from construction area ▪ Excavate for boat ramp foundations as per design, treating acid sulfate soil as per management plan ▪ Install boat ramp and queuing pontoons ▪ Clear vegetation and conduct earthworks for car park

Component	Construction Activities
parking	▪ Construct car park ▪ Reinstate disturbed areas and monitor for mangrove regeneration
Golf Course	▪ Conduct earthworks and install permanent drainage systems and lagoon systems ▪ Place topsoil/top dressing and sow fairways and greens with selected grass species ▪ Plant remaining areas with selected native species ▪ Maintain temporary erosion and sediment control devices until 80% grass cover is achieved and permanent stormwater and drainage systems are in place.

The development of major infrastructure and urban services is projected to take place over a 16 year period, likely commencing in 2008 with completion in 2024. The total construction and building expenditure is valued at $635 million, or $390 million in NPV terms.

Operation and Maintenance

The proponent proposes to enter into an operation and maintenance agreement with the Local Government Authority (LGA) to maintain and operate the infrastructure for a period of years to be agreed and until such operation and maintenance costs can be covered by income from rates applied to the developed land.

The agreement will allow the proponent to recover a proportion of the operation and maintenance costs from rates collected by LGA during the period of this agreement. The proponent will provide a training program for LGA staff before transfer of operation and maintenance responsibilities to the LGA.

Operation of electrical power and gas will then be undertaken by the relevant authority. Costs of operation and maintenance will be through supply tariffs. This same arrangement is used for all developments of this type in Queensland.

Operation of the proposed airstrip will be as a private operation for small/light single turbo-prop aircraft only.

Project Need

Future Tourism Need

The Hummock Hill Island development will contribute significantly to tourism within the central Queensland region providing flow on effects to the regional economy. It will also attract and cater to, a wide ranging market of potential visitors with little impact on existing tourist infrastructure.

Estimated tourism expenditure from the project will rise to $80 million per year by 2024. The development is projected to accommodate on average approximately 1,600 tourists per night (at full capacity) once fully developed.

The *Queensland Tourism Strategy: A 10-year vision for sustainable tourism* (2006) has been endorsed by the Queensland Government as the plan to develop the tourism market in Queensland

as outlined in Section 4 of the EIS. Four key goals are proposed by Tourism Queensland over the next 10 Years, these being:

- Goal 1 - increase visitor expenditure by $1.43 billion above forecasts to $21.6 billion;
- Goal 2 - Increase Queensland's market share from overnight visitors to 29.1%;
- Goal 3 - Increase tourism's economic contribution to Gross State Product (GSP) by $900 million above forecasts to 12.5 billion; and
- Goal 4 - Create an additional 11,000 tourism jobs above forecasts.

The Hummock Hill Island development will contribute significantly to achieving these goals as outlined below:

- By 2016 around $42 million in tourism expenditure will result from the proposed development, this equates to around 5% of the proposed 2016 visitor expenditure target for the Fitzroy region and greater for the Gladstone region, making a significant contribution towards achieving the Queensland Tourism targets.
- Tourism expenditure from the proposed development as stated above is estimated as $42 million by 2016 and $80 million by 2024 following completion of the project. By 2016 tourism expenditure from the development is anticipated to contribute 0.5% of the Queensland Tourism GSP and 12% of the Fitzroy tourism Gross Regional Product, a significant contribution to the Queensland Tourism targets for 2016.
- At the Fitzroy region level the proposed development is anticipated to generate around 350 jobs directly related to tourism by 2016 (refer to Section 17), 5% of the Tourism Queensland 10 year target for the Fitzroy region. Indirect job creation within the Fitzroy region will be greater by 2016 with over 400 jobs created regionally.

Future Residential Need

The Gladstone region and Bowen Basin mining centres are rapidly expanding based on increased industrial and mining output driven by current resources demands. Gladstone has been identified by the State Government as an area for future industrial expansion. The Gladstone State Development Area, located to the north west of Gladstone City, has been created to cater for much of this future industrial expansion.

Current population growth in the region (2.2 – 3.4% per annum) is greater than the Queensland average (1.7% per annum). The future population for the area[2] is anticipated to grow from 49,526 in 2006 to 80,495 by 2026 (OESR & PIFU, 2007). Based on the future population growth of an additional 30,000 residents for the region by 2026, around 9,000 additional residential allotments will be required based on an average 2.7 persons per household (Cox, 2007).

The residential housing component of Hummock Hill Island would accommodate around 5% of the future population growth and allotment demand, providing a range of housing types and

[2] Gladstone City, Calliope and Miriam Vale LGA (future Gladstone Regional LGA)

affordability in a desirable coastal location within a sustainable context that helps to reduce ecological footprint. The Island is ideally situated with Gladstone (65 km), Tannum Sands (40 km) and Miriam Vale (30 km) being the nearest regional centres providing shopping, postal and banking facilities.

Alternative Locations

Hummock Hill Island is available to the proponent through a special lease with the Queensland Government and no other such opportunities are currently available to the proponent within such close proximity to the major industrial and transport hub of Gladstone.

While it would be possible to provide an equivalent number of residential and tourism accommodation units elsewhere in the Central Queensland region, and potentially within 45 minutes drive of Gladstone, the particular attributes of Hummock Hill Island make it favourable over any other location within easy reach of Gladstone. In particular:

- The coastal location provides a micro climate that is more comfortable for tourists and residents, and reduces the need for artificial cooling - minimising energy consumption and associated greenhouse gas production;
- The beach and surrounds are attractive and provide outdoor recreational opportunities that cannot be provided anywhere else on the Central Queensland coast; and
- The land for the proposed development is available and has long been identified by the Queensland Government for this type of development under a special lease.

Do Nothing Option

The do nothing option would result in Hummock Hill Island remaining in an unused state. Benefits of the project would be foregone, including:

- $390 million ($240 million NPV) direct and indirect regional and $460 million ($280 million NPV)to Queensland value added income from building and construction;
- $810 million ($290 million in NPV terms) direct regional value-added income from tourism expenditure;
- 14,500 person years of employment that would be created directly and indirectly created from the tourism activity at the regional level. With the number of jobs created is expected to rise steadily to the peak level in 2024, of the order of 700 persons in the region; and
- Access to high quality tourism, residential, and recreational opportunities for existing and future residents of the region, including residents attracted to the region by further development in the State Government's Gladstone State Development Area.

Infrastructure Options

Power Supply

Alternative power sources investigated included combinations of:

- Mains grid connection from Ergon Energy's 22KV network on the mainland;

- On-Island generation using a gas fired cogeneration plant or diesel engine generators;
- Large scale wind turbines; and
- Solar/photovoltaic cell arrays.

All investigated alternatives concluded that:

- a baseload supply of electricity will be required from the mainland grid to ensure security of supply to the development;
- Extension of the grid to service Hummock Hill Island is cost effective compared to other sources of electrical power identified; and
- the baseload supply could be supplemented by the other sources including those listed above.

Wastewater

A comprehensive review of alternative technologies will be undertaken in the detailed design phase, primarily to ensure that any recent developments in wastewater recycling have not been overlooked. However, at this stage the development will use high velocity sonic disintegrator technology to meet all of the requirements for the project. Such technology is already in use in similar applications nearby, at Agnes Water.

Water Supply Strategy

A range of options for maximising the efficiency of water cycle management were considered, including:

- Mains water supply, involving installation of a water supply main connecting existing municipal water supplies to Hummock Hill Island;
- Desalination, involving installation and operation of a reverse osmosis desalination plant (thermal desalination was not considered because of high energy costs compared to reverse osmosis);
- Salt water, use of untreated water from the sea;
- Recycled water, being water treated to Class A or Class A+ in a wastewater treatment plant;
- Recycled water treated to better than Class A+ suitable for 100% potable reuse;
- Grey water, being water generated at a household level from showers, baths, hand basins and washing machines;
- Stormwater, being stormwater collected from overland flows (for example in a dam); and
- Rainwater, being water collected from rooftop catchments and stored in tanks at the household level.

The preferred option for use was: recycled water reticulation and rainwater tanks (recycled water supplemented by rainwater tanks) and potable backup.

This option was selected as the preferred option on the basis that:

- Capital costs are comparable to the Recycled Water Reticulation with Reticulated Potable Supply option and lower than the Greywater, Recycled Water & Reticulated Supply Option;

- It achieves the highest degree of potable substitution; and
- It complies with Miriam Vale Shire Council requirements that all new households and accommodation units have rainwater tanks installed.

Potable Water Supply

Three alternate sources of potable water supply were considered, including: pipeline from Tannum Sands Reservoir via southern route, pipeline from Tannum Sands Reservoir via Colosseum Inlet, and Desalination.

Desalination was chosen as the preferred option for potable water supply. The pipeline route via Colosseum Inlet was discounted due to construction and environmental considerations and the desalination option compared favourably to the pipeline via southern route.

Mechanical Vapour Compression (MVC) technology has been suggested for desalination water supply. MVC technology is suitable for small scale applications and is cost effective and energy efficient at this scale. It is also straightforward to operate, with low maintenance requirements.

A detailed investigation into preferred desalination technology will be undertaken in the detailed design stage. In particular, energy efficiency of a range of plants will be investigated and the most energy efficient plant selected to minimise energy demands.

Impact Assessment

World Heritage Values

Hummock Hill Island lies within the Great Barrier Reef World Heritage Area (WHA) and is located adjacent to the Great Barrier Reef Marine Park and Great Barrier Reef Coastal Marine Park. Although within the WHA, the Island does not have any formal conservation status, nor has it come under any kind of management plan in relation to its World Heritage status. Historically the Island was overlooked when National Parks and Conservation Areas were created in the region due to the lesser conservation value of the Island compared with nearby areas.

The Great Barrier Reef WHA has been included on the World Heritage List on the basis of meeting four criteria. The Island contains some features that may be considered aligned with the listing criteria as summarised below:

1) An outstanding example of a major stage of the earths evolutionary history;
    - Fringing reefs are absent from the Island together with major evolutionary geological processes or evolutionary history that have isolated unique flora and fauna from mainland populations. The proposed development will not impact the WHA listing under this criterion.
2) An outstanding example representing significant ongoing geological processes, biological evolution and mans interaction with his natural environment;
    - In general, features listed under this criterion have limited representation on the Island in the context of the sub-region and/or entire WHA. Surrounding waters do contain features

listed under this criterion, such as mangroves and seagrass meadows, the latter being habitat for dugong and turtles. Impact to these features from the proposed development and human interaction are minimal and do not impact the overall WHA values.

3) Contain unique, rare and superlative natural phenomena, formations and features and areas of exceptional natural beauty;
   - In general, unique, rare and superlative natural phenomena listed under this criterion are not represented on the Island in the context of the sub-region and/or entire WHA. In comparison to other areas in the WHA such as the Whitsunday region or Great Keppel Island, Hummock Hill would not be considered "*superlative*". Adjacent waters contain mangroves systems and habitat for dugong and turtles that will have minimal impact from the proposed development following management and mitigation measures; and
4) Provide habitats where populations of rare and endangered species of plants and animals still survive.
   - In general features listed under this criterion have limited representation on the Island in the context of the sub-region and/or entire WHA. Mangroves and seagrass meadows are present in adjacent estuarine and marine waters. Species of conservation significance that have representative habitat on the Island and/or adjacent waters include the black breasted button quail, dugong and marine turtles. Habitat for these species is outside the special lease and development area. Mitigation and management measures proposed for these species will minimise impacts to the WHV.

The Environmental Management Plans (EMPs) set out recommended measures to protect the environmental values (EVs) of the World Heritage Area and marine parks.

Geology, Geomorphology & Soils

Hummock Hill Island is an extension of the mainland Miriam Vale Granite geological unit comprising of a bedrock core of granodiorite flanked by colluvial/alluvial plains which grade into relict beachridge or foredune strandplains on the ocean side of the Island and intertidal saltflats and mangrove muds on the landward side of the Island. The Island is separated from the mainland by a shallow (approximately 4m deep) tidal channel called Boyne Creek.

The relict beach ridges and foredune strandplains consist of Holocene age sand ridges and inter-ridge swales probably formed during the mid to late Holocene sea level "stillstand", the relatively stable sea level period from about 6,500 years before present (yr BP) to the present day. Stephens (2007) indicates that the relict beach ridges and foredune strandplains of Hummock Hill Island are not unusual in a regional context, with nearby similar strandplains occurring on Wild Cattle Island National Park immediately to the west of Hummock Hill Island, the eastern side of Rodds Bay, the eastern side of Rodds Peninsula, Middle Island and within the Eurimbula National Park to the south of Rodds Peninsula.

Relict beach ridges and strand plains are not considered to achieve significant status under the definition of "*…a high degree of ecological integrity **and** biodiversity conservation values*" as required under the State Coastal Management Plan. Around 12% of the relict beach ridge system

present on the Island is located within the development footprint, though not all this area will be directly disturbed or impacted.

Strandplains on the Island also have a Mineral Occurrence/Inactive Prospect, No. 486524 Hummock Hill Island and an Exploration Permit for Mineral (EPM, #7164) and Mineral Development Licence (MDL, # 310) for mineral sands contained within these strandplains. The proposed development will prevent 12% of the Islands mineral sands resource from being exploited. Under current commodity prices the Islands mineral sands resources are not considered viable as a stand alone operation.

Soils within the proposed development area range from sandy (gleyed) podzolic soils on within the relict beach ridge system to sandy to loamy surface (hardsetting) duplex soils on colluvial plans to deep brown, yellow brown or mottled duplex soils and sodosols on the Miriam Vale granite. Many of the soils within the proposed development footprint are classified as high erosion risk. An erosion and sediment control plan will be developed based on identified erosion risk during the phased development. Phasing of the proposed construction works over 16 years reduces the area of soils exposed at any single time. The use of effective landscape plans and Water Sensitive Urban Design (WSUD) for the stormwater drainage system will also reduce the long term potential impacts.

Acid sulfate soils exist within the bridge and public boat ramp footprints. Further investigation of acid sulfate soils will be conducted prior to works in accordance with QASSIT guidelines and an acid sulphate soil management plan developed to manage and minimise any impacts.

Minor land contamination exists associated with the former cattle dip and fuel storage areas of the former homestead located on the Northern Headland. Further investigation and remediation of these areas will be conducted during the proposed construction program.

Landscape Character and Visual Amenity

Seven landscape units exist on the Island including sandy beaches and foredunes, tidal flats, littoral vine forests, grassy woodland on undulating plains, ridgeline vegetation communities, open eucalypt woodland and the cleared headland. The proposed development footprint will only occur within grassy woodland on undulating plains, ridgeline vegetation communities, open eucalypt woodland and the cleared headland units.

Sensitive view receptors include views from Tannum Sands, housing at Bangalee on the southern tip of Wild Cattle Island, Mundoolin Rocks on the mainland, and views within the estuarine and marine waters of the Great Barrier Reef World Heritage Area. An assessment of impacts to the visual amenity of the Island from sensitive receptors ranges from slight to moderate in most cases. The proposed access bridge across Boyne Creek will be result in a permanent change to receptors from Boyne Creek, however vegetation screens the bridge from existing land based receptors. Moderate visual impacts will be mitigated through maintaining existing screening vegetation and sensitive urban design with house palettes being limited to muted background colours.

Infrastructure and Transport

Electricity and gas will be delivered to the Island via the existing road corridor and will be installed by the relevant utilities provider. Potable water will be provided to the Island from a small

desalination plant, with remaining low contact water being sourced from rainwater tanks and recycled Class A+ water.

Public roads to the Island will use the existing road corridor of Clarks Road, with the existing unsealed track upgraded to a Rural Arterial classification to accommodate traffic from the Island. Internal roads on the Island will be constructed in accordance with Queensland Streets Design Guidelines for Subdivisional Streetworks. Public bike paths will also be provided as part of the Island transport network to minimise reliance on cars for short trips around the Island.

Construction traffic generated during the initial stage of the proposed development will generate 17 heavy vehicle trips a day accessing the site via Turkey Beach Road, Foreshores Road and Clarks Road. This number will decrease as initial infrastructure is completed and various tourist and residential stages of the development are constructed.

Increases in vehicle numbers during the 16 year construction period will be concordance with the increasing tourist and residential population increase. The peak traffic generated by the proposed development will generally coincide with the peak hours of the external road network which is mainly centred on work and school. The development is also expected to generate predominantly light vehicle traffic as the bulk of the development is residential in nature.

The Turkey Beach – Bruce Highway intersection will require upgrade to a roundabout in order to operate satisfactorily during peak hour traffic on completion of the proposed development and other developments at Turkey Beach. The Turkey Beach Road - Foreshores Road junction will require upgrade to a Type 'CH' intersection.

Existing public boat ramps to estuarine waters around the Island are either tide limited, such as Foreshores Boat ramp or require an excessive travel time both by road and water such as the all tide ramp at Turkey Beach. The need for public boat ramps associated with the proposed development is driven by the recreational demands of both tourists and local residents. Proposed public boat ramps in Boyne Creek and Colosseum Inlet will provide safe and controlled recreational access to these waters for both tourists and the local population.

The proposed private airstrip will be used for personal and private charter uses and will be designed to accommodate planes with a minimum take-off weight (MTOW) of 5,700 kg. The proposed runway design will be constructed with reference to Civil Aviation Advisory Publication No: 92-1(1). Aircraft movements are anticipated to be less than 6 flights per day and will pose minimal risk to birds on the Island.

Air Quality and Greenhouse Gas

The existing conditions within the local environment are primarily natural sources, including particulates from ocean salt spray and wind transport of soil from exposed areas. Due to its coastal location, Hummock Hill Island is generally considered to have relatively good air dispersion conditions.

The identified sensitive receivers are restricted to small communities such as Mundoolin Rocks, south of the Island and Bangalee on the south eastern tip of Wild Cattle Island and transient visitors within the local estuarine system.

The main potential for construction phase air quality impacts is likely to arise from dust generation during earthworks and vehicle movement over unsealed surfaces and would occur following the initial stages of construction, as residential receivers begin to inhabit the island.

Provided appropriate dust management measures are incorporated as part of proposed earthworks and construction, impacts on adjacent vegetation communities and ecosystems are expected to be managed to acceptable levels. However, further investigation into potential dust impacts and appropriate mitigation strategies specific to the types of construction methods to be employed would be undertaken by the construction contractor(s) during further design development. Mitigation measures will be provided considered in the development of detailed air quality management plans.

Construction greenhouse gas emissions would primarily relate to activities involving the consumption of diesel (on-site construction equipment such as trucks, dozers, scrapers, compactors, mulchers, water carts etc to clear vegetation, stockpile topsoil and perform bulk earthworks) and off-site consumption through transportation of materials and workers to and from the site. Electricity consumption would occur within site offices, workshops and ablutions facilities though this consumption would be very minor.

Construction and operation of the developed Island has the potential to generate greenhouse gas emissions. Construction activities generating greenhouse gas emissions include the use of diesel powered construction equipment, the transportation of materials to and from site and electricity consumption for construction related activities and site services.

Greenhouse gas reduction measures during construction and operation of the HHI development will aim to maximise energy efficiency in line with the Building Code Australia strategies (2003). This will include sourcing supplies that are located close to HHI, using renewable energy for site amenities and minimising waste generation.

Noise and Vibration

The existing noise environment at the site is expected to be typical of a natural rural environment, dominated by: insects, birds and other wildlife; wind rustling leaves; and wave noise from the nearby ocean. Some transient noise from visiting boats and leisure craft would also contribute to the noise environment within the area surrounding the proposed development. Distant noise from occasional aircraft over flights on their approach to and departure from Gladstone may also occur on occasion.

Sensitive sites to the development are likely to be residences and holiday homes at Bangalee on the southern tip of Wild Cattle Island, residences at Munoolin Rocks and isolated rural residential properties adjacent Clarks Road, Foreshores Road and Turkey Beach Road.

Potential noise and vibration generation from construction activities will be variable, depending on the stage of works, type of equipment operating at a particular time and the proximity to sensitive noise receptors.

The main noise and vibration impacts during construction on HHI are likely to be from the use of heavy equipment for transport, earthworks and vegetation clearing and other civil works following construction of early stages of the development and as tourist and residential accommodation expands. To limit the potential for noise and vibration impacts the Construction Contractor would be responsible for managing construction activities and ensuring that the construction environmental management plan includes minimisation of noise and vibration emissions.

Operational activities also have the potential to cause noise and vibration impacts at the new residential areas. Further investigation of detailed noise management measures will take place as part of a detailed design for the project components and management measures, including appropriate siting of noise generating items to maximise shielding provided to residences and restricting potentially nuisance noise sources to least sensitive times of the day, would be incorporated to ensure that noise and vibration impacts are not significant.

Surface Water

Permanent freshwater on the Island is limited to a small number of dams constructed during historical pastoral activities. These dams are filled via a number of small ephemeral watercourses that drain the central ridgeline and low hills of the Island and only flow during storms. A preliminary assessment of ecological value for these watercourses returned a low ecological value, with water dependant vegetation being absent.

Two ephemeral watercourses were also identified in the relict beach ridge systems of the Island. A preliminary assessment of ecological value for these ephemeral watercourses returned a medium ecological value, with some riparian vegetation, saltmarsh and mangrove vegetation being present.

The proposed development will avoid disturbing vegetation in watercourses by maintaining the required 10m buffer required under the SE Qld Regional Vegetation Management Code (2006). Some road crossings will be required for the development. Fauna passages will be included in all watercourse crossings to maintain fauna movement along riparian corridors.

Potential impacts on ephemeral watercourse flows and water quality will be mitigated through Water Sensitive Urban Design with the aim of minimising changes of both water flows and water quality to downstream receiving waters of the World Heritage Area. Detailed modelling of potential changes in both flows and water quality have resulted in a range of treatments, such as bio-retention basins etc, that will maintain flows and water quality to achieve discharges that are slightly below existing receiving water quality conditions. Nutrient loads to receiving estuarine and marine waters of the World Heritage Area will be concordant with the objectives of the GBRMPA Water Quality Protection Plan.

A Golf Course Management Plan, incorporating an Integrated Pest Management Plan developed in accordance with the Australian Golf Course Superintendents Association and Qld EPA management

practices, will provide best practice management practices that will limit the use of supplementary fertiliser and chemicals to a minimum will ensure that identified environmental values of receiving waters are maintained and not impacted.

Groundwater

Groundwater resources are limited to small areas within unconsolidated quartzose sand deposits and marine sediments located in the eastern and western sections of the Island. No human use of groundwater occurs on the Island or is proposed as part of the development.

Groundwater dependant ecosystems have been observed at the break of slope of low hills in the southern areas of the Island due to the shallow soils and relative impermeability of the underlying bedrock. These areas are generally indicated by *Melaleuca* spp.. The majority of these areas are coincidental with retained vegetation on the edge of the golf course fairways. Management of these areas will involve avoidance where possible followed by use of vegetation retention and planting to minimise hydrogeological changes.

Changes in ground permeability will be managed through Water Sensitive Urban Design and the use of permeable pavements or similar treatments and minimising non-permeable areas. Recycled wastewater will be irrigated at sustainable rates and monitored in the golf course area using in-ground sensors as part of the Golf Course Management Plan to avoid impacts to underlying groundwater. A monitoring program will provide notice of any potential changes to groundwater quality.

Coastal Environment

Erosion prone areas exist on the northern coastline of the Island located on separate tenure and not part of the Special Lease for the proposed development. Public infrastructure, such as beach access (east and west of the northern headland) and stormwater drainage (west of the northern headland) will need to cross these areas. The existing erosion prone area west of the northern headland provides protection up to a 100year storm recurrence. This includes a climate change allowance.

Some areas under buildings west of the northern headland will require filling to raise the floor level 0.4m above the defined storm tide event (DSTE)(100 year event) as required under the Plan of Development and Miriam Vale Shire Draft Planning Scheme. Clarks Road will also require to be constructed above the DSTE where it crosses supratidal saltflats on the approach to the proposed bridge.

Tidal flows within Boyne Creek will not be impacted by the proposed bridge or public boat ramp. A net improvement of tidal flow will occur following removal of the existing causeway following construction of the bridge. The existing causeway limits tidal flow during low tides and anecdotal evidence suggests the causeway has caused some siltation of Boyne Creek.

Public access to the coast will be increased as a result of the proposed development. Public access will be provided to the northern beaches of the Island and public boat ramps will provide access to Colosseum Inlet and Boyne Creek.

The coastal environment around the Island contains a number of environmental values including, World Heritage, Marine Parks, Nationally Important Wetlands, Fish Habitat Areas, supratidal saltflats, mangroves and seagrass meadows. A number of species of significance, such as dugong and turtles are associated with these areas.

Existing water quality in Boyne Creek, Colosseum Inlet and marine waters seaward of the Island exceed the Central Queensland region water quality guidelines for nutrients and some physico-chemical parameters. Proposed water sensitive urban design treatments for the development will slightly improve the suspended sediment and nutrient concentrations of stormwater discharging into the estuaries and marine waters and will not result in adverse impacts on water quality.

Waste Management

Waste produced on site during construction will include fill (contaminated and uncontaminated), demolition waste (concrete, bricks, tile, plasterboard and rubble), construction material wastes (timber framing, concrete, rock, gravel, scrap metals, cable, wire, insulation, plastics and packaging), vegetation and soils as a result of clearing, regulated waste (hydrocarbon waste, chemical residues, paints), drums and containers from supply of chemicals and oils, domestic and other general waste (food scraps, packaging, rags), recyclable waste (aluminium cans, glass, cardboard and paper), asbestos, and sewage effluent and sludge. During the operational phase of the project waste will be domestic and general waste, wastewater, recyclable waste, electrical and electronic waste and waste by-products from the tertiary wastewater treatment plant.

Potential construction impacts will be managed through the development and implementation of a waste management plan that incorporates the principles of the *Environmental Protection (Waste Management) Regulation 2000*. Residual impacts to identified environmental values following proposed mitigation requirements in the Waste Management Plan are considered to be negligible.

Operational waste management impacts will also be controlled via the Waste Management Plan, utilizing both commercial and Council waste collection services to transport waste off-site to the Benaraby Landfill or other suitable transfer station for disposal or recycling. Residual impacts to identified environmental values following the proposed Waste Management Plan and commercial and Council waste collections are considered negligible.

Cultural and European Heritage

The traditional Owners of Hummock Hill Island are the Gooreng Gooreng and Gurang people.

Areas of indigenous cultural heritage and non-indigenous cultural heritage have been identified within the proposed development footprint, especially adjacent to and within the northern bridge abutment, headland holiday homes and town centre which coincide with area of high indigenous cultural heritage significance. Seven sites and places of cultural heritage significance were detected through a field survey and a search of the DNRW administered Register and Database. Five of these sites or places are within the proposed development footprint. A low potential for further items or sites of high or exceptional cultural/archaeological significance exists within the study area. There is likelihood for further historic items of low to moderate significant to exist, particularly around the former Homestead Complex on the northern headland.

Direct impact on recognised and potential sites of cultural heritage significance by the project will generally be in the nature of surface and sub-surface disturbance and vegetation clearance related to residential development and the introduction of associated infrastructure including a golf course. Indirect impacts will occur in adjoining areas of the site from the introduction of additional population onto the island and increased human interaction by the general nature of the project.

A Cultural Heritage Management Plan has been signed between Eaton Place and the Traditional Owners and registered with the DNRW. Assuming the recommendations made in the Cultural Heritage Impact Report are suitably implemented, the nature and level of impact by the project is suitable in terms of impact to appropriately significant cultural heritage sites and places within Hummock Hill Island and therefore acceptable.

Nature Conservation – Terrestrial

Hummock Hill Island is not known to support any flora species listed as Endangered, Vulnerable or Rare (EVR) under the *Commonwealth Environment Protection and Biodiversity Conservation Act (1999)* or *Queensland Nature Conservation Act (1992)*.

Two fauna species listed as Vulnerable under the *Commonwealth Environment Protection and Biodiversity Conservation Act (1999)* and *Queensland Nature Conservation Act (1992)* are known from the Island, namely the Black-breasted Button Quail and the Beach Stone Curlew.

Two Endangered Regional Ecosystems are known from the Island, namely Queensland Blue Gum on alluvium (RE 12.3.3) and Poplar Box on alluvium (12.3.10).

The proposal will involve the loss of approximately 341ha of remnant vegetation (within the meaning of the *Queensland Vegetation Management Act 1999*), comprising eleven regional ecosystems listed as “endangered”, “of concern” and “not of concern”. These areas contain mapped essential habitat for the Koala and Wallum Froglet, although both species have not been found on the Island, and the mapping is considered questionable.

The primary mitigation approach has been the avoidance of sensitive areas through responsive design. A suite of complementary actions are proposed to mitigate impacts on terrestrial flora and fauna values, including the provision of compensatory habitat, acquisition or protection (through registered covenant) of appropriate biodiversity offset sites and implementation of a suite of Environmental Management Plans (EMP’s) during both construction and operational phases of the project.

The effective mitigation of impacts on terrestrial flora and fauna across the study area will require the development and implementation of a range of management plans and preparation of a consolidated compensatory habitat strategy.

The mitigation approach involves a set of complementary actions including:

- design elements such as location of buildings, incorporation of fauna crossings, vegetation planting and tree retention;
- maintenance of riparian vegetation that provides

- implementing weed and fire management within retained habitats (for the protection of populations of EVR flora and fauna contained therein);
- development of a compensatory habitat strategy; and
- implementation of EMPs during both construction and operational phases of the Project.

The compensatory habitat strategy is likely to involve a combination of actions including the purchase (and management) of advanced regrowth or remnant vegetation, strategic purchase of key land parcels in the open space/green space network and revegetation and rehabilitation of existing cleared or disturbed areas.

There will be a loss of habitat for some fauna species of conservation significance, although these species are generally mobile and provided with extensive habitat on the balance (undeveloped) portions of the Island.

Nature Conservation – Marine

Hummock Hill Island is situated on the landward boundary of the Great Barrier Reef Marine Park (GBRMP). The Great Barrier Reef World Heritage Area (GBRWHA) includes Hummock Hill Island itself as well as the surrounding waters including Colosseum Inlet, Boyne Creek and Rodds Bay.

A number of aquatic species are listed under either State or National conservation legislation that either inhabit or migrate to or through Rodds Bay and Colosseum Inlet.

Marine mammals such as dolphins and dugong are known to either migrate through or inhabit the Rodds Bay area. Anecdotal evidence suggests whales and dolphins in the area are observed in offshore waters and dugongs within estuarine and near shore waters, generally around seagrass meadows within Seven Mile Creek, Boyne Creek, Colosseum Inlet and north of the main beach. Waters surrounding Hummock Hill Island are incorporated into the Gladstone - Rodds Bay Dugong Protection Area. Anecdotal evidence from local commercial and recreational fishermen indicates that dugongs have been seen within Colosseum Inlet and Seven Mile Creek, though not frequently.

Turtle species that are confirmed to occur within the vicinity of Hummock Hill Island include the green turtle (*Chelonia mydas*), loggerhead turtle (*Caretta caretta*), and flatback turtle (*Natator depressus*). These species are listed as Vulnerable under the Commonwealth EPBC Act (1999).

The primary mitigation strategy for marine conservation values is the reduction and avoidance of disturbance to marine habitats. Marine wetland habitat loss during construction activities will be limited to the proposed access road and bridge across Boyne Creek, the adjacent public boat ramp in Boyne Creek and the public boat ramp in Colosseum Inlet. There will be no other direct loss or disturbance to marine or intertidal habitats.

Identified potential impacts on water quality, whilst sourced from different activities within the proposed development area, have a common theme via their transport mechanism to the marine environment – via storm water flows in identified ephemeral watercourses discharging to Boyne Creek and Colosseum Inlet from disturbed areas within the proposed development area. Development of erosion and sediment control plans (ESCP) and Water Sensitive Urban Design (WSUD) for permanent storm water controls will be effective in mitigating sedimentation, suspended

sediment, hydrocarbons, litter, nutrients, pesticides, herbicides and fungicides through various proposed treatment trains. Based on modelled scenarios, minimal impacts to identified EVs and estuarine marine fauna and flora are anticipated during construction and operation of the proposed development.

The proposed Golf Course will operate watering, fertilising and pest control in accordance with the *Australian Golf Course Superintendent's Association and QLD EPA Improving the Eco-efficiency of Golf Course in Queensland* (2001) (AGCSA). The AGCSA handbook is designed to minimise the impacts of golf course management and has been applied successfully to golf courses around Queensland. Operation of the proposed golf course on the Island utilising these principles will ensure negligible impacts to downstream estuarine and marine EVs, flora and fauna in line with the objectives of the Reef Water Quality Protection Plan (GBRMPA).

Increased boat traffic within estuarine waters around the Island is anticipated to be relatively minor with a subsequent minor increase in boat strike risk to turtles and dugong. Public education, signage at boat ramps showing locations of seagrass meadows, speed restrictions within Boyne Creek and high risk areas of Colosseum Inlet will form mitigation strategies to raise awareness of turtle and dugong in the vicinity of seagrass meadows, reducing risk of boat strike.

Mitigation of potential light interference with the low density nesting of turtles on the Main Beach will be incorporated at the detailed planning stage of the development.

The proposed Master Planning and mitigation strategies and measures are considered to effectively reduce potential adverse impacts on identified EVs and WHV of estuarine and marine fauna and flora surrounding Hummock Hill Island.

Social Economic

The Gladstone Region is one of the fastest growing regions in Queensland due to population and industry growth. Population is forecast to increase to 80,000 by 2026 for Gladstone City, Calliope and Miriam Vale Shires combined (Gladstone Regional Council). Increasing growth in the region is placing increasing pressure on housing and rental supply, driving up house and rental prices and reducing affordability.

Tourism is a key industry in the both the Central Queensland and Gladstone regions with approximately 356,300 visitors travelled to the Gladstone region[3] in the year to December 2006 (TQ, 2006). Tourism facilities and infrastructure within the region remains relatively undeveloped outside the Agnes Waters/1770 area. Tourism related operations are primarily concentrated in the Agnes Water/1770 and Gladstone City areas, with some holiday accommodation available at Tannum Sands, reflecting the two primary tourist centres for the region. Tourism Queensland's 10 year goal is to increase tourism expenditure in the region to $0.87 billion by 2015/16.

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[3] The Gladstone Region incorporates the LGAs of Miriam Vale, Calliope, Banana and Gladstone

The project is anticipated to cost $190 million, with $43 million expenditure on initial infrastructure, $44 million on social infrastructure and $103 million on resort and residential land development. Estimated net benefits to the regional economy are estimated at $270 million with 60% of the benefits attributable to tourist development and the remainder attributable to residential development.

Permanent impacts and benefits of the project include:

- Provision of 5% of the anticipated tourism expenditure target set by the Queensland tourism strategy for 2016;
- Provision of 33% of the future housing requirements for the Miriam Vale Shire LGA and 5% of the future Gladstone Regional Council LGA, introduced in stages concurrent with population growth;
- Provide a range of residential property options, from affordable units through to high value headland homes;
- Creation of community recreation facilities including sporting fields, public parks, 18 hole wild golf course and country club, tennis courts, cycling paths, a lawn bowls green, beaches, boating facilities, camping grounds etc. It is proposed that the Project would support the establishment of a primary school through the provision of land for a school, if required;
- Provide 260 construction jobs per year within the immediate region, directly and indirectly associated with the development over the 16 year development period;
- Creation of employment opportunities that include skilled and unskilled positions in engineering design, construction supervision and trades, earthmoving, equipment operation, building and landscaping;
- Creation of around 700 jobs by 2024 directly employed in the tourism sector of the proposed development;
- An increase in accessibility to estuarine and coastal waters for the local population; and
- Improvement in the range of facilities available to existing neighbourhoods, including retail and hospitality outlets for their use, and contribute to economic vitalisation in the immediate area.

This is likely to lead to a gradual increase in median incomes, and potentially help to retain younger people (15-24 years) in the area. Existing skill shortages in the region may be addressed through apprenticeships and training programmes, such as the $1 billion Queensland Skills Plan (State) and the $3.5 billion Realising Our Potential package (Federal). The Hummock Hill Island development could potentially take advantage of these packages to deliver social and economic benefits to the wider community.

Housing the anticipated construction workforce during initial stages of the proposed development is recognised as a potential issue for the project. The use of tourist accommodation such as motels, apartments and guesthouses for short-term construction workers would help to minimise potential impacts on rental accommodation in the region. The phased nature of the development reduces these pressures during later stages when accommodation is available on the Island.

An accommodation management strategy will be prepared in consultation with the Department of Housing to ensure that adequate housing is available for construction workers and their families, and to ensure that potential housing-related impacts on the broader community are appropriately managed. This will consider the timing and development of other major projects in the region to ensure that the cumulative impacts on housing are managed in a coordinated manner.

Changes to the social environment during construction would be managed by the Proponent so as to ensure that any impacts experienced are avoided, reduced or mitigated to the extent that is possible and may be reasonably expected.

The EIS includes a range of mitigation measures to address identified impacts on the social environment. These include communication with local residents and visitors in advance of construction activities, about changes arising from construction activities, and possible management measures.

The following mitigation measures are recommended to maximise potential benefits and manage or avoid potential impacts on community services and facilities:

- Further analysis of the threshold levels for the provision of on-Island services, to be undertaken in conjunction with relevant Local and State Government agencies;
- Consultation and communication with relevant Local and State Government agencies to identify and gain commitment for provision of and contribution to social infrastructure requirements to meet the expected increase in population, including upgrading of emergency services;
- Consultation and communication with the Department of Emergency Services to identify and agree provision for emergency services;
- Liaison with Rockhampton and/or Bundaberg emergency helicopter services to be included on the helicopter landing register and to develop protocols;
- Consultation and communication with health authorities regarding needs of older residents, including health care, and to identify and agree on-Island health service responses, including home care services;
- Design and provide office space to allow for private health providers;
- Facilitate development of community groups, support networks and events to build social capital within the community;
- incorporate universal design and Crime Prevention through Environmental Design (CPTED) principles to into the design of residential, commercial and community facilities and outdoor spaces;
- consultation and communication with Surf Lifesaving Queensland to investigate and determine the level of provision of private, funded or volunteer surf lifesaving services;

- Investigate and establish required beach safety measures, including lifeguard tower, and potential need for swimming enclosure to avoid marine stingers; and
- Consultation with Queensland Transport regarding the demand for and supply of public transport services for island residents.

Health and Safety, Hazard and Risk

The hazards and risks associated with the project have been identified through a risk assessment carried out in accordance with the appropriate "*Guidelines for Hazard Analysis*" and *Australian Standard AS/NZS 4360:2004 Risk Management*. The risk assessment outlines the implications for, and the impact on, the surrounding land uses from the proposed project.

The residual risk profile for the proposed development, with proposed mitigation/management strategies in place, is generally "Low" or "Moderate". A number of risks remained high and will be mitigated through design or planning to reduce the residual risk to moderate/low.

Environmental Management Plans

A draft Environmental Management Plan has been prepared to provide input into the detailed planning and design phase of the project. These plans will form the basis of the development of the final plans to be used on site to ensure the safe, efficient and environmentally responsible management of the construction and operation of Hummock Hill Island.

The EMP provides the State and Local authorities, and the proponent with a framework to confirm compliance with relevant legislation, regulations, policies and requirements. The plans also provide the community with evidence that the management of the project will be undertaken in an environmentally responsible manner.

Conclusions and Recommendations

Hummock Hill Island is the most suitable development location for coastal tourism in the Gladstone region. The Development assessed in this EIS will provide people living in the Gladstone Region with a much needed, high quality recreational destination with excellent beaches, sporting and leisure facilities that are not currently available in the region. The development will enhance the social and recreational infrastructure in the Gladstone Region, making the region more attractive to investors, particularly in industry and tourism. Central Queensland will benefit both economically and socially from a sustainable and integrated tourism industry on the island.

Importantly, the assessment and studies undertaken for the Project indicate that any negative impacts can be mitigated to a satisfactory level; that matters of environmental significance are not negatively impacted by the Project and there is significant beneficial impact in many instances.

Recommendations

Having regard for the benefits and the impacts of the Project presented in this EIS, it is a recommendation of the EIS that the Project proceeds subject to:

a) developing and implementing detailed environmental management plans for the construction phase and the operational phase; and

b) developing and implementing a scheme of effective mitigation measures and proponent commitments such as those set out in Attachment 1.

In making the recommendation, the Coordinator-General is requested to:

5) assess the EIS;
6) recommend that the Project can proceed; and
7) state conditions for the Project under Section 39(1)(a) of the *State Development and Public Works Organisation Act 1971*.

Attachment 1: Proponent Commitments

The key commitments required for implementation of the Project both during construction and operation are detailed in below.

General
The Proponent will construct Hummock Hill Island Development in accordance with the Environmental Management Plans developed for the Project which will be in accordance with the Eaton Place Pty Ltd Safety, Health and Environment Policy.
Land
Develop and implement an Acid Sulfate Soil Management Plan in accordance with Section 4.8 and 4.9 of the QLD State Planning Policy Guideline (2002). The plan will outline requirements to minimise potential acidification issues associated with construction works, handling methods and treatment requirements to reduce potential impacts from these activities such as: ▪ Minimising the disturbance of PASS; ▪ Neutralisation of excavated soils with pure fine agricultural lime ($CaCO_3$) at the nominated rate outlined in Table 4 of the *SPP 2/02 Guideline;* ▪ Application of lime to open excavation faces; ▪ Storage of excavated PASS material in a dedicated bunded area to capture stormwater flowing from stockpiles; ▪ Re-use of neutralised soils as general fill (pending geotechnical assessment).
Develop and implement a Erosion and Sediment Control Plan for each development stage in accordance with the Department of Main Roads Road Drainage Design Manual (2002) and the Soil Erosion and Sediment Control Guidelines – Engineering Guidelines for Queensland Construction Sites (IEAust (Qld)1996). The plan will consider the following measures: ▪ Fit the development to the existing topography, soils, and vegetation as much as is possible; ▪ Schedule construction operations in order to minimise soil exposure during the rainy season; ▪ Minimise disturbance and soil exposure by retaining natural vegetation, adopting phased construction techniques, and using temporary cover; ▪ Vegetate and mulch all denuded areas to protect the soil from rainfall. The primary effort for controlling sediment pollution from construction sites should be to minimise raindrop impact on bare soil; ▪ Utilize proper grading, barriers, or ditches to minimise concentrated flows and divert runoff away from denuded slopes or other critical areas; ▪ Minimise the steepness of slopes and control the length of slopes by utilizing benches, terraces, contour furrows, or diversion ditches; ▪ Utilize riprap, channel linings, or temporary structures in the channel to slow runoff velocities and allow the drainageways to handle the increased runoff from disturbed and developed areas; ▪ Keep the sediment on-site by utilizing sediment basins, traps, or sediment barriers; and ▪ Monitor and inspect sites frequently to assure the measures are functioning properly and correct problems promptly.
Limit the maximum building footprint to 50% for residential lots as required by both the Miriam Vale Shire Council Transitional Planning Scheme and the proposed Plan of Development.

Visual Amenity
Lighting will be managed in accordance with the EMPs for Land.
All external lighting of the site should conform to the following Australian standards: ▪ AS 1158 – Road lighting; and ▪ AS 4282 – Control of the obtrusive effects of outdoor lighting.
Infrastructure
Consult with Queensland Transport regarding the demand for and supply of public transport services for island residents.
Climate
Develop and implement a Bushfire Management Plan prior to construction. The plan should be developed by a suitably qualified person in accordance with SPP 1/03.
Building design will comply with relevant building codes for Central Queensland, taking maximum wind speeds into consideration.
Water Resources
Water Resources will be managed as set out in the EMPs.
Develop and implement an Erosion and Sediment Control Plan prior to commencing construction activities. The plan will be developed by a suitably qualified engineer in accordance with the *Soil Erosion and Sediment Control Engineering Guidelines for Queensland Construction Sites (IEAust, 1996)* or subsequent revisions.
Design and implement stormwater drainage measures in accordance with the *Queensland Urban Drainage Manual* (1993) and Healthy Waterways *Water Sensitive Urban Design Technical Guidelines for South East Queensland* (2006) (WSUD Guidelines). The objectives of permanent stormwater control measures will be: ▪ Achievement of the SPP (Water) requirements of; ▪ minimising ecological impacts on waters in the locality (complying with required WQO); ▪ acceptable health risks, aesthetics, protection from flooding, public safety and other social concerns; ▪ making use of stormwater for recycling and water conservation; ▪ making use of drainage corridors for improved recreational values and open space or landscape areas (refer to Section 42 of the EPP (Water)
Culverts and crossings will be designed in accordance with *Queensland Urban Drainage Manual* (1993) with a climate change buffer in the relevant calculation of discharge (Q) and will incorporate fauna passages of appropriate height and including dry passage ways for fauna.
Develop and implement an erosion and sediment control plan (ESCP) in accordance with Queensland Urban Drainage Manual (1993) and WSUD Guidelines (2006) and Soil Erosion and Sediment Control Guidelines – Engineering Guidelines for Queensland Construction Sites (IEAust (Qld)1996). The ESCP should be designed around the following objectives: ▪ Minimisation of vegetation and soil disturbance within ephemeral watercourses during construction; ▪ Drainage control from cleared areas; ▪ Erosion control of exposed surfaces; ▪ Sediment control; and

▪ Revegetation of cleared areas to re-establish ground cover.
Develop and implement a Golf Course/Turf Management Plan in line with recommendations in the *Improving the Eco-efficiency of Golf Courses in Queensland (AGCSA & Qld EPA, 2001)* that incorporates management principles such as: ▪ Design of the course to include bioretention basins to "process" stormwater nutrient loads prior to release to existing drainage lines and ephemeral watercourses; ▪ The use of in ground sensors to assess soil moisture and nutrients to manage recycled water application rates; ▪ Management of fertiliser use, limiting fertiliser applications, use of slow release natural organic fertilisers, application of fertiliser during forecast dry weather only; and ▪ Management of the course as a "wild" course retaining and utilising native vegetation to the maximum extent, limiting recycled water application to that available.
Develop and implement Integrated Pest Management Plans (IPMP) for pesticide management for the proposed development as recommended by the *Improving the Eco-efficiency of Golf Courses in Queensland (AGCSA, 2001)*. Components of the IPMP will include: ▪ Understanding course conditions and characteristics; ▪ Surveying pest species on the course; ▪ Defining pest management intervention thresholds; ▪ Development of a monitoring and record keeping program; and ▪ Development and implementation of pest control strategies.
Develop and implement a Water Quality Monitoring Plan prior to construction, to establish sub-regional WQO in accordance with the QWQG (2006). It should consider the GBRMPA Draft Interim Marine Water Quality Guidelines (as yet unpublished) and identify key contaminants of concern to be monitored during both construction and operation, proposed sampling locations, including reference sites and the frequency of monitoring.
Undertake an investigation of existing groundwater contamination in the vicinity of the dip site. If groundwater contamination is identified opportunities for remediation as part of site development may improve groundwater quality and reduce potential risks to human health and the existing environment.
Undertake groundwater monitoring will be required both during construction and operation of the proposed development, and should take place: ▪ during any dewatering activities during the lagoon construction to monitor recharge performance and potential changes in groundwater quality; and ▪ in the vicinity of proposed effluent disposal areas to ensure land irrigation of treated effluent does not result in mounding, salinisation or contamination.
Road drainage will be developed utilising both *Road Drainage Manual* (Main Roads, 2002) and the *Draft Water Sensitive Urban Design Engineering Guidelines: Stormwater* (BCC, 2006) with the aim to reduce contaminant loads to receiving estuarine and marine waters and meet WQO.
Air
Air quality will be managed as set out in the EMPs
Renewable energy and energy efficiency measures will be incorporated into the design to reduce energy demands and greenhouse gas emissions. These measures will include: ▪ designing buildings to 5 star standards for energy conservation; ▪ including solar hot water heating; ▪ use of gas to generate power the Islands desalination plant and provide gas for cooking; ▪ public awareness for programs focused on ways of avoiding the need for space cooling; and

▪ architectural building design which maximises natural lighting and ventilation and incorporates energy efficient appliances.
The construction contractor will develop and implement a dust management plan. The plan will include measures to limit dust emissions from the activities, such as: ▪ Construction of a sealed site access road will be undertaken during the initial stage of construction works and works will be staged to minimise the extent of disturbed land at any one time. ▪ Use on-site watering sprays to control visible dust emissions from disturbed and unsealed trafficked areas as required. This will be particularly important during dry and windy conditions. ▪ Use dedicated site entry and exit points, and defined roadways only and install truck wheel shaker pads or washer sprays at the access / egress points to unsealed trafficked areas in order to minimise tracking dirt onto the adjacent paved road network; ▪ Progressive rehabilitation of disturbed areas will be undertaken to minimise the potential for windblown dust; and ▪ In the event of a valid complaint in relation to construction dust, perform dust investigation monitoring to assist with the development of more appropriate dust management measures.
Maintain adequate buffer distances (typically 300-500m from the facilities) between the residential (short and long term) areas and the wastewater treatment plant
Undertake further investigation into the risk of odour nuisance and emissions controls during the detailed design.
Any Environmentally Relevant Activities proposed will have emissions control technology installed and the design and operation of power generator(s) will be such that emissions comply with the State Environmental Protection (Air) Policy 1997 and the National Environmental Protection Measure for Air Quality (GHD 2006).
Design and operate the Wastewater Treatment Plant so as to minimise generation of odour (GHD 2006).
Waste
Waste will be managed as set out in the EMPs
Develop and implement a Construction Waste Management Plan incorporating the following mitigation measures: ▪ Wastes to be managed in accordance with the Environmental Protection (Waste Management) Regulation 2000; ▪ Waste avoidance, minimisation, reuse and recycling principles to be utilised wherever possible; ▪ Wastes to be segregated to assist in recovery and recycling; ▪ Provision of waste facilities in all break out areas; ▪ Construction and demolition wastes to be reused and recycled, wherever possible; ▪ No disposal of solid or hazardous wastes on the island; ▪ Materials to be fabricated off site where possible to minimise the generation of waste; ▪ In order to reduce waste volumes, where possible, all wastes generated from construction and operational activities will be reused on site or sent to recyclers. Disposal to appropriately licensed waste facilities will only be undertaken where reuse or recycling is not possible or feasible; ▪ Where appropriate waste generators will be encouraged to segregate wastes at the source to minimise cross contamination of waste streams; ▪ Waste will only be transported by appropriately licensed waste transporters; ▪ A centralised waste collection area will be provided as part of the development. The Waste Transfer Station will be constructed on a concrete hardstand and roofed, where practicable; ▪ The Waste Transfer Station location and design has taken into consideration appropriate containment and engineering, buffer distances to receiving environments and ongoing operation of the facility and environmental monitoring programs; ▪ Colour-coded and/or labelled bins will be provided for each waste stream to assist in the segregation of wastes and maximise waste recovery and recycling;

▪ Alternatives to plastic bags to be provided at retail outlets; ▪ Records of waste quantities removed from the Island are to be maintained; ▪ A waste audit will be conducted when the development is operational and when each new stage of development becomes operational. The purpose of the waste audit will be to identify: ▪ types and volumes of wastes generated; ▪ further opportunities for waste avoidance, reuse reduction and recycling; ▪ waste storage and segregation methods; ▪ waste treatment and disposal techniques; and ▪ destination of waste materials.
Implement community education programme as part of waste management service.
Implement an education program for construction workers during induction.
Any construction waste that cannot be recycled or reused and requires disposal, will be transported to the Calliope Shire Council's Benaraby Landfill. A waste acceptance agreement must be sought from the Landfill Manager prior to dispatch of waste from the island. Records of approval will be kept on file as part of the recording requirement of the Waste Management Plan
All outgoing wastes from the island will be transported by road using appropriately licensed waste transporters and a copy of the waste tracking documentation will be completed and retained, as per the Waste Management Plan outlined in Appendix A7.3. All waste loads transported off the island will be covered, where practicable.
Noise and Vibration
Noise and vibration will be managed as set out in the EMPs
The construction contractor will develop and implement a construction noise management plan. The plan should incorporate the following mitigation measures: ▪ All practical steps be taken to silence construction equipment; ▪ Works be restricted to the hours of 6:30 am – 6:30 pm Monday to Saturday, and no work outside these hours if audible at the nearest sensitive place; ▪ Tailgates of all vehicles transporting materials to and from the site would be securely fixed prior to loading and immediately after unloading; ▪ All mobile plant equipment used on site shall be maintained in an efficient condition and operated in a proper manner; ▪ All equipment used on site would have evidence of compliance with recommended noise levels outlined in AS2436-1981 *Guide to Noise Control on Construction, Maintenance and Demolition Sites;* ▪ Maintain a complaints register and investigate if a community complaint regarding excessive noise or vibration levels is received; ▪ Review the Construction Noise Management Plant periodically to ensure it remains appropriate to the current stage of construction activities; and ▪ Implement a community consultation program, informing residents of the construction schedule, progress and alerting them to times of unusually noisy activities or out of hours work. ▪ During later stages of construction the following additional mitigation measures should also be incorporated into the plan: ▪ No 'warming up' of plant and machinery would occur near residential dwellings before specified working hours; ▪ Ensure all noise suppression devices are maintained to manufacturers specifications; ▪ Fit all exhausts of mobile plant operating within close proximity to sensitive receivers, with suitable mufflers; ▪ Consider further limiting the allowable hours of operation; and ▪ Consideration to fitting adjustable reversing alarms (which are set at a margin above background level).

Cultural Heritage
Comply with the requirements of the registered Environmental Management Plan (Reg No ?????) Utilise existing cleared areas for activities such as stockpiling and establishment of ancillary works areas as well as repairing any environmental damage directly resulting from activities associated with the project to minimise impacted areas.
Work crews will be specifically instructed of their obligations to look for cultural heritage material, including handing out educational leaflets at Workplace Health and Safety meetings. These leaflets should inform the workers what archaeological material may look like, and give them clear instructions on what to do if they find anything
Develop and implement an earthworks monitoring program involving the representatives of the participating Traditional Owners during initial vegetation removal and grubbing activities. These areas to be included in the monitoring program include: ▪ A 250 metre wide strip extending inland from the lease boundary inclusive of and located both east and west of the headland (Area 1); ▪ A 100 metre wide strip extending inland from that area of the development incorporating the high-water mark situated adjacent to tidal flats located southwest of the headland (Area 2); ▪ The entire area to be developed in the immediate vicinity of the causeway (Area 3); ▪ A 100 metre wide strip extending inland from the lease boundary and incorporating the lower reaches of the headland/ridgeline located to the west of the causeway and incorporating that area immediately south of the dammed watercourse identified in Section 13 (Area 4); ▪ A 100 metre wide section of the development area incorporating elevated land immediately north of the dammed watercourse (Area 5); and ▪ A 100 metre wide strip extending inland from that area of the proposed golf course incorporating the high-water mark situated adjacent to tidal flats located northwest of the causeway.
Establish exclusion zones for the following sites both during and following construction activities: ▪ All sites noted in Appendix A7.13 that are situated outside the immediate development area [HH05 - HH07 and HH10-12, HH16 and sections of HH13]. ▪ Stone arrangements located at sites HH03 (S04) and HH09 (S12A-D); and ▪ HH04 (S05). Traditional Owners will be consulted regarding the exact type, specifications and location of exclusion zones and have particularly emphasised the importance of this consultation process in relation to Sites HH03, HH05, HH06, HH07, HH09, HH10 and HH13.
Negotiate an artefact handling and a curatorial agreement between the Aboriginal community and the Queensland Museum.
All artefacts located during the survey within the confines of the project area, excluding Site HH04, be collected by nominated representatives of the Traditional Owners prior to the commencement of the project. These include HH01, HH02, HH08, HH13 (S18) and HH17.
Flora and Fauna
Develop and implement a Vector Management Plan which provides for: ▪ breaks in any continuous vegetation lines leading to residential areas; ▪ roadway embankment construction should be designed to eliminate (if possible) any standing water impoundment or redirection of water flows into potential mosquito breeding areas; ▪ stormwater drainage should be designed to avoid silt accumulation and be free draining. Exit points from drains into waterways or wetlands should be designed to avoid habitat changes at discharge points.

Develop and implement a Landscape Plan which addresses: ▪ planting in public open space and residential and commercial premise; ▪ planting of local indigenous species only; ▪ weed maintenance; and ▪ plant densities, species, schedules and timing. Details on fertilizer and chemical usage will be detailed on specifications attached to the approved Landscape Plan.
Develop and implement a Weed Management Plan (WMP) including suitable control measures (i.e. chemical and/or physical) in accordance with appropriate strategies recommended by Council.
Monitoring of riparian vegetation (where present) will also be required to assess any potential impact to vegetation communities within ephemeral watercourses in the relict beach ridge system. This monitoring will be conducted in accordance with Qld Herbarium requirements.
Develop and implement Integrated Pest Management Plans (IPMP) for pesticide management for the proposed development as recommended by the *Improving the Eco-efficiency of Golf Courses in Queensland (AGCSA, 2001)*. Components of the IPMP will include: ▪ Understanding course conditions and characteristics; ▪ Surveying pest species on the course; ▪ Defining pest management intervention thresholds; ▪ Development of a monitoring and record keeping program; and ▪ Development and implementation of pest control strategies.
Clearing within supratidal salt flats and mangroves will be minimised to the minimum width required to accommodate the road design and storm water controls. Clearing will be conducted in accordance with recommendations within the *Wetland Management Profile - Salt marsh Wetlands issued by the Queensland Wetlands Programme*.
Designate a 100m vegetation buffer zone at the salt flats and between HAT and housing within Colosseum Inlet and Boyne Creek to prevent vehicle access.
Develop and implement community education programs and interpretative signs to raise public awareness of salt flats role in the estuarine system, location of seagrass meadows and risks of Dugong and turtle collisions.
Consult with Queensland Parks and Wildlife with the view to designate special dugong and turtle areas within Colosseum Inlet and Seven Mile Creek where vessel operation restrictions (Speed) will exist.
Implement water sensitive urban design (WSUD) principles for all permanent control measures to mitigate litter, sediment, nutrient, hydrocarbon and chemical releases to adjacent estuarine and marine environments. Proposed control measures will be constructed in accordance with *Draft Water Sensitive Urban Design Engineering Guidelines: Stormwater (Healthy Waterways, 2006)*.
Develop and implement a compensatory habitat strategy for the project. The strategy objectives will: ▪ seek to comply with the requirements of the Queensland *Vegetation Management Act 1999* and associated Codes and Policies; and ▪ aim to provide tangible conservation benefits at the local and shire-wide scale, with an emphasis on threatened species conservation.
Develop and implement a lighting plan to protect sea turtles. The plan should consider: ▪ Turning off light sources or minimise number and wattage, ▪ repositioned lights behind structures, shielded, redirected, lowered, or recessed so that their light does not reach the beach.

▪ Install timers and motion-detector switches; ▪ Interior lighting can be reduced by moving lamps away from windows, drawing blinds after dark, and tinting windows.
The following strategies will be employed prior to and during proposed construction works: ▪ Prior to the commencement of any vegetation clearance, the Contractor shall identify all areas to be cleared on construction plans and in the field. ▪ Prior to commencement of the works, the applicant shall arrange a pre-start meeting with Council Environmental Assessment Officers or other relevant Council Officer. ▪ Prior to commencement of the Works, the applicant shall fence or clearly mark with tape, the limits of all protected vegetation. Within these zones the following activities shall not be permitted: ▪ Storage and mixing of materials; ▪ Vehicle parking; ▪ Liquid disposal; ▪ Machinery repairs and/or refuelling; ▪ Construction site office or shed; ▪ Combustion of any material; ▪ Stockpiling of soil, rubble or debris; ▪ Any filling or excavation including trench line, topsoil skimming and/or surface excavation, unless otherwise approved by the Project Manager; and ▪ Unauthorized pesticide, herbicide or chemical applications. ▪ Implement measures to minimise any damage to retained trees and / or the conserved area considering the following measures: ▪ Identifying a Tree Protection Zone: ▪ Pruning: ▪ Establishing the Tree Protection Zone: ▪ Fencing ▪ Trunk protection ▪ Mulching ▪ Maintain natural drainage patterns ▪ Clearing shall occur in the sequence of cutting, shearing of felled vegetation and tub grinding. ▪ Upon completion, grubbing operations shall ensure the site is left free draining with no ponding of stormwater.
When undertaking trenching or excavation within the root zone of any tree, roots will be severed cleanly rather than torn with a backhoe or other excavation equipment. All roots are to be exposed first and then cut cleanly with a sharp saw or loppers. Exposed roots are to be kept moist and covered with hessian for the duration of the exposure. Where roots with a diameter larger than 50 mm are encountered excavation should be undertaken by hand and such roots tunnelled under.
Gain consent from a qualified arborist if activities within the Tree Protection Zone become unavoidable.
Conduct a monthly site inspection to ensure that protection measures are being adhered to and that retained trees are not showing signs of damage or stress. Such inspections shall be completed by a qualified arborist.
Prior to the selective clearing operations, habitat trees shall be identified. Once this has been completed, clearing shall be conducted using a staged approach where the smaller non-habitat trees are removed in the first stage with the larger remaining habitat trees removed three to five days after the initial clearing. This staged method provides a disturbance stimulus and provides fauna with time to leave the site thus maximizing the chances of fauna survival while reducing the need for human

intervention for translocation or rescue purposes.
Assessment of the site for wildlife will be undertaken by an appropriately qualified person (i.e. accredited by QPWS for capture and release) at least 14 days prior to the pre-start meeting. After the pre-start meeting, the 'spotter catcher' shall provide a plan to Council indicating the broad range of fauna expected in the site, the proposed method of operation, and any expected constraints. All operational works involving habitat removal are to be supervised until satisfied that native fauna have been suitably relocated, and shall instruct the contractor when no further action is required. Council will confirm with the appointed person that no habitat removal occurred without supervision shall be present to inspect the trees and relocate remaining fauna where possible.
Prior to tree removal, an appropriately qualified ecologist shall attempt to "flush out" any denning or nesting animals not observed during the initial hollow inspection.
Following felling, a second inspection of the relevant trees shall be carried out to relocate fauna disturbed by the clearing process or remaining within the felled timber to a suitable location determined in consultation with QPWS.
All injured animals shall be immediately removed and taken to an appropriately qualified veterinary surgeon. Should any orphaned or injured native fauna be discovered at a later stage during operational works, then matter shall be immediately reported to the Central Moreton District Officer of the QPWS.
Following completion of the selective clearing stage, capture and release records shall be supplied to QPWS in accordance with their licensing conditions. A copy of these records, if requested, shall be supplied to Council.
Social
Provide a communication program targeted to local residents and visitors to the Island, and including: ▪ regular construction updates; ▪ advice on construction schedules; and ▪ the results of monitoring required by the EMP.
Develop, promote and implement an effective complaints response system for receiving, handling and responding to complaints received during construction of the Project, including: ▪ Provision and promotion of a phone contact with construction management staff during hours of construction; and ▪ A follow up procedure which notifies complainants within 24 hours of the intended response to the issue raised.
Develop monthly reports (publicly accessible on request) regarding communication activities, residents' complaints and resolution of complaints.
Undertake further analysis of the threshold levels for the provision of on-island services in conjuction with relevant Local and State Government agencies.
Consult with relevant Local and State Government agencies to identify and gain commitment for provision of and contribution to social infrastructure requirements to meet the expected increase in population, including upgrading of emergency services.
Consult with the Department of Emergency Services to identify and agree provision for emergency services.
Liaise with Rockhampton and/or Bundaberg emergency helicopter services to be included on the helicopter landing register and to develop protocols.
Consult with health authorities regarding needs of older residents, including health care, and to identify and agree on-Island health service responses, including home care services.
Facilitate development of community groups, support networks and events to build social capital within the community.
Incorporate universal design and Crime Prevention through Environmental Design (CPTED) principles to into the design of residential, commercial and community

facilities and outdoor spaces.
Consult with Surf Lifesaving Queensland to investigate and determine the level of provision of private, funded or volunteer surf lifesaving services.
Investigate and establish required beach safety measures, including lifeguard tower, and potential need for swimming enclosure to avoid marine stingers.
Health and Safety
Drinking water supplies from the proposed desalination plant will be required to meet NHMRC Australian Drinking Water Quality Guidelines (2004)
Master Planning has included provision for council and volunteer lifeguard services for public beaches.
All plant operators (including contractors) will be certified to operate their designated equipment.
Site management will be in accordance with Queensland OH&S Legislation and Policy which includes site security, warning signs prohibiting unauthorised access.
Construction activities will be conducted in accordance with the Construction OH&S Plan which outlines responsibilities for OH&S management, minimum OH&S standards to be met for the site, training (including contractors), reporting and compliance checks.
A site traffic management plan will address matters such as traffic flow, direction and speeds for construction traffic in residential areas and Clarks Road, in conjunction with the local Police Force and Local Government
Water storages and detention basins will be designed in accordance with Water Sensitive Urban Design Technical Design Guidelines for South East Queensland, (Healthy Waterways,2006)
Recycled water will be treated to Class A+ in accordance with the Queensland Recycled Water Guidelines (2005) as such waters will comply with the Guidelines for Managing Risks in Recreational Water (NHMRC, 2006)
Airstrip operations will be in accordance with CASA requirement
Permanent water storages will be constructed in accordance with the Queensland Recycled Water Guidelines (2005) and the Australian Mosquito Control Manual (Mosquito Control Association of Australia 2002)
Temporary water storages will be constructed in accordance with the Draft Water Sensitive Urban Design Engineering Guidelines, (Healthy Waterways, 2006).
The handling, storage and separation distances be maintained in accordance with Australian Standards and industry codes of practice, such as: ▪ AS 1692: Tanks for flammable and combustible liquids ▪ AS 1940: The storage and handling of flammable and combustible liquids ▪ AS 2187: Explosives - Storage, transport and use ▪ AS 3780: The storage and handling of corrosive substances ▪ AS 4452: The storage and handling of toxic substances
An Emergency Response Plan will be developed and implemented. The Plan will include provision for: ▪ A team in the construction employees to provide a first response capability (e.g. occupational first aid and basic fire fighting); ▪ An emergency controller, who will be the on-duty operations team leader, will control and coordinate emergency response actions on site until such time as the incident is either effectively managed or handed over to external emergency services; ▪ Stores, restaurants, commercial premises and offices will be fitted with approved and certified fire detection (smoke detectors) and sprinkler systems; ▪ First aid fire fighting equipment (hand held extinguishers and fire hoses) will be installed at strategic points at the development;

▪ All fire fighting facilities and equipment will be serviced, maintained and inspected by a certified body; ▪ Site induction training will include emergency response actions; ▪ Fire drills will be undertaken on a regular basis where necessary by construction personnel; ▪ Permanent facilities, such as fuel storage areas, will have a dedicated fire alarm, suppression and fire fighting systems; and ▪ A permanent emergency services presence will occur after the third year of construction with inclusion of a combined Police, Ambulance and Fire Brigade building located in are adjacent the town centre. The Principal Contractor will liaise with local State Emergency Services and local ambulance and hospital services with respect to planning for Emergency Response.
A Bird and Animal Hazard Management Plan will be developed (included as part of the Airstrip Manual) and implemented. The Plan will be prepared by a suitably qualified person such as an ornithologist or a biologist, etc and will address: ▪ hazard assessment, including monitoring action and analysis; ▪ pilot notification; ▪ liaison and working relationships with land use planning authorities; ▪ on-airport bird and animal attractors which provide food, water or shelter; ▪ suitable harassment methods; and ▪ an ongoing strategy for bird and animal hazard reduction, including provision of appropriate fencing.

Attachment 2: List of Approvals

Table 1 Key Approvals Required and Authorities

Legislation	Approval Requirements	Application to Proposed Development	AM
COMMONWEALTH			
Environmental Protection and Biodiversity Conservation Act 1999 (EPBC Act)	Approval for 'Controlled Action' from the Commonwealth Department of Environment and Water Resources (DEW).	Under the EPBC Act, a person must not take an action that has, will have or is likely to have a significant impact on a matter of national environmental significance without the approval of the Commonwealth Minister for the Environment and Water Resources. The proposed development may impact on the following matters of National Environmental Significance: World Heritage Areas (Great Barrier Reef); Listed endangered species; and Migratory and marine species. The project has been declared a "Controlled Action" by the Commonwealth Minister for the Environment, Water and Resources (refer to Appendix A3).	DEW
STATE			
State Development and Public Works Organisation Act 1971 (Non-IDAS approval)	An Environmental Impact Statement must be prepared for any project declared a Project of State Significance under this Act. The Coordinator-General's assessment and conditions become a Concurrence Agency response under the *Integrated Planning Act 1997* for the material change of use development application to Miriam Vale Shire Council.	An application for a Project of State Significance declaration under this Act was made. It was deemed that the Hummock Hill Island Development is a 'Project of State Significance' and will be assessed by the Coordinator-General under this process.	Co-ordinator General
Marine Parks Act 2004 Marine Parks Regulation 1990 Marine Parks (Great Barrier Reef Coast) Zoning Plan 2004 For works in a State marine park, the permit approval process is administered by Queensland Parks and Wildlife Service (part of the Queensland Environmental Protection Agency).	A marine park permit may be required for: Installing a structure in the Great Barrier Reef Coastal Marine Park (between high and low tide) (e.g. bridge, boat ramp); and Discharging waste into the Great Barrier Reef Coastal Marine Park.	Boat ramps and a bridge are proposed to be constructed in Boyne Creek and Colosseum Inlet which would require placement of structures in the Queensland Great Barrier Reef Coastal Marine Park (i.e. the land/waters between high tide and low tide). The structures would require Marine Parks Permits. An emergency sewage outlet is proposed for disposal of treated	EPA

Legislation	Approval Requirements	Application to Proposed Development	AM
		effluent when flows are greater than three times average dry weather flow (ADWF) typically when severe weather conditions preclude land irrigation. This outflow will discharge to an ephemeral creek that flows to the main channel of Colosseum Inlet. This would require a Marine Parks Permit.	
Vegetation Management Act 1999 (IDAS approval)	Development Permit for Operational Works - clearing of native vegetation. Department of Natural Resources and Water is the assessment manager for the application.	Remnant vegetation is present on Hummock Hill Island including "endangered"," of concern" and "not of concern" regional ecosystems. The proposed development has been planned to avoid clearing of "endangered" vegetation except where absolutely necessary for infrastructure provision. Clearing of "of concern" and "not of concern" regional ecosystems would be required. "Of concern" vegetation cleared for the project would be off-set as required under the *South East Queensland Regional Vegetation Management Plan* (2006).	DNRW
Water Act 2000 (IDAS approval)	Development Permit for Operational works - disturbance of the bed and banks of a watercourse. Department of Natural Resources and Water is the assessment manager for the application.	Schedule 8, part 1, table 4, item 3 of the *Integrated Planning Act 1997* specifies that operational work for the purposes of taking or interfering with water under the *Water Act 2000* is assessable development. This includes all work in a watercourse (e.g. a pump, gravity diversion, stream re-direction, weir or dam). Crossings of ephemeral watercourses on Hummock Hill Island would trigger a permit requirement under the *Water Act 2000* if bed and banks are interfered with. Mainland water supply pipeline alignments may include crossings of freshwater streams to which the *Water Act 2000* would apply. There is no intention to extract water from aquifers or surface waters.	DNRW
Aboriginal Cultural Heritage Act 2003	No permits required.	Disturbance of Aboriginal cultural heritage material can only be undertaken in accordance with a Cultural Heritage Management Plan	

Legislation	Approval Requirements	Application to Proposed Development	AM
		(CHMP). A CHMP is required for any project for which an Environmental Impact Assessment is undertaken. Surveys with the local Aboriginal people have confirmed the presence of Aboriginal cultural heritage material on Hummock Hill Island. A Cultural Heritage Management Plan has been compiled and approved by DNRMW on 17 January, 2007.	
Native Title Act 1993 (Cth) Native Title (Queensland) Act 1993	No permits required.	Native Title has been extinguished over Lot 3 (development lease). Infrastructure, such as the bridge and road corridors, are to be dedicated as road reserves and not subject to Native Title.	
Fisheries Act 1994 (IDAS Approval)	Operational Works Permit – operational work completely or partly within a declared fish habitat area; Operational Works Permit - disturbance or removal of Marine Plants; and Resource Allocation Authority for any disturbance within a Fish Habitat Area. The Department of Primary Industries and Fisheries (DPI&F) is the assessment manager for the development permits. DNRW is the administering authority for the 'resource allocation authority' unless within a Fish Habitat Area where DPI&F is the administering authority.	Colosseum Inlet boat ramp would require a Resource Allocation Authority and an Operational Works Permit due to works in and adjacent to tidal wetlands and the Colosseum Inlet Fish Habitat Area (FHA). The area 100m on either side of the centreline of the existing access track and causeway is excluded from the FHA and approvals for the bridge crossing and Boyne Channel boat ramp would not be required. Disturbance and removal of a small number of mangroves on Boyne Channel would require Operational Works approval. Disturbance to mangroves on Colosseum inlet can be avoided.	DPI&F
Environmental Protection Act 1994 (IDAS Approval)	Material Change of Use Permit – establishment of new Environmentally Relevant Activities (ERAs). The Environmental Protection Agency is the assessment manager.	The Hummock Hill Island Development would require development permits to operate the following ERAs: ERA 15 (Waste Water Treatment Plant); ERA 19 (Dredging)	EPA
Nature Conservation Act 1992	Approval from the EPA is required to disturb, harm or destroy any species listed under the Act.	Flora and fauna surveys undertaken to date have identified several bird species listed under the *Nature*	EPA

Legislation	Approval Requirements	Application to Proposed Development	AM
	A development permit under the *Integrated Planning Act 1997* is not required.	*Conservation Act 1992* as being present on the site (Refer to Section 13). It is not likely that the proposed development would harm or disturb these species and approval under the Act is not likely to be required.	
Transport Infrastructure Act 1994 (IDAS Referral)	Permit for Preliminary Approval - Material Change of Use. Concurrence agency approval from Department of Main Roads in relation to impacts on state controlled roads, would be required for the "Preliminary Approval for Material Change of Use".	The proposed development exceeds the development thresholds established in the *Integrated Planning Regulation 1998*, Sch 5, Table 3, items 2 and 3.	DMR
Coastal Protection and Management Act 1995 (IDAS Approval)	Operational Works Permit - Tidal Works within a coastal management district; and Resource Entitlement (non-IDAS Approval – DNRW administering authority). The EPA would be the assessment manager where the works are not prescribed tidal works. Where the works are prescribed tidal works, EPA would be a concurrence agency.	Required for works within Colosseum Inlet and Boyne Channel, including works associated with bridge and boat ramp construction.	EPA
LOCAL			
Miriam Vale Shire Council Transitional Planning Scheme or Draft Miriam Vale Shire Council Planning Scheme	Development permits for: Material Change of Use (preliminary approval); Material Change of Use (as per the approved Plan of Development); Reconfiguring a Lot; Carrying out Operational Work; and Placing an advertising device on premises.	A 'preliminary approval' material change of use is required to be sought from Miriam Vale Shire Council. Subsequent development applications for material change of use, reconfiguration of a lot, operational works and advertising devices shall be assessed within the framework of the approved Plan of Development for the site.	Miriam Vale Shire Council

SECTION 1
INTRODUCTION

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1. Introduction

1.1 Project Setting

Eaton Place Pty Ltd (ACN: 110 480 772) hold a Special Lease (SL)(SL 19/52155) over Lot 3 on FD841442 (1,163 Ha) located on Hummock Hill Island, 30 km south-east of Gladstone City on the Central Queensland Coast (refer to Figure 1.1). The SL gives the proponent freehold rights to 436 ha of land within Lot 3 to be developed in accordance with actions and arrangements identified through the Impact Assessment Study (SL Condition C369) following consent from the Minister and Council and obtaining all relevant approvals.

The SL was created in 1991 by the Goss Government following land use negotiations between mineral sand mining interests and State agencies that created National and Environmental Parks in areas of high conservation value, such as Byfield, Curtis Island, Wild Cattle Island, Rodds Peninsula, Eurimbula and Deepwater National Parks and Bustard Head Conservation Park. Remaining areas such as Hummock Hill Island and Middle Island were considered to have lower conservation values and also considered to have suitable opportunities for either mining or tourism. The SL has been regularly renewed since 1991 and was re-negotiated in 2005. A number of proposals for the Island have been proposed during the various renewals and also following the re-negotiation of the lease.

The proposed Hummock Hill Island development is to construct a master planned integrated tourism and residential development to provide a high quality and affordable holiday destination for tourists and high quality recreational facilities for residents of the Gladstone district. The project will consist of two resort hotels, camping grounds, holiday accommodation and residential development, golf course and associated sporting facilities, education precinct, a small commercial centre, and small scale marine commercial facilities. The development will provide public access to arguably the best beach between 1770 and the Capricorn Coast. This beach and the surrounding waterways are presently only accessible by boat. However, once the access road and the bridge to the Island are constructed residents and workers from Gladstone will be able to access the Island in 45 minutes.

The Master Plan for the proposed Hummock Hill Island Development is presented in Figure 1.2.

On October 25, 2005, the Coordinator-General declared the project "*a significant project for which an EIS is required*" under Section 26(1)(a) of the *State Development and Public Works Organisation Act, 1971* (SDPWO Act).

The project was declared a "Controlled Action" by the Commonwealth Minister for the Environment and Heritage (DEH)[1] in October, 2005 under the EPBC Act.

[1] Now re-named Department of Environment and Water Resources.

LEGEND

- Town
- Railway
- Major Road
- Dam

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Figure 1.1 - Site Location - Hummock Hill Island

Hummock Hill

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Figure 1.2 - Hummock Hill Island Master Plan

HUMMOCK HILL

EATON PLACE Pty ltd

JOB NO: 4489-01-C 15/11/07 A-MP-00-03(F) SCALE: 7500 @ A0 0 50 100 200 300 600

MLDesign architects planners interior designers

Hummock Hill Island is situated at the juncture of the Wide Bay and Capricorn Coasts, 30 km south east of Gladstone and provides the ideal combination of warm climate, accessibility, deep water estuaries, safe beaches, clean air and a landscape that ranges from open cleared areas, re-grown vegetation and natural landscape. The Island is approximately 13 km long, 3 km wide, with a total area of 2,150 ha, of which 341 ha (12%) fall within the development footprint. It is separated from the mainland by Boyne Creek, a shallow tidal estuary that flows into the deeper waters of Colosseum Inlet and Seven Mile Creek. Gladstone City is 45 minutes drive from the Island, with Tannum Sands and Boyne Island located 30 minutes to the north-west and the town of 1770 is a 90 minute drive to the south east.

The Island has a long history of human use; firstly by the local indigenous population and subsequently for pastoral activities, with the grant of a pastoral lease in 1870 that saw the Island used for raising beef cattle and as a source of timber. Vegetation clearing on the Island was required as a condition of Pastoral Lease renewal through this time. The pastoral lease was rescinded in 1980. No agricultural activity has occurred on the Island in the 25 year since this time.

Plans were proposed for a tourism based development in the early 1990s; the subject of the 1993 EIS by the Tod Group (1993). Miriam Vale Shire Council issued a development approval for 5,000 lots, a marina, two golf courses and a hotel/convention centre in the mid 1990s. A further tourism and residential development was proposed in 1999 consisting of a hotel resort, caravan park, two golf courses, low and medium density residential, commercial science/technological precincts and a rocket launching facility. An Exploration Permit – Minerals (EPM) has existed over the Island since the early 1980's due to identified mineral sands deposits in coastal sand deposits.

The current proposal for an integrated tourism and residential development has been the subject extensive master planning with the aim of minimising disturbance to key environmental assets within and adjacent the proposed project area.

About two thirds of the development lease and the remainder of the Island will not be developed and will be managed (via a special area levy) for conservation values and compatible recreational usage. The project will be developed to the highest environmental standards, utilising state-of-the-art engineering and architectural solutions to minimize impacts on the local environment, to minimise the demand for (and use of) precious natural resources and to ensure long-term environmental sustainability of the development. Environmental management plans will be prepared to monitor and manage any impacts on the surrounding environment identified in the Environmental Impact Statement during construction and operation.

Hummock Hill Island and adjacent estuaries are within the Great Barrier Reef World Heritage Area, the State administered Great Barrier Reef Coastal Marine Park and border the Mackay/Capricorn Great Barrier Reef Marine Park (administered by the Commonwealth). Directly East of the Island is the Eurimbula National Park which is situated on Rodds Peninsula and to the north west is Wild Cattle Island National Park (refer to Figure 1.3).

The coastline within the region is a significant attraction to the population and provides recreational opportunities for local and more remote populations associated with the Gladstone

industrial area and coal mines within the Bowen Basin to the west. The State Coastal Plan (2002) recognises that "*significant population growth in Queensland is projected and development of urban land uses will continue to be a major activity within the coastal zone.*"

The Island's coastal location lends itself perfectly to the concept of a master planned 21st Century village where residents live in harmony with natural systems and are empowered to take responsibility for managing and minimising their own ecological footprint. Management of water, wastewater and energy supply services will be based at the household and local community levels, taking advantage of a number of innovative technologies and supporting infrastructure which have been successfully applied at these levels. The 21st Century village approach means tourists and householders attracted by the natural values of the Island and its surrounds can commit to minimising their own ecological footprint and ensure protection of natural values within the area.

1.2 Project Proponent

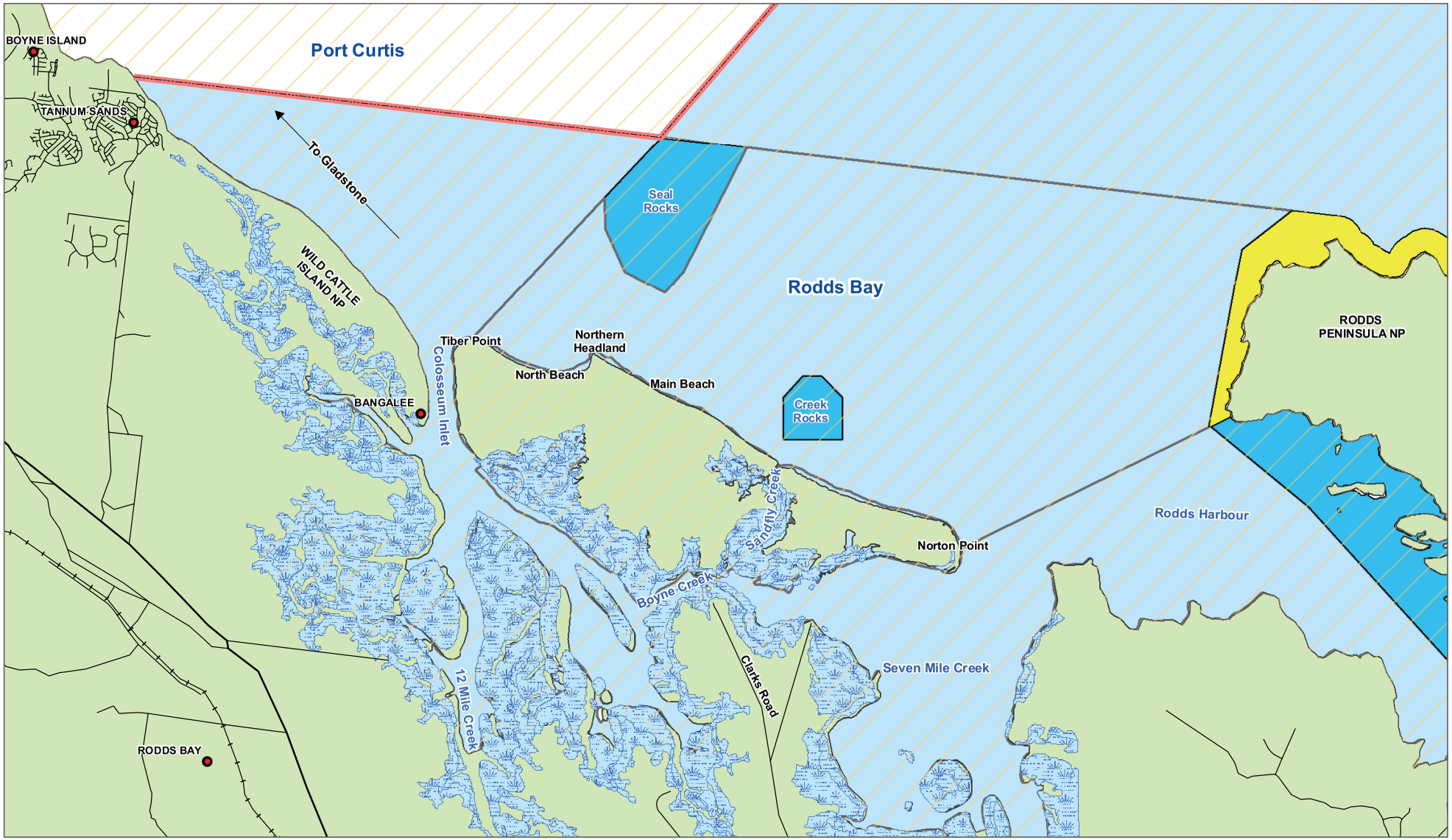
The proponent is Eaton Place Pty Ltd (ACN 110 480 772). Principal shareholders of the proposed development of Hummock Hill Island are the Scarf and Hatsatouris' families from Sydney, NSW. Over the past 10 years their family companies and associated companies have been responsible for major property developments in NSW, consisting of shopping centres, home unit developments and commercial properties with a value of over $250 million.

Recent projects by Eaton Place Pty Ltd include:

- Shopping complex, comprising cinema complex and 22 shops;
- 294 New South Head Road, Sydney – office building;
- Rezoning of land for 70 home units Port Macquarie;
- Development of The City Centre Market and Pitt Streets;
- The Georges Centre, 45 Cross Street, Double Bay, Sydney;
- Redevelopment of 125 York Street, Sydney;
- Redevelopment of 70 Edgecliff Road, Woollahra, Sydney;
- Redevelopment of Edgecliff Post Office into retail and commercial; and
- 207 Darlinghurst Road, commercial and residential development – Darlinghurst, Sydney.

1.2.1 Environmental Record

There are no current or former proceedings under a law of the Commonwealth or a State for the protection of the environment or the conservation and sustainable use of natural resources against Eaton Place Pty Ltd, any Board member or its senior management.



LEGEND

- Town
- Major Road
- Railway
- Marine Park Boundary
- Great Barrier Reef World Heritage Area
- Intertidal Wetland

Marine Park Zoning

- Conservation Park Zone
- General Use Zone
- Habitat Protection Zone

Figure 1.3 - Natural and Conservation Features of Hummock Hill Island and Rodds Bay

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Hummock Hill

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Figure 1.4 - Aerial View of Hummock Hill Island and Surrounds

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N W E S

Hummock Hill

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1.3 Project Description

The proposed Hummock Hill Island Development is an integrated tourist and residential community incorporating a diverse range of tourist accommodation including resort style hotels, holiday units, camping grounds, residential housing, and a town centre based around retail and educational services that will cater for a broad range of people. The proposed community will consist of an estimated 2,300 tourists and 1,600 residents (at 100% capacity). This population will be achieved over a period of 15 years (construction being 16 years).

The master planned development provides a unique opportunity to develop a community that aligns with and engages all the elements possible in a diverse human and natural environment which also comprises a pleasant coastal setting.

Development will avoid areas of 'endangered' regional ecosystems to the maximum extent possible. Areas 'of concern' or 'not of concern' Regional Ecosystems that are disturbed for development will be managed to maximise preservation and maintenance of existing ecological functions such as riparian corridors to provide fauna movement through the proposed development. Further vegetation management will occur at the individual Lot level with covenants requiring building footprints to be less than 50% of the Lot area and the retention of existing vegetation outside this area.

Appropriate guidelines (as a deed of covenant) will be developed to provide strategies and methods to reduce disturbance of ecosystems to a minimum and ensure that ecological function is maintained. Where disturbance does occur, guidelines will establish criteria for the rehabilitation and ongoing maintenance, with an emphasis on compatible species and water efficient irrigation.

The many elements of the proposed development have been located with careful consideration to the existing conservation areas, topography of the site, utilisation of views and vistas, and integration within the natural landscape.

The development has been designed to fit in and around the existing environment, with minimal disturbance, and a sustainable outcome has been achieved. Ecologically Sustainable Development (ESD) principles have been the driver behind the design with Hummock Hill Island supporting a low impact master planned community.

Development on Hummock Hill Island has been proposed since the early 1990's, firstly for residential and recreational development in 1991 and for a combined residential, technology park and space launch facility in 2002. Extensive studies for these proposals were undertaken over that time and provide a strong baseline augmented by more recent studies undertaken for this EIS. Additional studies were conducted for the current proposed development and include:

- Project Direction - Dockside Developments Pty Ltd
- Project Management - Sinclair Knight Merz (SKM)
- Independent Professional Review - GHD Pty Ltd
- Master Planning - ML Design, 2006

• Project Description -	GHD Pty Ltd; SKM; Dockside Developments Pty Ltd; ML Design; Cardno
• Terrestrial Fauna & Flora –	Central Queensland University, 2005; Sinclair Knight Merz, 2007
• Geomorphology Assessment	Cardno, 2007
• Marine Fauna & Flora -	Sinclair Knight Merz, 2006
• Water Quality -	Sinclair Knight Merz, 2006
• Air Quality & Noise -	Sinclair Knight Merz, 2006
• Climate -	Sustainable Fx, 2007
• Social Environment -	Sinclair Knight Merz, 2006
• Cultural Heritage -	Archaeo Cultural Heritage Services Pty Ltd, 2006, 2007
• Landuse Planning -	Sinclair Knight Merz, 2006
• Hazard and Risk -	Sinclair Knight Merz, 2006
• Economic Assessment -	Focus Economics, 2007
• Community Consultation -	Sinclair Knight Merz, 2007
• Water Supply -	Cardno, 2006; MPI Group, 2007
• Stormwater Management -	Cardno, 2006
• Power Supply -	Lincolne Scott, 2007
• Sustainable infrastructure -	MPI Group, 2007

1.4 Project Objectives and Scope

The project offers a unique tourism opportunity in a strategic development region of Queensland and will provide the important industrial centre of Gladstone and mining areas of Central Queensland with quality tourist, residential and recreational facilities that are not currently available in the region. The project contributes to achievement of the desired regional outcomes for the Wide Bay Region (refer Section 2).

The development will provide access to beaches and waterways that are presently not accessible to residents or tourists. There is a demonstrable growing demand for access to good quality beaches within reasonable access time from Gladstone and the mining towns to the west.

The proposed educational centre will support research in environmental management and provide facilities for residents and tourists to undertake study programs linked to a major Queensland university. This is an example of a private enterprise endorsement of the Government's Smart State Policy.

The proposed project will consider all environmental opportunities and constraints to ensure that the development takes place within the sustainable limits of the environment. The development will be in harmony with the natural environment and showcase innovative urban and residential design in relation to energy and water consumption as well as protection of ecosystems. The

natural environment is a key feature of the Island's setting and planning and design of the project will ensure that the natural attractions of the Island and surrounding areas are protected for both residents and visitors.

The development will be built on environmentally sustainable development (ESD) principles and will utilise cutting edge technologies to minimise reliance on external power and water resources. The phased development program will also allow new and/or improved technologies to be incorporated into later stages of development. These ESD principles will foster the creation of a 21st Century village that seeks to exist in harmony with its environment. This 21st Century village will offer a range of tourism, lifestyle and residential options, will facilitate a unique opportunity to generate diverse and dynamic social systems and provide the social cohesion and support recognised as being increasingly important to quality of life.

The Gladstone region has been identified by the State Government as a prime area for major industrial development due to the availability of large tracts of suitable undeveloped land; proximity to a deep water port (the Port of Gladstone); availability of competitively priced energy; ready access to water, gas and raw materials; and well planned infrastructure in the form of roads, rail and waste treatment facilities (Office of the Coordinator-General, 2006). Sustained population growth within the Gladstone region associated with current and future development and intra state coastal migration will continue to exert pressure on current population centres. These major centres include Gladstone and Boyne Island/Tannum Sands and also the eastern seaboard towns of 1770 and Agnes Waters which service the Bowen Basin and associated coal mines.

The project will contribute significantly to the local and regional economy, both in terms of expenditure during construction and operation, and diversification of the economic base. Significant benefits will accrue to the Local Authority, through an increased rates base and consequent income through council fees and charges.

The State Government made the Local Government Reform Commission's recommendations public on Friday 27 July 2007. This included the recommendation that Miriam Vale Shire Council be amalgamated with Calliope and Gladstone Shire Councils. The name proposed for the new Council is Gladstone Regional Council. Amalgamation is scheduled for the first quarter of 2008 to coincide with local Government elections.

1.5 The Environmental Impact Statement Process

1.5.1 Process

This Environmental Impact Statement (EIS) has been prepared under the *State Development and Public Works Organisation Act, 1971* (SDPWO Act) Significant Project Process (refer Figure 1.5) to support an application for preliminary approval for a material change of use for the proposed land on Lot 3 on FD841442. On October 25, 2006, the Coordinator-General declared the project "*a significant project for which an EIS is required*" under Section 26(1)(a) of the SDPWO Act. Draft Terms of Reference (ToR) for the EIS were prepared, advertised and exhibited from 20 November, 2006 to 18 December, 2006.

In considering comments on the draft TOR from Commonwealth, State, and local Government agencies, authorities and other interested parties, the Coordinator-General issued a final TOR on 22 June, 2007 (refer Appendix A1).

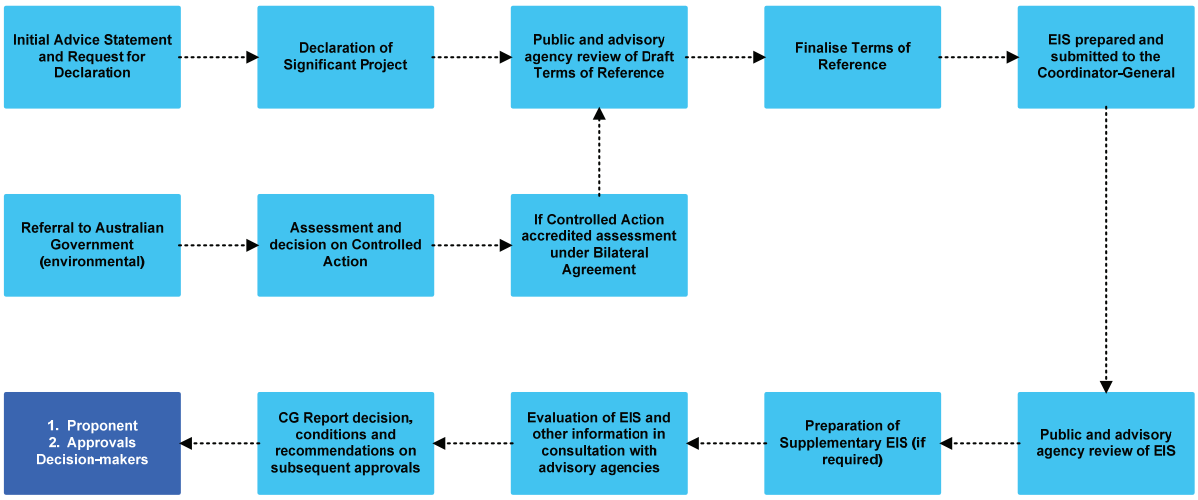


Figure 1.5 – Summary of the EIS Process Under the SDPWO Act

The project was referred to the Commonwealth Minister for the Environment and Heritage (DEH)[2] in October, 2005 for a decision as to whether the project was a "Controlled Action" under the *Environmental Protection and Biodiversity Conservation Act, 1999* (EPBC Act). The Commonwealth notified its decision, by letter dated 13 January, 2006, that the project was a "Controlled Action" on the basis of:

- Sections 12 and 15A (World Heritage);
- Sections 18 and 18A (Listed threatened species and communities); and
- Sections 20 and 20A (Listed migratory species).

Impact assessment under the SDPWO Act is the subject of a bilateral agreement between the Queensland and Commonwealth Governments in relation to matters of National Environmental Significance (NES) under the EPBC Act. The EIS has been prepared under the provisions of the SDPWO Act and in accordance with the Final ToR. The EIS process provides the Coordinator-General with a framework to:

- Consider the economic, social and environmental aspects of the project in the context of legislative and policy provisions and decide whether the project may proceed;
- Set conditions for approval, as appropriate, to seek to achieve economically, socially and environmentally sustainable development; and

[2] Now re-named Department of Environment and Water Resources.

- Where necessary, recommend environmental management and monitoring program/s.

Public notification of this EIS has been placed in relevant local, State and National newspapers advising where copies of this EIS are available for inspection or purchase, how submissions may be made to the Coordinator-General on the EIS and the timeframe in which submissions may be made. The Coordinator-General may also consider submissions made by relevant Commonwealth, State, and local Government agencies and authorities during the submission period. Following the submission period the proponent may be required to prepare a supplementary report/addendum to the EIS to address specific matters raised in submissions.

At the completion of the assessment phase of the EIS the Coordinator-General will prepare a report evaluating the EIS and any supplementary studies pursuant to section 35 of the SDPWO Act for approval and a material change of use application under the *Integrated Planning Act, 1997* (IPA).

The Coordinator-General's report will include an evaluation of potential environmental effects due to the project and any related matters. The report will reach a conclusion about potential effects and any proposed mitigation measures based on the submitted EIS, supplementary studies and any properly made submission, any other submissions accepted by the Coordinator-General, comments and advice from advisory agencies, specific technical reports and legal advice.

The proposed development will also require a range of subsequent development approvals under legislation identified in Section 1.7. Under Section 39 of the SDPWO Act the Coordinator-General's report may direct Assessment Managers under the IPA as follows:

- That there are no conditions or requirements for the project; or
- That conditions must attach to the development approval; or
- That the development approval must be for part only of the development; or
- That the approval must be a preliminary approval only; or
- That the application for the development approval must be refused.

The proponent's objective is to seek preliminary approval for the proposed development with all further development applications subject to the project specific Code of Development that will be sympathetic with the Miriam Vale Shire Transitional Planning Scheme.

Under the bilateral agreement, the Department of the Environment and Water Resources (DEW) and the Great Barrier Reef Marine Parks Authority (GBRMPA) act in an advisory capacity to the Coordinator-General for the EIS assessment process under the SDPWO Act. Whilst the objective of the EIS under the SDPWO Act is to seek preliminary approval for the proposed development, there is no provision for preliminary approval from the Commonwealth Minister (or his/her delegate). The Minister (or his/her delegate) can only make a decision to either approve of not approve the project, however approval can be provided with conditions. As such, the level of information required in the EIS needs to be of sufficient detail to allow the Minister (or his/her delegate) to make an informed decision on the entire project.

The Commonwealth Minister for the Environment and Water Resources and GBRMPA will assess the EIS and any supplementary information to ensure that requirements of the EPBC Act are addressed following release of the Coordinator-General's report. The Minister's and GBRMPA assessment will consider information from the Coordinator-General when making his decision.

The process for EPBC Act assessment under the bilateral agreement is as follows:

- Agree on assessment under a Bilateral Agreement;
- Agree on Terms of Reference for EIS. (A draft ToR that satisfies both Commonwealth and State government requirements is provided in Appendix A1).
- Conduct assessment as per State approvals pathway (refer to Section 2);
- Coordinator General submits assessment report to the DEW;
- Commonwealth Minister for Environment and Water Resources seeks views from any relevant Commonwealth Ministers and relevant agencies such as GBRMPA; and
- Minister issues either an approval or refusal decision under the EPBC Act.

Figure 1.6 shows the EPBC Act assessment process. The pathway under a bilateral agreement has been designated with ticks.

1.5.2 Objectives of the EIS

The EIS objectives are to provide publicly available information on the need for, and likely effects of, the proposed Hummock Hill Island Development, to set acceptable standards and levels of impacts (both beneficial and adverse) on relevant environmental values and demonstrate how potential environmental impacts can be managed through the protection and enhancement of relevant environmental values.

Specific objectives of the EIS process are to:

- Describe for the public, Coordinator-General and advisory agencies the nature of the proposed Hummock Hill Island Development and the likely benefits and potential impacts;
- Assess potential impacts of the proposed development on the three identified controlling provisions (refer to Section 1.5.1) under the EPBC Act and to assess if the identified impacts will be acceptable or not;
- Identify and evaluate relevant issues associated with the Project;
- Identify potential environmental, economic, infrastructure requirements and actions, cultural, social, transport and land use planning impacts of the preferred concept, and recommend infrastructure and facilities needs together with other design and operational measures required to minimise or compensate for adverse impacts and enhanced benefits;
- Consult with the community and relevant stakeholders in the process of identifying, assessing and responding to the impacts of the Project;
- Identify necessary licences, planning and environmental approvals including approval requirements pursuant to the EPBC Act, IPA, *Environmental Protection Act 1994*, *Coastal*

Protection and Management Act 1995, *Fisheries Act 1994*, *Nature Conservation Act 1992*, Vegetation *Management Act 1999*, *Electricity Act 1994*, other relevant legislation and the Miriam Vale Council Planning Scheme; and

- Provide an input to the decision making process, assisting with the determination of whether to accept or modify the Project, approve with conditions or carry out further studies.
-

1.5.3 Structure and Presentation of Findings

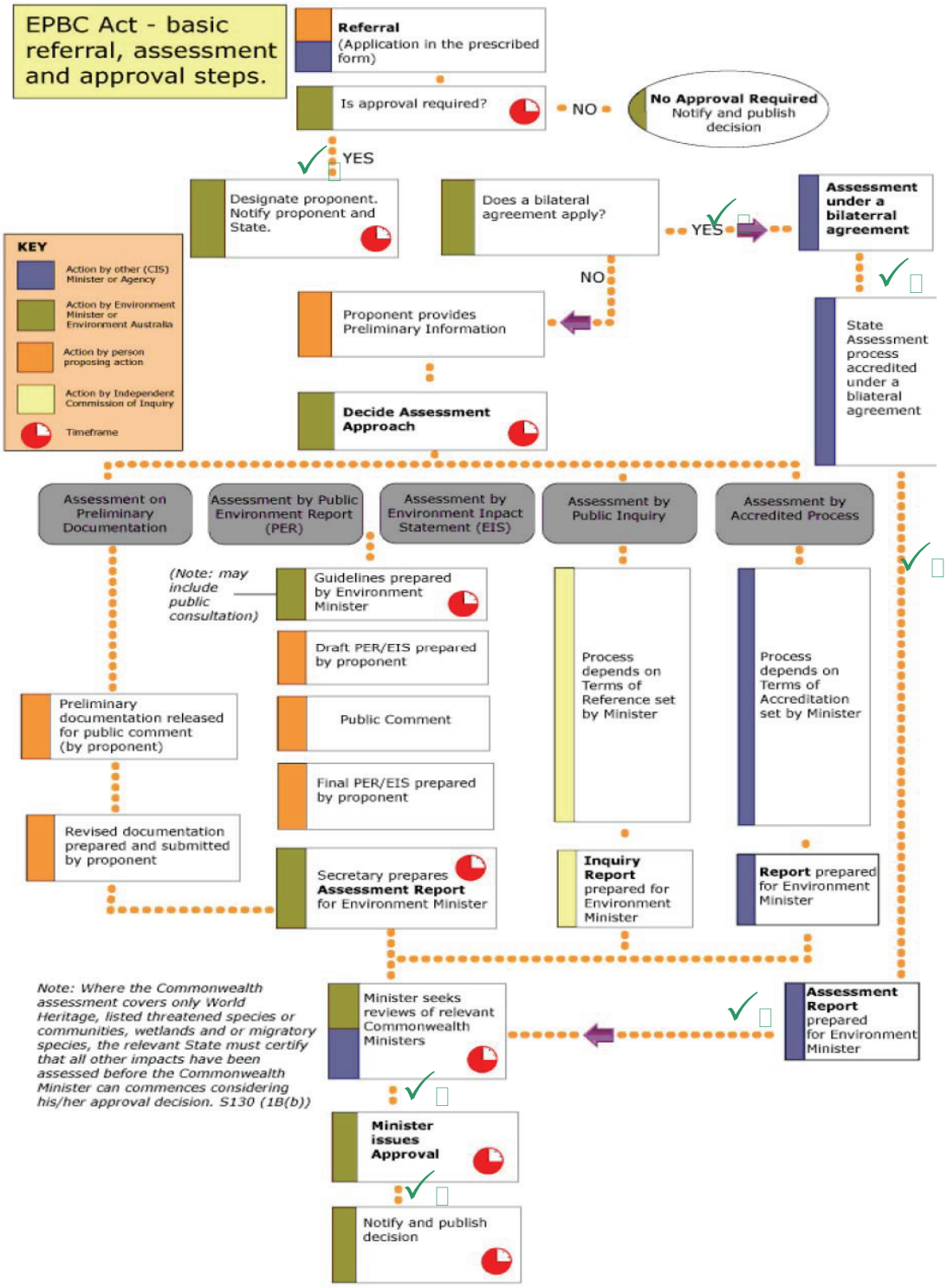
The EIS is presented as a comprehensive document providing sufficient information to allow an informed decision on the potential impacts and benefits of the project. The document provides interested bodies or persons with a basis for understanding the project, existing environment, alternatives considered, proposed solutions to particular issues, impacts that may occur and measures taken to mitigate adverse impacts.

The Executive Summary provides a broad overview of the Hummock Hill Island Development, the existing environment and the project impacts. It also provides a summary of the conclusions reached and the recommendations put forward to the Coordinator-General. To gain a comprehensive understanding of the complexities of the Hummock Hill Island Development, its likely impacts, proposed mitigation measures and outcomes of the process, the Executive Summary should be read in conjunction with the EIS and other supporting information.

This EIS is presented in three volumes:

- Volume 1 and 2 – The body of the EIS, providing a detailed summary document which identifies the key issues, predicted environmental impacts and recommended mitigation measures; and
- Volume 3 - Appendices - Technical papers dealing with such matters as water supply and treatment, stormwater controls, traffic and transport and other technical reports elaborating on the bio-physical and socio-economic aspects related to the development.

The EIS identifies and addresses the relevant legislation and other non-statutory guidelines administered at the Commonwealth and State levels of government as well as at the local government level through the Miriam Vale Shire Council.



(Source: Hummock Hill Island IAS)

Figure 1.6 – EPBC Act Approval Process

Potentially beneficial or adverse impacts of the project are examined and remedial measures proposed so that the project development, including the definition of the project specification, is based on sound economic, social and environmental protection and management criteria. The EIS is a comprehensive stand-alone document containing sufficient information to make an informed decision on the potential impacts. It provides:

- For interested bodies and persons, a basis for understanding the project, alternatives considered in the developed of the preferred concept design, the existing environment that it may affect, the impacts that may result and the measures to be taken to mitigate all adverse impacts;
- For groups or persons with rights or interests in land, an indication of the impacts of the proposed Project on that land, including access and measures to mitigate all adverse impacts; and
- An opportunity for the community to make submissions to the decision maker about the project and the EIS.

The process followed in the preparation of the EIS has sought to integrate fully the findings and outcomes of an extensive and comprehensive consultation process with both the engineering design development and the technical studies for the EIS.

1.5.4 Submissions

Formal submissions are invited on the EIS in accordance with the SDPWO Act. Submissions must be in writing, signed by the submitter and an address should be provided. The submission should be addressed to:

Project Manager – Hummock Hill Island Development
Major Projects Division
Department of Infrastructure and Planning
PO Box 15009
City East QLD 4002
Fax: (07) 3225 8282

1.6 Consultation

1.6.1 Scope and Objectives

Preparation of the EIS has involved a public consultation and communication process involving a range of key stakeholders and community members. Consultation has engaged 'affected persons' (which comprise near neighbours to the project and surrounding communities) and 'interested persons', as defined within the *Environment Protection Act 1994* (EP Act).

Whilst the proposed development is strictly a residential community and tourist resort, reference has also been made to the Environmental Protection Agency's Mining Guideline #7: *"Issue Identification and Community Consultation"* as required in Section 1.5 of the ToR.

The public consultation process has supported the EIS development by identifying key issues and areas of concern to relevant stakeholders and community members. The EIS has responded to these issues and identified ways to minimise potential impacts and maximise potential benefits of the Hummock Hill Island Development.

Objectives of the communication and consultation program for the Hummock Hill Island Development included:

- An open and accountable community consultation program which meets and, where possible, exceeds, all requirements under the SDPWO Act and EPBC Act;
- Opportunities for 'affected' and 'interested' persons to contribute to the process;
- Qualitative measures of community support and relative levels of concern about particular issues; and
- Ability to understand and respond to community issues where necessary and particularly to ensure that community issues are addressed in the EIS.

The consultation process has sought to encourage and facilitate active community involvement in the EIS process and provide ongoing information about the Hummock Hill Island Development. The approach has been to assist 'affected' and 'interested' persons to explore project benefits, impacts and issues by facilitating community participation in reviewing project plans and enabling formal review of project documentation (e.g. Draft Terms of Reference and EIS).

Those people likely to be directly affected by the project (e.g. nearby landowners, local government etc) have been provided with correspondence and opportunities for specific consultation.

Information about the Hummock Hill Island Development has also been made available to the wider communities of Miriam Vale, Calliope and Gladstone through media activity, print advertisements and a public display.

Traditional Owners have been consulted as part of the EIS process and have been involved in the development of a Cultural Heritage Management Plan (CHMP) for the proposed development (refer Section 13 and Appendix A7.10).

A full list of 'affected' and 'interested' persons engaged in consultation is detailed within Appendix A5.

1.6.2 Consultation and Communication Mechanisms

The communication and consultation process has established a number of communication channels and materials to inform key stakeholders and community members about the proposed development and seek their input into the EIS.

The key communication tools listed below were utilised and will continue beyond the EIS process into construction and operation of the Hummock Hill Island Development:

- Face-to-face meetings with 'affected' and 'interested' persons;
- Advertisements and media activity in key local, metropolitan and national news media;
- Newsletters and fact sheets;
- Information and feedback tools including project website, freecall 1800 number, reply paid mail service and project email;
- Public displays; and
- Meetings with relevant advisory bodies.

A full description of the communication process for the EIS, and its findings, is provided in Appendix A5.

1.6.3 Consultation Issues and Outcomes

Consultation with key stakeholders and community members, through the various interactions and feedback mechanisms outlined above, has identified a range of issues and comments that have been addressed in the EIS. Issues raised were discussed within context and led to a number of positive comments about the project.

Correspondence received during the consultation process is summarised below.

Correspondence Type (Inward)	Received
Public display enquiry	32
Meeting	13
Feedback form	9
Project enquiry line (1800 number)/telephone call	9
Email	6
Letter	4

A response to each comment received was provided by the proponent during consultation. Further information (e.g. copy of the Initial Advice Statement), if requested, was supplied within 14 days.

The most common comments received have been categorised as follows:

Comment or Issue Category	Count
Community impact	15
Newsletter (e.g. request)	11
Request to be added to mailing list	6
Environment	5
Access	5
Property impact	3
Property value	3
Timing	2
Compensation	1

The key environmental issues of concern regarded flora and fauna, provision of water and power, construction, traffic and transport, and project design. A number of general issues were also discussed (e.g. consultation process).

To summarise, enquiries, concerns or issues raised throughout the consultation process related to:

- Potential direct and indirect impacts on flora, fauna and aquatic biology;
- Utilities/services – water, power, telecommunications and waste;
- Construction impacts, including skills shortages and accommodation constraints;
- Traffic and transport – increased traffic and access issues, particularly for local residents and landowners;
- Project design – development footprint, visual amenity, location of facilities, impact on native title land and enquiries about land tenure;
- Community links and facilities – impacts on current recreation space and usage, community facilities and local employment; and
- Project benefits, including improved access and utilisation of Hummock Hill Island, increased local property values, tourism and recreational opportunities, and employment growth.

The environmental and social concerns raised during public consultation and their prevalence are detailed in Appendix A5.

Where issues have been identified, the proponent has addressed these issues and described impact mitigation measures within the relevant chapters of the EIS.

A summary of project website (www.hummockhill.com.au) usage and downloads, between May and October 2007, is provided below:

Type	Total
Number of visitors to website (sessions)	574
Number of hits recorded	2,847
Number of .PDF files downloaded	101
Number of times "EIS Process" PDF downloaded	25
Number of times "EIS Draft Terms of Reference" PDF downloaded	52

1.7 Legislative Framework

1.7.1 Approvals Process

Approvals for the proposed development at Hummock Hill Island are required at Commonwealth, State and local government level.

1.7.1.1 Australian Government Approvals

The proposed development has been designated a "Controlled Action" under the EPBC Act with the controlling provisions being:

- Sections 12 and 15A (World Heritage);
- Sections 18 and 18A (Listed threatened species and communities); and
- Sections 20 and 20A (Listed migratory species).

The Queensland Coordinator-General has declared the proposed development to be a Project of State Significance requiring an EIS under the SDPWO Act.

A Bilateral Agreement exists between the Commonwealth and Queensland governments allowing a joint assessment process to be undertaken for these two Acts. An overview of this process has been provided in Section 1.7.1. The outcomes of the assessment process are:

- A Coordinator-General's Report that acts as a Concurrence Agency report under the Integrated Development Assessment System (IDAS) and directs assessment managers and referral agencies regarding subsequent approvals under IDAS. The Coordinator-General's report may provide direction to assessment managers/referral agencies in regard to Development Approvals, and may also direct conditions to be attached to any approval.
- A decision by the Federal Minister for the Environment as to whether or not the project can proceed and, if it proceeds, any conditions that should apply.

Once the EPBC and SDPWO Act Project of State Significance assessment processes are completed, the proposed development will require a number of development approvals and permits. These include approvals that are incorporated into IDAS under the IPA, as well as some additional approvals.

1.7.1.2 Queensland Approvals

Given the complex nature of the proposed development, it is intended to seek preliminary approval for a Material Change of Use to vary the existing Miriam Vale Planning Scheme to incorporate a Plan of Development and underlying development codes relating to the proposed development. The process for preliminary approval (Material Change of Use) following on from the EIS is depicted in Figure 1.7. Relevant conditions imposed on the project through the Coordinator-General's Report would need to be incorporated into the preliminary approval.

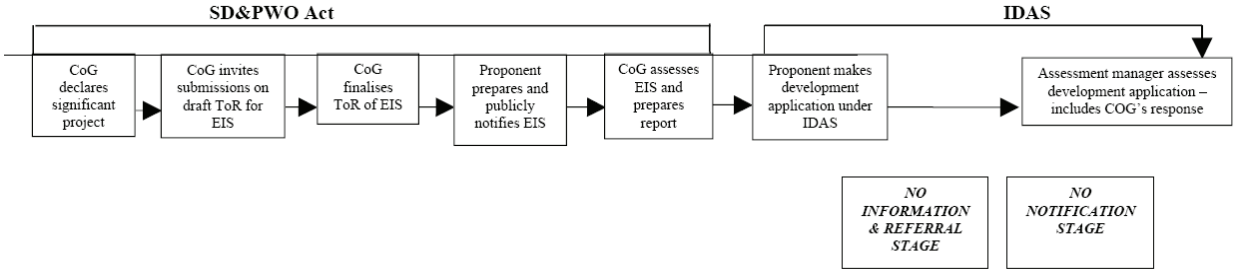


Figure 1.7 –EIS and Material Change of Use Process

Subsequent to the Co-ordinator Generals report and decision, a Material Change of Use (MCU) seeking preliminary approval will need to be lodged with Miriam Vale Shire Council under the provisions of the IPA. The IPA enables an applicant to seek a preliminary approval overriding the existing Local Government planning scheme if the application involves a MCU from the current land zoning and is impact assessable development [s 3.1.6 of the IPA]. The preliminary approval application may seek to:

1. Establish the level of assessment for any further development on the site; and

2. Identify the codes against which subsequent development will be assessed.

A Plan of Development is part of the MCU application to assist Miriam Vale Shire Council in making its decision for the proposed MCU. A Plan of Development is a site specific planning document that may also draw on the Miriam Vale Shire Council Planning Scheme for development codes against which subsequent development is assessed. The proposed Plan of Development for the Hummock Hill Island Development is presented in Appendix A2.

The approval of a Plan of Development as part of the MCU development application provides Council with certainty as to the form of the development to be undertaken on site. In addition, the Plan of Development also provides the mechanism through which the level of assessment and the assessment codes (as per the requirements of IPA) are approved and established for the further required development approvals.

The preliminary approval does not authorise development works to take place, but rather establishes a framework for all future works triggering assessment against the planning scheme to be assessed against the Plan of Development. Thus each stage and component of the proposed

development is assessed against the Plan of Development. Generally, development proposals that are consistent with the Plan of Development are subject to either self assessment or code assessment. Development proposals that are inconsistent with the Plan of Development would need to undergo impact assessment, and would be assessed against the relevant provisions of the Miriam Vale Shire Planning Scheme.

In addition to the MCU for the proposed land uses, additional approvals will also be triggered under Schedule 8 the IPA, including:

- Operational works for clearing of vegetation made assessable under the *Vegetation Management Act 1999*;
- Operational works in a Coastal Management District made assessable against the provisions of the *Coastal Protection and Management Act 1995* by the IPA and the *Integrated Planning Regulation 1998*; and
- Material Change of Use for an Environmentally Relevant Activity (ERA) for both sewage treatment works (ERA 15) and fuel storage (ERA 11).

In addition to non-IDAS approvals, the following additional approvals and permits are relevant to the proposed development:

- Authorisation to construct a structure in a marine park under the [Queensland] *Marine Parks Act 2004*; and
- Authorisation to discharge into a marine park under the [Queensland] *Marine Parks Act 2004*.

Further information on relevant legislation is provided in subsequent sections.

1.7.2 Commonwealth Legislation

1.7.2.1 Environmental Protection and Biodiversity Conservation Act 1999

The EPBC Act seeks to protect matters of NES, being those matters that the Australian Government is obligated to protect under international treaties, and other matters which the Australian Government may regulate under the Australian constitution. Matters of NES which are covered by the EPBC Act are:

Matters of NES include:

- Listed threatened species and ecological communities;
- Migratory species protected under international agreements;
- RAMSAR wetlands of international importance;
- The Commonwealth marine environment;
- World Heritage properties;
- National Heritage places; and
- Nuclear actions.

Projects considered likely to have a significant impact on any of these matters require assessment under the EPBC Act. Guidelines on what constitutes a significant impact have been prepared under the Act (refer to Appendix A3).

As discussed in Section 1.7.1, the proposed development is a Controlled Action under the EPBC Act and requires assessment in relation to the potential for significant impacts on the Great Barrier Reef World Heritage Area as well as potential impacts on listed threatened species and migratory species. The project may not proceed without approval under Part 9 of the Act.

As discussed in Section 1.7.1, the EPBC Act allows for joint assessment of projects with accredited State government processes such as the Project of State Significance process established under the SDPWO Act. Consequently, the proponent will address impacts on relevant matters of NES in an EIS prepared under the SDPWO Act (this document).

1.7.2.2 Great Barrier Reef Marine Park Act 1975

The Great Barrier Reef Marine Park Act 1975 establishes the Commonwealth Great Barrier Reef Marine Park (GBRMP) and sets up the management framework for the marine park. The GBRMPA is the managing agency for the GBRMP and is affiliated with DEW.

The GBRMP lies offshore from the ocean side of Hummock Hill Island, with the boundary at low water mark along the northern coastline.

The proposed development at Hummock Hill Island does not impact directly on the GBRMP and hence no formal approvals are required under this Act. Due to the proximity of the development to the GBRMP, GBRMPA will advise DEW during its assessment of the proposed development under the EPBC Act.

1.7.3 Queensland Legislation

1.7.3.1 State Development and Public Works Organisation Act 1971

While there is no formal statutory process for EIS conducted under this Act, steps in the process are typically:

- Proponent prepares and submits an Initial Advice Statement;
- The Coordinator-General considers the project against the criteria for a Project of State Significance under Section 27 of the Act;
- ToR for the EIS are prepared and agreed with the Coordinator-General;
- The Draft ToR are publicly advertised and distributed to relevant State government referral agencies and DEW;
- ToR are finalised, taking into account any relevant comments received;
- An EIS is prepared in accordance with the requirements of the ToR;
- The EIS is reviewed and accepted by the Coordinator-General (or delegate);

- The EIS is placed on public exhibition and is provided to all relevant State Government referral agencies and DEW for a period of 4-6 weeks;
- Comments from members of the public and referral agencies are submitted to the Coordinator-General. DEW may also submit informal comments on matters of NES;
- The Coordinator-General considers all comments received on the EIS and directs the proponent to provide further information as considered necessary;
- The proponent prepares and submits a Supplementary Report addressing matters raised in comments on the EIS;
- The Supplementary Report is distributed to referral agencies who are requested to submit final comments and approval conditions to the Coordinator-General; and
- The Coordinator-General prepares a report containing an assessment of the project, a decision of whether to proceed or not, conditions that should be attached to the project and subsequent development approvals. This report becomes the Concurrence Agency report under IDAS and the Assessment Report under the EPBC Act. The report addresses NES matters for a Controlled Action.

1.7.3.2 Integrated Development Assessment System

Integrated Planning Act 1997

IPA forms the foundation of Queensland's planning and development assessment legislation. The purpose of this Act is to seek to achieve ecological sustainability by:

- Coordinating and integrating planning at the local, regional and state levels;
- Managing the process by which development occurs; and
- Managing the effects of development on the environment (including managing the use of premises).

IPA establishes IDAS which is a step-by-step process for lodging, assessing and deciding development applications. The following Acts (relevant to this Project) have been incorporated into the IDAS process:

- *Coastal Protection and Management Act 1995;*
- *EP Act;*
- *Fisheries Act 1994;*
- *Transport Infrastructure Act 1994;*
- *Vegetation Management Act 1999;* and
- *Water Act 2000.*

The Coordinator-General's Report allows the project to proceed but development cannot commence until development approvals are obtained. For IDAS, the Coordinator-General's Report is the concurrence agency response for subsequent material change of use applications. Subsequent material change of use approvals must abide by the recommendations and conditions in the

Coordinator-General's Report. Under the IDAS process, the project is likely to trigger applications for the following types of assessable development:

- Material change of use for the start of a new ERA as defined in the EP Act;
- Permit for clearing native vegetation on land that is subject to a lease under the *Land Act 1994*, other than a lease used for agriculture or grazing;
- Permit to remove marine plants under the *Fisheries Act 1994*;
- Approval for operational works involving the interfering with water under the *Water Act 2000*; and
- Approval for operational works (tidal works) in accordance with the *Coastal Protection and Management Act 1995*.

In addition to the above, the proposed development also requires approval under the Miriam Vale Shire Council Planning Scheme. For the purposes of addressing the IPA and Miriam Vale Shire Council's planning requirements, an application will be made to Miriam Vale Shire Council seeking preliminary approval (varying the effect of the planning scheme on the land) for a Material Change of Use.

The purpose of the preliminary approval is to establish a 'plan of development' as discussed previously. Further development on the Hummock Hill Island will then proceed in accordance with the approved Plan of Development, and conditions of approval and any subsequent approvals.

Further public notification under IDAS is not required as the public exhibition of the EIS is considered to satisfy IPA public notification requirements.

The flowchart for these approvals is shown in Figure 1.8.

Vegetation Management Act 1999

This Act Regulates the clearing of vegetation in a way that:

- Conserves vegetation in declared areas;
- Ensures the clearing does not cause land degradation;
- Prevents the loss of biodiversity;
- Maintains ecological processes;
- Manages the environmental effects of the clearing; and
- Achieves reduction in greenhouse gas emissions.

Clearing vegetation to which the *Vegetation Management Act* 1999 (VMA) applies is defined as operational work under IPA. The VMA, together with IPA, provides a single regulatory framework for clearing of native vegetation on freehold land and most State land tenures, including the project area.

Approval by the Department of Natural Resources and Water (DNRW) is required for the clearing of remnant native vegetation contained in the project area.

Water Act 2000

The *Water Act 2000* provides a legislative basis for the sustainable planning and management of the State's non-tidal water resources. The *Water Act 2000* identifies that most water related developments or developments affecting water supply and freshwater streams require assessment and approval under the IPA.

The IPA defines water related developments as:

- Most works in a watercourse (pumps, gravity diversions, stream diversions, weirs, barrages and dams);
- Works that interfere with overland flow;
- Artesian bores; and
- Subartesian bores (in a declared 'groundwater' area).

Approval is required from the DNRW for the project, under the *Water Act 2000* for the following:

- Development permit (operational works) for works in a watercourse (e.g. gravity diversion, stream redirection); and
- Riverine Protection Permit to destroy vegetation, excavate or place fill in a watercourse under Section 266 and Section 814.

Aboriginal Cultural Heritage Act 2003

This Act provides recognition, protection and conservation of Aboriginal cultural heritage. In accordance with this act, the project's effects on Aboriginal cultural heritage are being managed through the development of a Cultural Heritage Management Plan (CHMP) (refer to section 13). The CHMP was formally notified to the Port Curtis Coral Coast (PCCC) (QC 01/29 [Q 6026/ 01]) native title claimant group through their applicants.

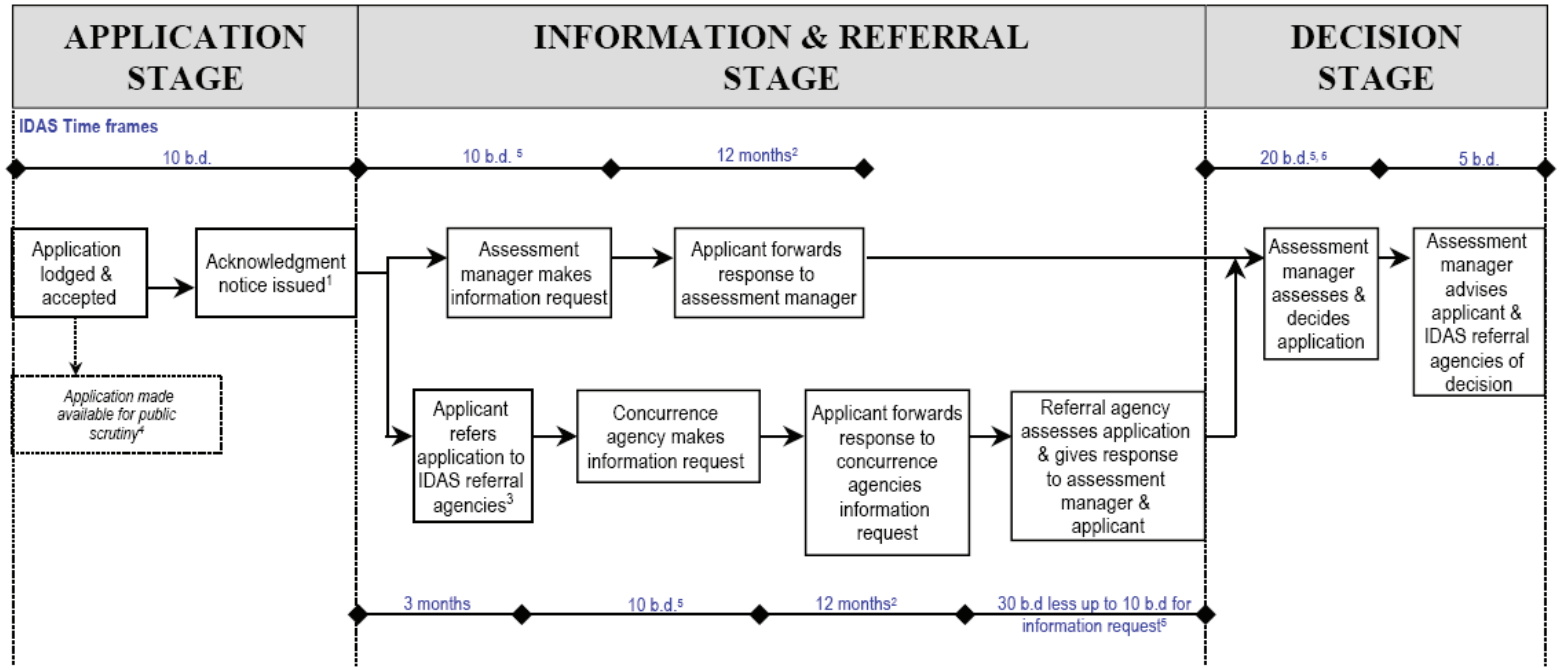
The *Aboriginal Cultural Heritage Act 2003* establishes duty of care guidelines to ensure all reasonable and practical measures are taken to ensure that (an) activity does not harm [remove or possess] Aboriginal Cultural Heritage. The Act establishes a framework for the assessment of potential impacts on cultural heritage and processes to be undertaken in preparing CHMPs.

Hummock Hill

IDAS FLOWCHART 11

As at Tuesday 12 July, 2005

For an application involving –
- Code assessment only
- IDAS referral agencies
- **No** Referral coordination
- Information request issued



Note: b.d. = business days

Figure 1.8 – IDAS Approvals Flowchart

The *Aboriginal Cultural Heritage Act 2003* establishes a risk management assessment based on many factors including nature of activity and likelihood of causing harm, extent of consultation, searches of database/register, extent of any survey, nature/extent of past use of area, nature of cultural heritage likely to be harmed and compliance with duty of care guidelines.

The *Aboriginal Cultural Heritage Act 2003* does not require any formal approvals to be obtained. Instead, it makes it an offence to harm any item of Aboriginal cultural heritage significance unless such harm takes place in accordance with an agreed CHMP. The content of a CHMP must be agreed between the Proponent and the Traditional Owners of the affected lands. The Act and the associated Duty of Care guidelines set out processes by which Traditional Owners can be involved in a process of negotiating a CHMP.

Demonstrated compliance with the Duty of Care guidelines is a defence against prosecution for harming items of Aboriginal Cultural Heritage material.

The actual investigation and management requirements as set out by the duty of care guidelines are basically a function of level of both existing and proposed disturbance of the subject site. Hummock Hill Island is largely undisturbed in an archaeological context, and the site is therefore a Category 5 in the Duty of Care Guidelines. Satisfaction of the Duty of Care requires a CHMP to be negotiated and adhered to for all development related activities on the site.

The Guidelines also require a CHMP for any project where an EIS is required.

A registered CHMP is in place for the proposed development (refer to Section 13).

Note that requirements of the *Aboriginal Cultural Heritage Act 2003* do not constitute approval in relation to IPA and the CHMP negotiation process can be undertaken independently of Development Approvals.

Fisheries Act 1994

The *Fisheries Act 1994* regulates fisheries resources and fish habitats, and was 'rolled' into the IPA and IDAS process on 1 March 2005.

In relation to the proposed development, the *Fisheries Act 1994* controls removal of marine plants and works in or adjacent to a Fish Habitat Area and development approval will therefore be required as follows:

- For removal of mangroves, salt couch and other vegetation in the tidal zone associated with construction of bridge and boat ramp infrastructure; and
- For construction of the boat ramp at Colosseum Inlet which is within the Colosseum Fish Habitat Area.

Note that there is an existing exclusion area in the Colosseum Fish Habitat Area extending 100 m either side of the existing causeway. This will mean that a development approval for operational works in a Fish Habitat Area will not be required for the bridge and Boyne Channel boat ramp.

Applications for Development Approval for developments within 100m of a Fish Habitat Area must be referred to the Department of Primary Industries and Fisheries as an advice agency.

Environmental Protection Act 1994

The EP Act includes a requirement for certain activities to be permitted, these being ERAs. Approval to operate an ERA is obtained through a Development Approval under IPA. Additionally, a Registration Certificate must be obtained under the EP Act to lawfully carry out an ERA. ERAs are defined in Schedule 1 of the *Environmental Protection Regulation 1998*.

The Project Proponent will require the following ERAs:

- ERA 15 (Waste Water Treatment Plant); and
- ERA 19 (Dredging).

The land uses envisaged for the Island would also require approval of the following ERAs:

- ERA 11 (Fuel Storage);
- ERA 28 (Motor Vehicle Workshop);
- ERA 69 (Boat Maintaining or repairing facility); and
- ERA 82 Waste Transfer Station (although this may not be required if alternative waste management practices can be implemented).

However, the operators of these facilities (and others not envisaged at this stage) will be responsible for obtaining the relevant ERA approvals prior to the activity commencing.

In addition to development approval requirements, Sections 319 and 320 of the EP Act establish a duty of care to all individuals and organisations to protect the environment (the General Environmental Duty). Therefore, it is not permissible to cause environmental harm (as defined in the Act) whilst undertaking any activity unless all reasonable and practicable means are taken to avoid that harm.

Nature Conservation Act 1992

The *Nature Conservation Act 1992* is intended to conserve biological diversity, ecologically sustainable use of wildlife, ecologically sustainable development and international criteria developed by the World Conservation Union (International Union for the Conservation of Nature and Natural Resources) for establishing and managing Protected Areas.

An approval under the provisions of the *Nature Conservation Act* (not the IPA*)* is required to disturb, harm or destroy any species listed under the Act. Surveys to date have identified a limited number of species listed under the Act.

Coastal Protection and Management Act 1995

The objective of this Act is to provide for the protection, conservation, rehabilitation and management of the coastal areas including resources and biological diversity.

Approvals will be required for development aspects of this project including:

- Tidal work or prescribed tidal work; or
- Operational works carried out within a coastal management district (including draining or allowing drainage or flow of water across State coastal land).

These approvals are obtained through the IDAS process and will be required for construction of the bridge initially and, at a later date, the two boat ramps.

The *Coastal Protection and Management Act 1995* also regulates the management of state coastal quarry resources. A Quarry Allocation is required to remove any material from state land below the high water mark and evidence of this allocation is required to be submitted with any IDAS application for tidal works approval. Quarry Allocation is obtained from the EPA.

Land Act 1994

The *Land Act 1994* (Land Act) regulates the opening and closing of State and local roads and land dealings relating to changes in land tenure. The primary focus of the Land Act is the development of the State.

The Land Act provides that special conditions can be placed on an offer of freehold or a freeholding lease. The Current Special Lease contains conditions of freeholding and includes the following:

- Obtaining all necessary development approvals from the appropriate authorities for development proposals envisaged in respect of the lease land; and
- Progressively developing the leased land for subdivision for business, residential, tourist or recreation purposes.

In developing the leased land, the lessee is required to, amongst other things:

- Fill the land where necessary after making adequate protection against storm surge;
- Provide adequate stormwater drainage;
- Upgrade road access;
- Pay headworks contributions for water supply and sewerage;
- Provide other services (electricity, telephone service); and
- Set aside and development land for community facilities (high school, public hospital, public building) and park and recreation spaces.

In certain circumstances, depending upon the outcome of the native title assessment, the applicant (as a condition of the letter of offer) may be required to satisfactorily address native title issues for

the proposed conversion of tenure. Native title on Lot 3 on FD841442 (the Special Lease area) has been extinguished.

The Queensland Government, in granting the Special Lease (SL 19/52155) in 1991, decided the site was suitable and desirable for a range of Business, Industrial, Commercial, Residential, Tourist and Recreation purposes. This decision has been reflected in approval of a previous application for a residential and tourist development by Miriam Vale Shire Council in 1996.

The long-established land use intention for the leased area is for subdivision and a tourism and residential development. Indeed, there is an obligation, under the conditions of the lease, for the lessee to develop the leased land promptly and make payments to the Queensland Government for the revenue generated from sales.

Transport Infrastructure Act 1994

The *Transport Infrastructure Act 1994* (TI Act) provides for the management of the National and State road network and rail network. A permit under this Act is required to work in, or interfere with, a State-controlled road or railway. It is a requirement of the Special Lease that necessary road upgrades be provided by the Proponent, including upgrades to the Bruce Highway intersection with Turkey Beach Road.

Referral of the Preliminary Approval development application to Main Roads under the TI Act is triggered by works over a certain threshold (Schedule 5 of the IPA Regulation).

Queensland Marine Parks Act 2004

This Act repealed and modernised the *Marine Parks Act 1982* and was fully commenced on 31 August 2006. Parts 12 (validation and declaration provisions relating to reclamation) and 13 commenced on 12 October 2004.

The object of the Act is to provide for the conservation of the marine environment.

A permit will be required for the installation of a structure in the Coast Marine Park and/or discharging waste into the Great Barrier Reef Coastal Marine Park. For works in a State Marine Park, the permit approval process is administered by Queensland Parks and Wildlife Service (a division of the EPA) and is usually done in parallel with the IDAS application for tidal works.

Local Laws

The following Miriam Vale Shire Council local laws may apply to the project:

- *Local Law No. 12 (Caravan Parks) 2003* - . A licence will be required to operate the proposed tourist park on the Island. Under this local law, a person must not operate a caravan park unless authorised by a licence.
- *Local Law No. 15 (Domestic Water Carriers) 2004*. person must not carry on the business of domestic water distribution unless:
  a) the person holds a licence under this local law; and

b) the water tanker or water tankers used for the purposes of the business are approved by the local government.

- *Local Law No. 21 (Roads) 2002* A person (other than the local government) must not make an alteration or improvement to a local government road unless authorised by a licence.

1.7.4 Summary of Project Approval requirements

A list of the approvals required to be obtained under the relevant State legislation described above is provided in**Table 1.1.**

Table 1.1 – Applicable Legislation and Administering Authority (AM)

Legislation	Approval Requirements	Application to Proposed Development	AM
COMMONWEALTH			
Environmental Protection and Biodiversity Conservation Act 1999	Approval for 'Controlled Action' from DEW.	Under the EPBC Act, a person must not take an action that has, will have or is likely to have a significant impact on a matter of National Environmental Significance without the approval of the Commonwealth Minister for the Environment and Water Resources. The proposed development may impact on the following matters of National Environmental Significance: ▪ World Heritage Areas (Great Barrier Reef); ▪ Listed endangered species; and ▪ Migratory and marine species. The project has been declared a "Controlled Action" by the Commonwealth Minister for the Environment, Water and Resources (refer to Appendix A3).	DEW
STATE			
State Development and Public Works Organisation Act 1971 (Non-IDAS approval)	An EIS must be prepared for any project declared a Project of State Significance under this Act. The Coordinator-General's assessment and conditions become a Concurrence Agency response under the IPA for the material change of use development application to Miriam Vale Shire Council.	An application for a Project of State Significance declaration under this Act was made. It was deemed that the Hummock Hill Island Development is a 'Project of State Significance' and will be assessed by the Coordinator-General under this process.	Co-ordinator General

Legislation	Approval Requirements	Application to Proposed Development	AM
Marine Parks Act 2004 *Marine Parks Regulation 1990* *Marine Parks (Great Barrier Reef Coast) Zoning Plan 2004* For works in a State marine park, the permit approval process is administered by Queensland Parks and Wildlife Service (part of the Queensland Environmental Protection Agency).	A marine park permit may be required for: ▪ Installing a structure in the Great Barrier Reef Coastal Marine Park (between high and low tide) (e.g. bridge, boat ramp); and ▪ Discharging waste into the Great Barrier Reef Coastal Marine Park.	Boat ramps and a bridge are proposed to be constructed in Boyne Creek and Colosseum Inlet which would require placement of structures in the Queensland Great Barrier Reef Coastal Marine Park (i.e. the land/waters between high tide and low tide). The structures would require Marine Parks Permits. An emergency sewage outlet is proposed for disposal of treated effluent when flows are greater than three times average dry weather flow (ADWF) typically when severe weather conditions preclude land irrigation. This outflow will discharge to an ephemeral creek that flows to the main channel of Colosseum Inlet. This would require a Marine Parks Permit.	EPA
Vegetation Management Act 1999 (IDAS approval)	Development Permit for Operational Works - clearing of native vegetation. DNRW is the assessment manager for the application.	Remnant vegetation is present on Hummock Hill Island including "endangered"," of concern" and "not of concern" regional ecosystems. The proposed development has been planned to avoid clearing of "endangered" vegetation except where absolutely necessary for infrastructure provision. Clearing of "of concern" and "not of concern" regional ecosystems would be required. "Of concern" vegetation cleared for the project would be off-set as required under the *South East Queensland Regional Vegetation Management Plan* (2006).	DNRW
Water Act 2000 (IDAS approval)	Development Permit for Operational works - disturbance of the bed and banks of a watercourse. Department of DNRW is the assessment manager for the application.	Schedule 8, part 1, table 4, item 3 of the *Integrated Planning Act 1997* specifies that operational work for the purposes of taking or interfering with water under the *Water Act 2000* is assessable development. This includes all work in a watercourse (e.g. a pump, gravity diversion, stream re-direction, weir or dam). Crossings of ephemeral watercourses on Hummock Hill Island would trigger a permit requirement under the *Water Act 2000* if bed and banks are interfered with.	DNRW

Legislation	Approval Requirements	Application to Proposed Development	AM
		Mainland water supply pipeline alignments may include crossings of freshwater streams to which the *Water Act 2000* would apply. There is no intention to extract water from aquifers or surface waters.	
Aboriginal Cultural Heritage Act 2003	No permits required.	Disturbance of Aboriginal cultural heritage material can only be undertaken in accordance with a Cultural Heritage Management Plan (CHMP). A CHMP is required for any project for which an Environmental Impact Assessment is undertaken. Surveys with the local Aboriginal people have confirmed the presence of Aboriginal cultural heritage material on Hummock Hill Island. A Cultural Heritage Management Plan has been compiled and approved by DNRW on 17 January, 2007.	
Native Title Act 1993 (Cth) Native Title (Queensland) Act 1993	No permits required.	Native Title has been extinguished over Lot 3 (development lease). Infrastructure, such as the bridge and road corridors, are to be dedicated as road reserves and not subject to Native Title.	
Fisheries Act 1994 (IDAS Approval)	Operational Works Permit – operational work completely or partly within a declared fish habitat area; Operational Works Permit - disturbance or removal of Marine Plants; and Resource Allocation Authority for any disturbance within a Fish Habitat Area. The Department of Primary Industries and Fisheries (DPI&F) is the assessment manager for the development permits. DNRW is the administering authority for the 'resource allocation authority' unless within a Fish Habitat Area where DPI&F is the administering authority.	Colosseum Inlet boat ramp would require a Resource Allocation Authority and an Operational Works Permit due to works in and adjacent to tidal wetlands and the Colosseum Inlet Fish Habitat Area (FHA). The area 100m on either side of the centreline of the existing access track and causeway is excluded from the FHA and approvals for the bridge crossing and Boyne Channel boat ramp would not be required. Disturbance and removal of a small number of mangroves on Boyne Channel would require Operational Works approval. Disturbance to mangroves on Colosseum inlet can be avoided.	DPI&F

Legislation	Approval Requirements	Application to Proposed Development	AM
Environmental Protection Act 1994 (IDAS Approval)	Material Change of Use Permit – establishment of new ERAs. The Environmental Protection Agency is the assessment manager.	The Hummock Hill Island Development would require development permits to operate the following ERAs: ▪ ERA 15 (Waste Water Treatment Plant); ▪ ERA 19 (Dredging)	EPA
Nature Conservation Act 1992	Approval from the EPA is required to disturb, harm or destroy any species listed under the Act. A development permit under the IPA is not required.	Flora and fauna surveys undertaken to date have identified several bird species listed under the *Nature Conservation Act 1992* as being present on the site (Refer to Section 13). It is not likely that the proposed development would harm or disturb these species and approval under the Act is not likely to be required.	EPA
Transport Infrastructure Act 1994 (IDAS Referral)	Permit for Preliminary Approval - Material Change of Use. Concurrence agency approval from Department of Main Roads in relation to impacts on state controlled roads, would be required for the "Preliminary Approval for Material Change of Use".	The proposed development exceeds the development thresholds established in the *Integrated Planning Regulation 1998*, Sch 5, Table 3, items 2 and 3.	DMR
Coastal Protection and Management Act 1995 (IDAS Approval)	Operational Works Permit - Tidal Works within a coastal management district; and Resource Entitlement (non-IDAS Approval – DNRW administering authority). The EPA would be the assessment manager where the works are not prescribed tidal works. Where the works are prescribed tidal works, EPA would be a concurrence agency.	Required for works within Colosseum Inlet and Boyne Channel, including works associated with bridge and boat ramp construction.	EPA

Legislation	Approval Requirements	Application to Proposed Development	AM
LOCAL			
Miriam Vale Shire Council Transitional Planning Scheme or Draft Miriam Vale Shire Council Planning Scheme	Development permits for: Material Change of Use (preliminary approval); Material Change of Use (as per the approved Plan of Development); Reconfiguring a Lot; Carrying out Operational Work; and Placing an advertising device on premises.	A 'preliminary approval' material change of use is required to be sought from Miriam Vale Shire Council. Subsequent development applications for material change of use, reconfiguration of a lot, operational works and advertising devices shall be assessed within the framework of the approved Plan of Development for the site.	Miriam Vale Shire Council

SECTION 2
PLANNING AND LEGISLATIVE FRAMEWORK

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2. Planning and Legislative Framework

This Section of the EIS reviews and addresses Commonwealth, Queensland, regional and local legislative and policy frameworks relevant to the land use, infrastructure and planning component of the proposed Hummock Hill Island Development.

2.1 State Planning Framework

2.1.1 Integrated Planning Act 1997

The *Integrated Planning Act 1997* (IPA) is the primary statutory legislation that defines the framework for planning and development assessment in Queensland. This Act establishes the Integrated Development Assessment System (IDAS), which links with other related environmental and natural resource management legislation and incorporates the assessment of development proposals against that legislation.

Referral and public notification stages of the IDAS process may be integrated into the evaluation of the EIS for a proposal where it is determined to be a "significant project" under Section 26 of the *State Development and Public Works Organisation Act 1971*. This is discussed further in Section 1 of the EIS.

2.1.2 State Planning Policies

Provisions of IPA enable the State Government to prepare and adopt State Planning Policies (SPP). The policies have effect throughout the State, except where specified, and set out the State Government's position on planning and development matters of State significance.

State Planning Policies apply to assessable development and must be considered during the assessment of any relevant development applications lodged under IDAS. In addition, the provisions of the IPA require that SPPs are incorporated into local government planning schemes.

State Planning Policies relevant to the proposed Hummock Hill Island Development are:

- State Planning Policy 1/92 – Development and the Conservation of Agricultural Land;
- State Planning Policy 2/02 – Planning and Managing Development Involving Acid Sulfate Soils;
- State Planning Policy 2/03 – Mitigating the Adverse Impacts of Flood, Bushfire and Landslide; and
- the State Coastal Management Plan.

2.1.2.1 State Planning Policy 1/92 Development and the Conservation of Agricultural Land

State Planning Policy 1/92 sets out the broad principles for the protection of good quality agricultural land from inappropriate development. The Hummock Hill Island Development area has been assessed in accordance with the guideline relating to this policy and this assessment is included in Section 5 of the EIS. The site has been classified broadly as non-agricultural land (steep slopes of Hummock Hill, sand dunes and mudflat and mangrove areas) and pasture land of very low

to low fertility (gently sloping plains and foot slopes of Hummock Hill Island) and as such, it is not Good Quality Agricultural Land (GQAL).

On that basis, the proposal would not result in the loss of GQAL and would not compromise the State's interests under this policy.

2.1.2.2 State Planning Policy 2/02 Planning and Managing Development Involving Acid Sulfate Soils

State Planning Policy 2/02 sets out the State's interests in managing acid sulfate soils in low-lying coastal areas. The policy applies to development involving filling or excavation above defined thresholds and areas at or below 5 metres AHD where the natural ground level is less than 20 metres AHD. It is supported by 'Guidelines for SPP2/02: Planning and Managing Development involving Acid Sulfate Soils' which provides information and advice on interpreting and implementing SPP2/02 in development assessment. The Department of Natural Resources and Water is an advice agency for this matter.

Potential acid sulfate soil (PASS) has been identified in the vicinity of the proposed boat ramp in Boyne Creek. Results of the soil tests are included in Section 5. Soil tests have not been undertaken in the vicinity of the proposed boat ramp in Colosseum Inlet based on this area being predominantly medium to coarse sands with minimal PASS likely to occur. Potential acid sulfate soils and acid sulfate soils would be managed in accordance with an Acid Sulfate Soil Management Plan in order to achieve the development outcomes of the SPP and not compromise the State's interest. The management techniques are included in Section 5 and the relevant Environmental Management Plan (EMP).

2.1.2.3 State Planning Policy 1/03 Mitigating the Adverse Effects of Flood, Bushfire and Landslide

State Planning Policy 1/03 aims to minimise the potential adverse impacts of flood, bushfire and landslide on people, property, economic activity and the environment. It is supported by 'Guideline for SPP 1/03: Mitigating the Adverse Impacts of Flood, Bushfire and Landslide' which provides information and advice on interpreting and implementing SPP 1/03 in development assessment and when making and amending planning schemes.

This SPP sets out development outcomes that must be considered when assessing development. The outcomes relevant to the Hummock Hill Island Development are:

Outcome 1: Within the natural hazard management areas, development to which this SPP applies is compatible with the nature of the natural hazard, except where:

- The development proposal is a development commitment; or
- There is an overriding need for the development in the public interest and no other site is suitable and reasonably available for the proposal.

Outcome 2: Development that is not compatible with the nature of the natural hazard but is otherwise consistent with Outcome 1 is minimised as far as practicable from adverse impacts from natural hazards, and does not result in an unacceptable risk to people or property.

The development has been located and designed to minimise adverse impacts from natural hazards in accordance with the objectives of this SPP. Section 18 identifies and discusses potential hazards and risks associated with the proposed Hummock Hill Island Development.

2.1.2.4 State Coastal Management Plan

Under the *Coastal Protection and Management Act 1995,* the State Coastal Management Plan (State Coastal Plan) and regional coastal management plans have the status of a State Planning Policy for the purpose of making and amending planning schemes and assessing and deciding development applications.

The State Coastal Plan provides guidance for the protection and management of the coastal zone. The coastal zone includes coastal waters and all areas to the landward side of coastal water in which there are physical features, ecological or natural processes or human activities that affect, or potentially affect, the coast or coastal resources.

The State Coastal Plan establishes a long term vision for Queensland's coast which is to encourage government, industry and the community to work together to understand its natural systems, protect and rehabilitate important areas and ensure that our activities and settlements are sustainable.

Queensland's coastal zone is divided into eleven regions with key coastal resources, values and management issues for each region set out in the State Coastal Plan. Hummock Hill Island lies in the Wide Bay Coast Region, which extends from the northern boundary of Miriam Vale Shire to the southern boundary of Noosa Shire.

The State Coastal Management Plan is a policy document which provides policy direction for government decision-makers within the coastal zone. Particular decision-maker roles include:

- Within the coastal management district – EPA, under the *Coastal Management and Protection Act 1995,* is either a concurrence agency or assessment manager for certain development applications. EPA also is the responsible agency for resource allocations associated with quarry material. Where local government is involved in the application, the EPAs jurisdiction does not include amenity and aesthetic issues;
- Within local government boundaries (and prescribed tidal works outside local government boundaries) – Local government is the assessment manager for development applications under a planning scheme. EPA only has a concurrence agency role outside of a coastal management district where artificial waterways extend outside the coastal management district; and
- Approvals required under other legislation – for example DNRW would consider relevant coastal management policies in assessing applications under the Water Act and Vegetation Management Act and the EPA would consider coastal management policies in assessing applications under the Environmental Protection Act and Marine Park Act.

The State Coastal Plan sets out a range of principles, policies and outcomes for the management of the coastal zone, which are set out under ten broad topics. Policies of particular relevance to the Hummock Hill Island Development are addressed in **Table 2.1**.

The responses to the relevant policies of the State Coastal Plan demonstrate broad compliance with the plan. The key policies outcomes relate to:

- Protection of the erosion prone area – all residential and tourism buildings would be located outside of the erosion prone area with only the bridge, boat ramps, water infrastructure and recreational access facilities located inside. These facilities would be designed to avoid or minimise any impacts to coastal processes and coastal resources;
- Development outside of current designated urban areas – the State Government has granted this Special Lease outside existing designated urban areas. Its location and style of development provides for a range and diversity of housing types and settings that is not provided for in the existing urban areas. Through this EIS, it is demonstrated that impacts to coastal resources are avoided where possible and minimised and managed otherwise; and
- Benefit to the state – the benefits of this development have been analysed and considered against the possible adverse impacts. It was found that the development has significant benefits to the State while minimising any adverse impacts.

2.1.2.5 Draft Wide Bay Burnett Regional Coastal Management Plan

The Wide Bay Burnett Regional Coastal Management Plan is currently being prepared by the Environmental Protection Agency but has not been released for public consultation as of November, 2007. Hummock Hill Island would be covered by this plan. It would support the State Coastal Management Plan in providing direction for coastal management in the region. This Plan would provide regional coastal management policies and mapping for the Wide Bay Region. Depending on the release of the draft plan for consultation and its finalisation, it may need to be considered in future development applications for the development.

Table 2.1 – State Coastal Management Plan

Policy	Intent	Response
Policy 2.1.2 - Settlement pattern and design	This policy seeks to conserve the coast in its natural or non-urban state outside of existing urban areas, to the extent practicable, avoid or minimise impact to coastal resources and seeks to maintain public access to the coast to protect the public's expectation of access.	The need for this development and the availability of alternative land is addressed in Section 3. This development provides a diversity of housing choice and location not able to be accommodated within nearby existing urban areas. Due to its location on an Island, expansion of the development beyond the lease area is not possible. Design of the integrated development on Hummock Hill Island creates a new integrated tourist and residential community that coexists with the natural environment in a sustainable manner. To achieve this, valuable coastal resources have been identified for protection and appropriate buffers have been identified to further protect them from incompatible development to the extent practicable. This EIS investigates possible impacts on coastal resources and demonstrates how these impacts would be avoided or minimised.
Policy 2.1.5 - Maritime infrastructure	This policy supports the provision of public maritime infrastructure and requires need to be demonstrated and significant impacts on coastal resources to be avoided or minimised.	Proposed maritime infrastructure is described in Section 3. The location and design of the proposed maritime infrastructure has considered possible impacts on coastal resources to minimise impacts. Sections 9, 15 and 18 provide an assessment of possible impacts and demonstrate how these impacts would be avoided or minimised.
Policy 2.1.10 - Tourism and recreational activities	This policy seeks to maintain recreational and tourism opportunities while ensuring that the coastal resources and their values, upon which these experiences rely, are protected.	The provision of tourism and recreational activities is an integral component of the Hummock Hill Island Development. It is planned to provide a wide range of high quality nature and non-nature based activities and resources including pedestrian access to sandy beaches, walk/cycle tracks, scenic lookouts, boat ramps and a 18 hole golf course to retail and leisure facilities in the commercial centres. Waste treatment and access infrastructure would be designed to cater for peak usage of tourism and recreational facilities (refer to Sections 6, 11 and 16 for further detail).
Policy 2.1.12 - Managing water resources	This policy seeks to minimise adverse impacts on coastal processes and coastal ecosystems by appropriately managing the extraction of water from watercourses and groundwater in the coastal zone.	Water supply for the proposed development would utilise a combination of desalination, recycling and rainwater tanks and would not utilise groundwater or watercourses (refer to Section 8 for further details).

Policy	Intent	Response
Policy 2.2.2 - Erosion prone areas	This policy seeks to maintain erosion prone areas free from development so as to maintain natural coastal processes. The erosion prone area is: ▪ Specified widths from the toe of the frontal dunes (open coast); and ▪ Generally 40 m above mean high water springs or highest astronomical tide which ever the greatest distance along tidal creeks unless there are existing revetments.	The erosion prone areas have been identified and mapped and the area is generally retained free of development. In particular, the most sensitive erosion prone areas on the east and north sides of the Island would be retained free from development. The main intrusion into erosion prone areas is described below under Policy 2.3.1. These works would be designed to prevent increased vulnerability of the coastline to erosion and would be developed in accordance with EPA Management Guidelines.
Policy 2.2.4 Coastal hazards	This policy seeks to keep areas demonstrated to be vulnerable from coastal hazards such as storm tide inundation, free from development. Where development may occur in vulnerable area, the level of vulnerability is required to be managed.	The areas to be developed are outside the erosion prone area and areas most vulnerable to coastal hazards. Hazards, including coastal hazards are addressed in Section 18.
Policy 2.3.1 - Future need for access Policy 2.3.2 - Design of access	This policy seeks to enhance public access and useability of the foreshore without compromising coastal resources and that access to the foreshore and coast complies with specific design criteria.	Public access to the coastal zone would be retained where human access is compatible with the management of these areas (SKM 2005). Pedestrian access would be improved at certain locations, through the creation of well-defined public access points from the development to the coastal zone. Two new boat ramps are proposed, one adjacent to the new bridge and the second on the inland side of the Island, south of Tiber Point. These ramps would provide new access points to the coastal environment and would serve to discourage access elsewhere. All new access infrastructure would be located and designed to avoid impact on the coastal resources.

Policy	Intent	Response
Policy 2.4.1 - Water quality management	This policy seeks to protect water quality in order to protect and maintain other coastal resources.	The environmental values of the surface and marine environment have been identified and these are detailed throughout Section 9. Water quality in the coastal area would be managed through the implementation of water sensitive urban design principles in the proposed Hummock Hill Island Development. There would be limited reliance on mainland water resources and sustainable utilisation of on-island water resources including roof catchment collection and reuse of grey water. These are discussed in further detail in Section 3.4.1. The two proposed boat ramps on the mainland side of the Island have the potential to increase boating activity in the coastal waters surrounding the Island. The proposed ramps would cater for small runabouts and the cumulative level of pollutants that would be generated by this boating activity and consequential impact on the coastal water quality is unlikely to be significant and is discussed in Section 8.
Policy 2.4.2 – Wastewater discharge to coastal waters	This policy seeks to protect coastal waters from the adverse impacts of waste water discharges.	The proposed Hummock Hill Island Development includes the construction of a sewerage treatment plant on Hummock Hill Island. Section 3.4.1.3 includes details of the preferred wastewater management facilities, which focus on the recycling of wastewater and prevention of wastewater discharge into coastal waters.
Policy 2.4.3 – Waste disposal facilities	This policy seeks to avoid or minimise adverse impacts on coastal resources from new waste disposal facilities (i.e. landfill) are appropriately located, designed and managed to sustain the values.	A landfill is not proposed on the Island. Waste disposal facilities planned for the proposed Hummock Hill Island Development seek to avoid contamination of groundwater and surface water by treating waste either on Hummock Hill Island or transporting to mainland facilities via the council waste collection service. This is discussed in Section 3.6.1.
Policy 2.4.4 – Stormwater management	Stormwater runoff (quality and quantity) is managed in accordance with best practice, to ensure that environmental values of the estuaries and other coastal waters are protected.	A stormwater management plan would be implemented in association with the development proposal to manage stormwater runoff to protect environmental values and designed in accordance with water sensitive urban design principles. This is discussed in Section 3.4.2.
Policy 2.4.5 – Groundwater quality	Groundwater quality and recharge processes are to be maintained.	Groundwater quality would not be adversely impacted by the proposal and this is discussed further in Section 8.

Policy	Intent	Response
Policy 2.5.1 - Areas of state significance (Indigenous Traditional Owner cultural resources)	This policy seeks to protect 'Areas of state significance (Indigenous traditional Owner cultural resources)' in order to protect their cultural connection between Indigenous Traditional Owners and the coastal zone.	As areas of state significance have not been identified through a regional coastal management plan, this policy only requires consultation with Traditional Owners – which has been undertaken (refer to Section 15 for further details). A Cultural Heritage Management Plan for the proposed Hummock Hill Island Development has been developed in consultation with Traditional Owners and has been approved by the Qld Department of Natural Resources and Water.
Policy 2.7.1 Areas of State Significance (Scenic Landscapes)	This policy 'encourages' scenic values to be protected where a regional coastal management plan has not been prepared.	Sections of the Island have been disturbed by previous land management practices. The development has been designed to minimise any visual impacts (refer to Section 5 for further details).
Policy 2.8.1 - Areas of State significance (natural resources)	This policy seek to protect coastal biodiversity values which include coastal wetlands, dune systems and mangroves which occur in this area, from development unless there is a net benefit to the state.	Areas of state significance are identified and assessed in Section 3. Particularly relevant to the development are the endangered regional ecosystems and significant coast dune systems on the Island. The proposal seeks to minimise development in these areas in order to preserve them as natural areas. This would contribute to the recreational and tourism setting and opportunities of the proposed Hummock Hill Island Development. However some impacts would be likely to these areas. However the development is considered to be of net benefit to the state as demonstrated on Section 3.
2.8.2 - Coastal wetlands	Further loss or degradation of coastal wetlands is to be avoided and impacts on coastal wetlands prevented, minimised or mitigated (in order of preference).	The proposal seeks to avoid impacting on the coastal wetland areas by maintaining appropriate buffers to the wetland areas and maintaining existing discharge levels from ephemeral watercourses into the wetland areas. This is discussed in Section 9.
2.8.3 - Biodiversity	Biodiversity on the coast is to be safeguarded through conserving and appropriately managing the diverse range of habitats including coral reefs, seagrass, soft bottom (benthic) communities, dune systems, saltflats, coastal wetlands and riparian vegetation.	The proposal seeks to maintain the biodiversity of the coastal ecosystem on and around Hummock Hill Island by avoiding biodiversity and habitat loss. Vegetation and fauna habitats on the Island have been mapped and the Master Plan for the proposed Hummock Hill Island Development avoids development in areas of endangered ecosystems and important habitats. This is discussed further in Section 14.

2.1.2.6 Curtis Coast Regional Management Plan

The State Coastal Management Plan is supported by the Curtis Coast Regional Coastal Management Plan 2003, which provides regional direction for implementing the State Coastal Plan. Hummock Hill Island is situated outside the southern boundary of this region and as such, the proposed development is not subject to the policies and guidance contained in the document.

Notwithstanding, the proximity of Hummock Hill Island to the area included in the Curtis Coast Regional Coastal Management Plan warrants consideration in terms of the possible impacts that the proposal may have on the adjoining area.

Wild Cattle Island/Colosseum Inlet is identified as a key coastal site and lies predominantly west of Hummock Hill Island. The site is recognised as a Fish Habitat Area and the ecological functioning is to be protected from incompatible development and activities that may detrimentally impact upon these values.

Seagrass and mangrove habitats exist within Colosseum Inlet west of Hummock Hill Island and offshore of Wild Cattle Island, which are identified in the Curtis Coast Regional Coastal Management Plan as regionally important coastal habitats. The potential impact of the Hummock Hill Island Development on these areas is unlikely to be significant and is discussed in Section 15.

2.1.3 Regional Planning Framework

2.1.3.1 Wide Bay Burnett Regional Plan

The Wide Bay Burnett Regional Plan was launched on 23 May 2007. The Wide Bay Burnett Regional Planning project is a Regional Growth Management process which covers the twenty-two local governments in the Wide Bay-Burnett region, including the Shire of Miriam Vale.

Although not a statutory instrument, the Regional Plan provides Policy Principles and Policy Actions to guide the balanced growth and sustainability of the region. The Regional Plan is managed by the Regional Planning Advisory Committee (RPAC), which consists of representatives from all levels of government and the community.

The applicable Objectives and Policy Principles contained within the Regional Plan are addressed in Table 2.2. Column 1 of Table 2.2 provides a summary of the applicable regional environmental and planning issues, objectives and principles included in the Regional Plan. Column 2 provides a response on how the proposed Hummock Hill Island Development responds to the Regional Plan.

In general, the proposed development can demonstrate compliance with the outcomes sought by the Wide Bay Burnett Regional Plan apart from the preferred settlement pattern. This EIS demonstrates the need for and appropriateness for this development in relation to the Regional Plan without significantly detracting from the key outcomes sought by the preferred settlement pattern.

Table 2.2 – Assessment of Wide Bay Burnett Regional Plan

Natural Economic Resources	
Biological Economic Resources	
Primary production based on harvesting of native ecosystem products is an integral component of the region's economy. Objective: To manage the region's commercially utilised biological resources so that their economic and ecological values are not compromised. Policy Principles: Terrestrial and aquatic native ecosystems generating native species products are identified and recognised for their commercial and 'ecosystem service' importance and sustainably managed. Managed modified ecosystems producing native and exotic species (plantations, aquaculture, intensive crop and livestock production facilities) to minimise impacts on native flora and fauna, environmental attributes (water, air and soil quality) and ecological processes. Planning and land use decision making is informed by readily accessible, adequate and relevant natural resource information incorporated into pertinent policy and approval processes.	The proposed Hummock Hill Island development would retain approximately 50% of the Special Lease area for conservation purposes. The Island's natural coastal processes would be maintained, as discussed in Section 9.
Land Use and Management	
Land based agriculture capitalises on the region's natural assets and the resourcefulness of primary producers and processors to serve expanding local, domestic and international markets; with regional employment and economic returns as outcomes. Urban development pressure on agricultural land and rising community expectations regarding management of off-site impacts from all land uses highlight the need for protection of this resource and maintenance of its productive capacity through sustainable land management practices. Objective: To protect the region's agricultural land resources and ensure their sustainable management. Policy Principles: Identify and protect land suitable for agricultural and aquacultural production, outside of areas of biodiversity significance, through planning measures. Encourage the adoption of sustainable land management practices and effective property scale planning, responsive to changing economic and biophysical understanding. Encourage land management practices which provide ecosystem services for whole of community benefit.	Hummock Hill Island does not possess any significant agricultural values, and as such the Hummock Hill Island Development would not result in a loss of agricultural resources. No pastoral activity has occurred on the Island since 1991, consequently there will be no loss of agricultural productivity.

Minerals and Extractive Industry	
Regional deposits of minerals and extractive materials constitute a vital component of the region's economy and provide a significant resource for construction purposes. Ongoing access, uncompromised by incompatible adjacent developments, and 'leading edge' extractive, processing and transport practices which have regard to environmental impacts, are vital to a growing Wide Bay Burnett region. Objective: To ensure supplies of minerals and extractive resources are available for future use, and that their processing, transport and downstream value-adding contribute to the local economy without adverse human and environmental impacts. Policy Principle: Minerals and extractive resources should be protected and the operation of extraction and processing activities carried out in a manner which does not compromise current and future resource use aspirations, amenity and ecosystem processes.	Sand areas of Hummock Hill Island are listed by Qld DME as a Mineral Occurrence, Inactive Prospect over which an Exploration Permit – Mineral (EPM) exists. The Special Lease overlaps 12% of the EPM area. The mineral occurrence is listed as small, being 750,000 tonnes of Heavy mineral (HM). Development in accordance with Special Lease would prevent the extraction of 12 % of the mineral resources and in doing so, conflict with the purposes of the mineral development lease. Higher grade HM deposits on the eastern and central portions of the Island will remain accessible. However, mineral deposits on the Island are not currently economically viable in their own right and require inclusion of larger deposits south of Bustard Head and north east of Rockhampton (currently within a National Park). It is unlikely that HM deposits within the National Park will be made available for mining which puts in doubt the viability of HM deposits on the Island (refer to Section 5)
Water Supply	
Water is a fundamental resource. Increasing demand for water, fuelled by population increase, rising community expectations regarding water quality and ecosystem protection, and uncertainty regarding the implications of climate change highlight the importance of prudent far-sighted management of regional water resources. Objective: To balance the competing demands of economic development, human settlement and maintenance of ecosystem processes in the allocation of water resources. Policy Principle: Management of regional water resources will balance economic and social outcomes within the ecological capacity of catchment ecosystems, and be cognisant of the implications of seasonal climate variability and long term climate change.	The proposed Hummock Hill Island Development would minimise the demand on potable water resources through the use of water sensitive urban design. The Hummock Hill Island Code (refer to proposed Plan of Development in Appendix A2) requires all dwellings to be fitted with rainwater tanks and recycled water to be used for outdoor use.

Environmental Value Protection	
Air Quality	
The region's air quality is generally good with only localised sources of pollutants. Maintaining the region's liveability and minimising regional pollutant contribution to the atmosphere is a priority, as regional population and supporting industries grow. Reducing nuisance to residents and any threats to community health from air toxicants and particulates is an important part of such maintenance. Objective: To maintain and improve regional air quality for the protection of human health and amenity, and to preserve ecological processes. Policy Principle: Reasonable and practical measures which minimise release of air contaminants are adopted in accordance with best practice industry standards.	The proposed Environmental Management Plan (refer to Section 20) identifies potential air quality impacts and measures to minimise those potential impacts in order to maintain regional air quality for the protection of human health and amenity, and to preserve ecological processes.
Biodiversity	
The Wide Bay Burnett region's biodiversity wealth is an asset of inestimable value. Realisation of this value in economic and social terms is dependent on the protection and, where necessary, restoration of regional values. Objective: To protect the region's significant terrestrial and aquatic ecosystems, constituent species and ecological processes. Policy Principle: The extent, function and condition of wetlands is maintained and improved, enhancing their capacity to sustain habitat for dependant flora and fauna species and hydrological processes. Terrestrial biodiversity protection is enhanced across all land tenures. Aquatic ecosystems, their constituent species and related processes are maintained and improved. Threats to biodiversity values (including climate change, pests and weeds, and incompatible development) are identified, understood and actions to either remove or ameliorate their effects are facilitated.	The project does not extend into the Island's wetland areas and the current extent, function and condition of wetlands would be maintained. There would be some impacts on terrestrial biodiversity, however the project aims to minimise clearing and changes to the physical landscape where possible, such that impacts on terrestrial biodiversity would be minimised.

Coastal Environment	
The Wide Bay Burnett coastline is a dynamic transition zone between marine and terrestrial habitats, providing for significant landscape and oceanic processes as well as high levels of biodiversity. Objective: To ensure that the coastal landscape is protected for the benefit of current and future generations, and that coastal ecosystems and the natural processes that support them are appropriately managed. Policy Principle: Activities in the coastal zone should allow for natural fluctuations in coastal processes and not adversely impact on the natural coastal environment. High value natural assets of the coast are protected from incompatible uses and managed for community benefit.	No residential or commercial development is proposed in the erosion prone area. Activities in the erosion prone area would be limited to nature based recreation activities such as walking, swimming, kayaking etc. The Island's natural coastal processes would be maintained (refer to Section 9).
Regional Landscapes (Open Space/Special Places)	
Regional landscapes provide for recreation, conservation, protection of landscape processes and buffers between incompatible land uses. The Wide Bay-Burnett Region enjoys a large reserve of such lands in public ownership. The challenge is to accommodate the expanding urban footprint while still maintaining these values. Objective: To retain a network of open spaces which enhances the region's liveability and provides for the needs of future generations. Policy Principles: Areas of natural, cultural, recreational and scenic value are identified, protected and made appropriately accessible for current and future generations. Open spaces are managed to balance public access and use with protection of site values, where potential conflict exists.	Approximately 50% of the development lease area would remain untouched and would be included in a conservation precinct (zoning) under the proposed Plan of Development. This would provide nature based recreational opportunities which contribute to the Island's liveability for current and future populations. The development's effects on scenic amenity are unlikely to be significant and are described in Section 5b. The development's effects on cultural heritage values are to be managed through a Cultural Heritage Management Plan and are described in Section 13.
Water Quality	
Expansion of urban development has potential to adversely affect water quality, are consequences of population growth. Meeting the community's water quality expectations will entail adoption of innovative approaches to new development and management of existing activities; with decision-making about future development levels informed by realistic evaluation of the social, economic and environmental impacts of such development. Objective: To maintain water quality standards across the region which provide for maintenance of aquatic ecosystems and services. Policy Principle: Regional water quality planning that is underpinned by reliable local knowledge. Improved community understanding of the interaction between human activities and water quality is fostered and actions which contribute to improved local water quality are supported.	The potential impacts on water quality have been considered and addressed in Section 8. The proposed Environmental Management Plan includes measures to maintain water quality on Hummock Hill Island, thereby maintaining the Island's aquatic ecosystems and services. The proposed Environmental Management Plan is contained in Section 20.

Settlement Pattern	
Preferred Settlement Pattern	
The primary purpose of the Regional Settlement Plan Strategy is to provide a planning framework for sustainable growth in the Wide Bay Burnett to the year 2026. Objective: To ensure that urban development within the region is directed towards areas that can be serviced efficiently and equitably, without degradation of environmental values, or restriction of the operation of future development of important economic activities. Policy Principle: The development of a Regional Centres Network is essential in providing community services to regional sub catchments and identifying the most cost effective and efficient locations for future infrastructure investment. A strong and successful centres network provides a community focus and can help to achieve compact, self contained and diverse communities. A strong centres network also facilitates efficient transport systems, provides a focus for government investment and promotes commercial confidence in private sector investment.	The proposed development does not detract from the established or desired regional centres network. The Hummock Hill Island Development only proposes to provide for the convenience shopping needs and some entertainment needs of the Island's visitors and residents as part of the development. The proposed development will include a combined emergency services building, medical centre and educational facilities. However, Gladstone will still provide the administrative and higher order commercial, social and entertainment needs for the visitors and residents on Hummock Hill Island.
Development Constraints	
The use of land for a specific purpose is constrained by a range of physical, social and economic factors that need to be considered prior to it being designated as suitable for that use. The benefits of locating particular land uses in areas that exhibit high levels of development constraints must be weighed against the potential costs to the wider community and future generations. Objective: To ensure that urban development within the region is not located in areas that are, or are likely to be, subject to factors that threaten life, amenities, property or the environment. Policy Principle: Land uses relating to where people live or work should not be located on or adjacent to locations that are potentially subject to natural hazards, likely to be used for the storage or use of hazardous materials or noxious industries, or identified for extractive industry or other incompatible land uses.	In regard to natural hazards, some parts of Hummock Hill Island are subject to a Bushfires Risk, as identified in the draft Miriam Vale Shire Council Planning Scheme Overlay Plan. In response, housing will not be established on the western slopes of the ridgeline on Hummock Hill Island., which is an area that is susceptible to bushfire risk. Generally, the Hummock Hill Island Development is compatible with the Island's environment as development will consist mostly of residential dwellings, tourist and retail uses, which are not likely to cause impacts (refer to Section 18 for further details on hazards).

Coordination and Sequencing	
In delivering services to a fragmented settlement pattern, the coordination and sequencing of a range of infrastructure and community services are important in achieving cost savings and the timely delivery of services to meet the needs of the Wide Bay Burnett community. Development sequencing can achieve efficiencies in the provision of a range of public and private funded facilities and services. Objective: To ensure that urban development within the region occurs in a coordinated manner so that efficiency of existing infrastructure and services is maximised and new infrastructure and services are supplied in a cost-effective manner. Policy Principle: Development in the region will be coordinated so as to ensure that existing infrastructure and services are utilised efficiently and effectively and new infrastructure and services can be planned and supplied in an orderly, cost effective manner.	The proponent will provide the necessary infrastructure on Hummock Hill Island so as not to detrimentally affect the coordination of infrastructure in the region.
Residential Development and Urban Design	
Urban Form and Character	
Residential design is a major factor in the wellbeing of individuals, families and communities. The design of communities and neighbourhoods should facilitate the provision of housing that is affordable, appropriate, safe and secure within well serviced, aesthetically pleasing and safe environments. Objective: To ensure that urban development proposals follow best practice town planning design guidelines. Policy Principle: The preferred settlement pattern should include a range of residential living opportunities consistent with other Regional Plan principles.	A range of housing options are proposed for Hummock Hill Island. These include apartment dwellings, small lot town houses and cottages and detached dwellings on larger lots, which provide a range of residential living opportunities. Hummock Hill Island is a master planned community, and as such residential areas will be developed in a coordinated manner.
Housing Mix, Affordability and Design	
The need for affordable housing, and for housing options for single adults, communal living arrangements and single parent families is growing. Housing designs should also take into account the regional climatic variables, energy efficiency initiatives and the diversity of housing type and tenure required to satisfy community demand. Objective: To ensure that adequate supplies of housing exist within the region; that individual household designs are appropriate to the needs and circumstances of the residents; and that housing meets best practice guidelines in terms of safety and energy efficiency. Policy Principle: The Wide Bay Burnett community has access to an adequate supply of affordable housing that complements the natural and built environment and heritage of the surrounding area, and is carefully designed to maximise residents' amenity, safety and security.	As per above, a range of housing options are proposed for Hummock Hill Island. These include apartment dwellings, small lot town houses and cottages and detached dwellings on larger lots, which provide a range of residential living opportunities.

Transport	
Equitable Access to Transport	
Objective: To provide all residents of the region with access to transport services that meet their needs. Policy Principle: An acceptable level of transport services should be available to all residents, particularly members of the community who do not have access to transport and so have limited access to services.	The proponent will provide the necessary road infrastructure to service the Hummock Hill Island Development prior to any construction of tourism facilities on the Island. Master Planning of the proposed development has provided for bus services to the Island and includes bus stops for tourists and residents to utilise local services that will meet the increasing demand.
Infrastructure Planning	
Infrastructure Coordination and Efficiency	
In order to service the preferred settlement pattern in a cost-effective and timely manner, it is important to coordinate infrastructure provision. Improved coordination and integration of infrastructure and land use planning can significantly assist in reducing infrastructure costs to the community, and ensure the resources of all levels of government are more effectively and efficiently applied to a highly dispersed population Objective: To ensure orderly urban growth and efficient provision of infrastructure. Policy Principle The efficient and timely delivery of infrastructure should be consistent with the Preferred Settlement Pattern.	The proponent will provide the necessary urban infrastructure to service the Hummock Hill Island Development as a condition of the SL, prior to constructing any tourist, commercial and residential areas.
Regional Water Supply	
Water supply is expected to be a major limiting factor for growth in many of the region's communities. This is likely to be exacerbated by projected population growth in coastal areas, coupled with predicted climate change impacts of increased temperatures and rainfall uncertainty. Potential disruption to industrial, agricultural and urban growth through drought and water shortages could adversely affect prosperity and quality of life aspirations for the region's inhabitants. Objective: To provide sufficient water and related infrastructure to service the needs of the community and economic activities in the region whilst maintaining healthy ecosystems. Policy Principle: Regional and sub-regional collaboration, planning and coordination of the Wide Bay Burnett water resources to ensure the efficient, cost effective and sustainable management of the region's water catchments, impoundments and distributions systems.	The proponent for Hummock Hill Island will provide the necessary water infrastructure to service the Island. However, demand on potable water resources will be reduced through water sensitive urban design measures including endemic and drought tolerant landscaping design, the harvesting and storage of rain water from building rooftops and the use of recycled water for outdoor and non-consumption purposes. By implementing these measures, the development can minimise the effects on the region's water catchments, impoundments and distributions systems.

Rural Community Water Supply and Sewage Treatment	
Residents of rural communities are usually responsible for onsite water supply and wastewater disposal, typically through rainwater tanks, dams and/or bores, and domestic septic systems. The variable rainfall pattern in the region sometimes necessitates domestic water supply replenishment from offsite, while septic system operation can sometimes be adversely affected by changes to the water table. Appropriate standards need to be applied to ensure risks to human and environmental health are minimised. Objective: To ensure rural communities have safe, efficient and cost-effective water supplies, sewage treatment systems and waste water reuse and disposal systems. Policy Principle: Best practice water treatment and quality standards should be adopted for on-site water supply, recycled water supplies, transported domestic water, and sewerage treatment and disposal to minimise health risks for residents and adverse impacts on the environment.	While not a rural community, Hummock Hill Island is relatively isolated from the existing infrastructure. Accordingly the proponent will be providing the necessary water infrastructure to service the Island. This will include a waste water treatment plant, desalinisation plant and dual water reticulation.
Waste Management and Resource Recycling	
Despite increases in the rate of recycling, the region faces enormous challenges in dealing with the waste generated from households and business activities. As the region's population and economy grows, more pressure will be placed on communities to develop and implement more efficient means to reduce waste, to reuse and recycle resources and to fund the collection, transport and disposal of waste. There are opportunities to achieve effective waste management outcomes and create new business opportunities through the recycling and processing of waste products. Where possible, waste management initiatives should be undertaken and coordinated through regional or sub-regional local government partnerships. Objective: To maximise recycling opportunities and ensure the safe, efficient and cost-effective management and disposal of solid waste and wastewater throughout the region. Policy Principle: Management of the region's waste and recycling activities is of critical importance and should be coordinated on a regional and sub-regional basis.	Waste issues have been considered and a waste management plan for the development has been developed (refer to Section 11).

Information and Communications Technology	
Telecommunications is a major facilitator of economic development through its ability to drive tremendous efficiencies in the supply chain, link consumers and producers, and encourage innovation. Businesses that do not have access to best practice telecommunications services will find it increasingly difficult to compete in a global market. It is essential for the social and economic sustainability of the region that high-speed broadband services are readily available at affordable prices, that information systems are in place to take advantage of these services, and that the region is well positioned to take advantage of technologies as they emerge. Objective: To ensure all communities throughout the region are provided with acceptable standards of information and communications services. Policy Principle: All communities should have access to modern information and communications technology.	The proponent will provide the necessary telecommunications infrastructure.
Human Services And Social Justice	
Provision of Community Services	
Community services and facilities are required to provide quality of life and community wellbeing. It is financed and managed by all levels of government, community organisations and the private sector. Objective: To provide communities with access to essential services which support their daily needs and underpin their quality of life and functioning as viable working communities. Policy Principle: To ensure new and effective levels of community services and facilities are provided to the Wide Bay Burnett region, whilst adhering to social justice principles. Cooperative interaction must occur between all levels of government and community organisations in the planning and development of human services and community facilities to ensure services are accessible, cost effective, and responsive to local needs.	Community services and facilities are discussed in Section 16.
Advice on Social Impacts	
Managing the physical, social and cultural aspects of population growth requires careful planning to ensure the successful integration of the new and the old. Social considerations, including community wellbeing, must be incorporated into planning for urban and rural growth Objective: To ensure that the social impacts of population growth and social change are fully identified and managed. Policy Principle: Social planning and social impact assessment should be incorporated in all relevant aspects of planning in the Wide Bay Burnett region.	Refer to Section 16, which provides a social planning assessment of the proposed development. The social planning assessment reports on issues associated with: ▪ Property and business, ▪ Employment, ▪ Housing, ▪ Community infrastructure ▪ Health and safety, ▪ Accessibility; and ▪ Cultural heritage.

Challenges of a Lifestyle Region	
The Wide Bay Burnett coastal sub-region is experiencing rapid population growth. The majority of the population increase comprises older retirees who do not participate in the workforce which has some economic implications for the region. This high growth in the coastal areas also appears to be causing a 'ripple effect' of population migration extending into rural areas. The region needs innovative mechanisms to ensure that these demographic trends improve, rather than negatively impact, on the region's economy. Objective: The region's population growth and changes in demographic characteristics generate wealth, employment, diversity and sustainable communities. Policy Principle: Develop and implement innovative ways of attracting and supporting a demographically diverse population of new residents to the Wide Bay Burnett region.	As reported in the Section 13 Social Environment, there is currently a strong demand for housing in the region. The Hummock Hill Island Development would directly support this policy objective. The project would provide a range of residential living opportunities. The attractiveness of the Hummock Hill Island Development is enhanced by its proximity and access to the region's natural environment.
Sport and Recreation	
The region currently offers a wide variety of sport and recreation opportunities and facilities. Through continual planning these opportunities can only improve the lifestyle of the region as well as the social and economic benefits that they foster. Recreation, sport and quality of life options have been clearly identified as factors that influence the attraction and retention of families, professionals and other settlers to this region. Planning that recognises the expectations of potential new residents, as well as those of the existing community, can create a recreational environment that: ▪ attracts young families to the region; ▪ enhances community mental and physical well being; ▪ enhances the cultural identity of the region; and ▪ creates business opportunities in tourism, health and fitness and cultural services. Objective: To ensure communities have access to a range of active and passive recreational opportunities and facilities appropriate to their need. Policy Principle: Urban and rural community development should incorporate an appropriate range of recreation and sporting opportunities and facilities that are responsive to the increasing needs of the community.	It is proposed that Hummock Hill Island be provided with a golf course, boat ramp and sports oval to meet the recreational needs of the Island's population. In addition, access will be provided to the Island's beaches and conservation areas to allow for low impact recreational activities such as bushwalking, swimming, kayaking, etc.

Aboriginal And Torres Strait Islander Cultures And People	
Aboriginal and Torres Strait Islander culture is intrinsically linked to the natural environment. Activities involved in recognition, protection and conservation of cultural heritage allow Aboriginal people to reaffirm their obligations to 'land' and 'country'. In the Wide Bay Burnett region there is a need to collate and record information regarding the interests of indigenous people and to further develop processes that enable Aboriginal and Torres Strait Islander people to participate as active partners in the future development of the region. Engaging Aboriginal and Torres Strait Islander People Objective: To ensure the view of Aboriginal and Torres Strait Islander people living in the region are valued, and that they can fully participate in decision-making processes in the region which impact on their interests. Policy Principle: Aboriginal and Torres Strait Islander people in the Wide Bay Burnett region are engaged as active partners in development and planning processes that move the region towards its vision for 2026.	Refer to the Section 13, which includes a cultural heritage assessment and details on how the Aboriginal people in the local area were engaged as part of the in development process for Hummock Hill Island.
Cultural Heritage	
Objective: To ensure that appropriate measures are in place to protect and preserve Aboriginal and Torres Strait Islander historical cultural information and artefacts. Policy Principle: Aboriginal and Torres Strait Islander local heritage, including archaeological, traditional, historic and contemporary cultural values in the Wide Bay Burnett region are recognised protected and preserved.	Refer to Section 13, which includes a cultural heritage assessment.
Social and Economic Equity	
Objective: To assist Aboriginal and Torres Strait Islander people in accessing appropriate levels of social services and infrastructure, and to participate in economic activities. Policy Principle: Aboriginal and Torres Strait Islander people should have equitable access to opportunities for a high standard of living, good economic prospects and general wellbeing.	Refer to Section 16. This social planning assessment reports on the project's implications for local Aboriginal people. While the project has no direct benefit to the indigenous population specifically other than as part of the wider community, opportunities exist during both the construction and operation phases of the project for training and employment.

Tourism	
Tourism is a significant driver for growth throughout the region. Many of the natural tourism advantages of the region are under-developed, under-packaged and under-promoted. Objective: To effectively capitalise on the region's natural advantages and current trends and patterns in tourism, in order to promote a sustainable, prosperous tourism industry through enhancing viability, innovation, efficiency and market awareness. Policy Principle: Having regard to the long-term preservation of the region's key natural assets, identify opportunities in tourism which builds on the region's natural advantages, promotes cooperation in tourism packaging and branding, while supporting the most cost-effective application of marketing and promotional funds.	The Hummock Hill Island development will enhance the tourism industry in the region by providing approximately 500 tourist accommodation units. Tourists staying at Hummock Hill Island will have access to the Island's natural environment, including beaches and bush land areas, for the purposes of low impact recreation opportunities. Hummock Hill Island's natural assets, which contribute to the attractiveness of the Island for tourists, will be protected. This will be achieved by retaining approximately 50% of the development lease area for conservation purposes and development will not be permitted on the 'coastal management district', in order to conserve the Island's natural values.
Inwards Migration	
A significant driver for growth throughout the region is the aggregation of patterns of migration to and within the region. These changes provide significant opportunities for further economic growth. Objective: To effectively plan for and capitalise on current demographic trends and patterns of inwards migration to the region. Policy Principle: Having regard for the long-term preservation of the region's key assets such as balanced settlement patterns and renewable resources; evaluate the impact of new population movements and demographic patterns at the local and sub-regional levels, identify opportunities and constraints generated by these drivers, encourage the development of planning strategies to address constraints, and to access economic development opportunities.	The proposed development will support and encourage migration into the region by providing housing and tourism opportunities. The draft Plan of Development and planning implications of the project are addressed within this section. The social and economic implications of the project are discussed in Sections 16 and 17.
Cultural, Creative and Lifestyle Industries	
Cultural, creative and lifestyle industries are emerging as strong economic drivers throughout the region, that often relate to the individual characteristics of sub-regions and local areas. These emerging trends are strongly related to tourism, inwards migration and retirement. There are significant opportunities for further economic growth in these sectors. Business growth in many of these industries will largely flow as market-driven outcomes; however, there is positive value in identifying opportunities and improving planning and delivery of services to support these opportunities. Objective: To effectively capitalise on current and projected future trends and patterns in cultural, creative and lifestyle industries in the region. Policy Principle: Identify, promote and support opportunities relating to the creative, cultural and lifestyle industries.	The Hummock Hill Island Development, including its provision of tourist and entertainment facilities and a golf course, should be supported for the lifestyle benefits offered to the region.

Skills Development, Technology Adoption and Innovation	
Common themes emerging from consultation across the region highlight the need for enhanced and targeted skills training. Mismatches seem to abound between training providers and businesses, with lack of openness and consultation on both sides. Compared with training unemployed people, there has been an under-emphasis in resources for training directed at business and industry needs; the balance can be redressed in a way that serves both, through concerted consultation and planning. A related skills issue is the relatively low adoption of technology; information about better use of technology needs to be promoted, encouraged and supported by access to relevant training. Objective: To achieve adequate matching of existing skills, supply and demand, and new skills formation to meet the labour requirements of present and potential industries, to improve focus on areas of specific need such as trade training, training of unemployed youth and retraining of older workers, and to promote awareness and take-up of training in new technologies. Policy Principle: Growth in the supply of skilled labour should be encouraged by extended and meaningful consultation to better match the skills of the labour force with employment opportunities through the region and to better match the provision of skills development and training with the requirements and standards of existing and potential industries.	As reported in Section 16 of this EIS (Social Environment), an estimated 684 jobs are expected to be created during construction of the Hummock Hill Island Development and through subsequent consumer and tourist activities. Miriam Vale had a moderately high unemployment rate in 2001, and would benefit from local employment opportunities provided both during construction and once the Village and Town Centres are operational.

2.1.3.2 Central Queensland Regional Growth Management Framework

Similar to the Wide Bay Regional Plan, the Central Queensland Regional Growth Management Framework is a non-statutory long term, broad-based, integrated regional planning strategy. Its purpose is to guide the management, growth and development in the Central Queensland region to 2022. Hummock Hill Island is not situated in the Central Queensland Region however the southern boundary of this region includes the common boundary of Miriam Vale Shire and Calliope Shire.

Of primary consideration in relation to this framework is the relationship that the Hummock Hill Island Development of approximately 4000 people is likely to have with the hierarchy of centres within this region. The region's centres are categorised as follows:

1) Major Urban Centre;
2) Key Regional Centre;
3) Coastal Growth Area; and
4) Other Towns.

Gladstone City is the second largest population centre in the region behind Rockhampton. In Calliope Shire and Gladstone City, the manufacturing, electricity, gas and water supply industries were the largest employers at the 1996 census (CQRGMF, 2002).

The importance of the Gladstone region as an industrial centre has been reinforced through the State Government's commitment to the development of the Gladstone State Development Area

(GSDA) (CQRGFM, 2002). The GSDA has been expanded since its declaration in 1993 and now comprises approximately 21,000 hectares of land west and north-west of Gladstone that is considered broadly suitable for large-scale industrial development. The region is suitable for large-scale industrial development for given the deep water Port of Gladstone, well planned infrastructure, access to natural resources and access to well priced energy. The development of land in the GSDA will increase employment opportunities in the region and this will attract workers to the area. Workers and their families will seek to live within commuting distance of the GSDA and this will generate a demand for housing within commuting distance of the GSDA.

It is acknowledged that tourism, agriculture, forestry and fishing make a significant contribution to the area's economy. Industrial tourism is a developing opportunity while existing opportunities centre on Heron Island and the Great Barrier Reef.

Population projections indicate that coastal areas will grow more so than inland areas, with the populations of Livingstone, Fitzroy and Calliope Shires, and Gladstone City expected to have the highest rates of growth in the region over the next 20 years (CQRGFM, 2002).

Yeppoon, Boyne Island, Tannum Sands and Emu Park are the coastal areas exhibiting strong growth as a result of their proximity to Gladstone and Rockhampton, which offer high order services and facilities. However, the Central Queensland Regional Framework for Growth Management identifies the scarcity of coastal lands or land offering sea views in the region and the care that needs to be taken to ensure that such lands are developed in a way that preserves their physical characteristics as much as possible.

The Hummock Hill Island Development has the potential to accommodate a portion of the population that will be drawn to the area for employment in the GSDA. This will assist in managing the pressure on the coastal areas in the Central Queensland Region to accommodate population growth, in particular Boyne Island and Tannum Sands.

While Hummock Hill Island is situated outside the Central Queensland Region, it is within a reasonable commutable distance of Gladstone City, which offers higher order goods and services than the towns in Miriam Vale Shire. As such, it is anticipated that the new population on Hummock Hill Island would expand the Gladstone City's catchment area and contribute to the economic and social prosperity of this centre.

Many of the region's tourism attractions are located on the coastline and offer experiences focussing on the Great Barrier Reef and other coastal resources. Similar tourism and recreational experiences will be offered from Hummock Hill Island and this will assist in managing the concentration of activities whilst increasing accessibility to resources in the coastal zone. Both outcomes, if managed properly, would be positive outcomes.

With the proposed local government amalgamations, the relevance of this plan and the development of Gladstone and surrounds to Hummock Hill has increased.

2.2 Local Planning Instruments and Local Laws

2.2.1 Miriam Vale Shire Council Transitional Planning Scheme

The Transitional Planning Scheme for Miriam Vale Shire (the Transitional Planning Scheme) is the current planning scheme for the shire. This Section addresses the strategic intent and development provisions of the transitional plan.

The purpose of the transitional plan is to provide guidance to the future land use and development within the Shire of Miriam Vale whilst encouraging appropriate economic growth, social and economic well-being for residents and facilitating economic sustainability.

The transitional plan comprises the following:

- Strategic Plan;
- Zoning Maps; and
- Planning Scheme Provisions.

2.2.1.1 Strategic Plan

The strategic plan sets out the preferred land use structure for the Shire, the purpose of which is to provide guidance to the preferred pattern of development. The intent of the Strategic Plan is to manage land use, economic development, social and economic wellbeing, environment and culture and lifestyle within the Shire. This intent is supported by five categories of aims that identify the ways in which the intent is to be achieved:

- Land Use Management;
- Economic Development;
- Social and Economic Wellbeing;
- Environment; and
- Culture and Lifestyle.

The aims that are relevant to the Hummock Hill Island Development are identified in Table 2.3.

Table 2.3 – Transitional Strategic Plan Aims

Aim	Comment
Economic Development	
▪ To support the expansion of the economy of the Plan Area through the establishment of rural, industrial and commercial enterprises which provide a sound and appropriate employment basis; ▪ to promote the development of tourism and recreational facilities and to promote the establishment of a viable tourism industry; ▪ to support appropriate growth and development within the Plan Area.	The proposed Hummock Hill Island Development, comprising a range of tourism accommodation and housing, recreational facilities and supporting facilities, will provide the catalyst for expansion of the Shire's economy by establishing a predominantly self-sufficient community of approximately 5000 people. This community would function as a new centre for employment in the Shire, providing employment opportunities ranging from the construction phase to the continued operation of businesses, facilities and services. The tourism and recreational facilities are key elements of the integrated development and will contribute to the growth of a viable and diverse tourism industry in the Shire. As such, the proposal is consistent with the relevant aims of the Strategic Plan relating to economic development.
Social and Economic Wellbeing	
▪ To ensure infrastructure is provided at an appropriate standard commensurate with acceptable standards of living for the community; ▪ to ensure the provision of a transportation network which efficiently serves the needs of residents and visitors; ▪ to limit development to locations where an acceptable standard of amenity can be maintained; ▪ to maintain socio-economic diversity within the community through flexibility in the location and type of housing	Current infrastructure provision on Hummock Hill Island is very limited and the establishment of a new community on Hummock Hill Island will necessitate significant infrastructure provision to sustain the community and achieve a liveable environment. The access road to Hummock Hill Island and the bridge over Boyne Creek will be constructed in the first stage of infrastructure works. The potable water supply, wastewater treatment plant, solid waste transfer station and electricity will be provided in the next stage of infrastructure works coinciding with the first stage of construction of the resort and residential development to ensure that an acceptable standard of living is provided to dwellings. Details of proposed infrastructure are included in Section 3. Further infrastructure including the trans Island boulevard will be constructed to coincide with the staging of further development on Hummock Hill Island. Socio-economic diversity within the Hummock Hill Island Development community will be facilitated through provision of a diverse range of housing choice, both permanent and temporary. Housing choice will include bushland allotments, golf course allotments, hillside allotments, resort apartments and tourist park accommodation.
Environment	
▪ To promote a high quality environment as a significant resource for both residents and visitors; ▪ to limit development to locations where adverse environmental effects can be minimised; ▪ to ensure that all development conforms to appropriate performance standards and criteria; ▪ to protect all environmentally significant or sensitive areas from adverse impacts of development;	The proposed Hummock Hill Island Development concept focuses on achieving coexistence of the natural and built environments. It is proposed to utilise and promote the environment as a key resource that will contribute to the unique character and liveability of the proposed Hummock Hill Island Development. The Hummock Hill Island Development seeks to preserve the environment, protect significant environmental resources to the extent practicable and put in place management protocols to manage potential development effects.

Aim	Comment
▪ to promote environmental concern and awareness within the community ▪ to promote the principles of ecologically sustainable development, within an appropriate economic framework, within the land use management process.	
Culture and Lifestyle	
▪ To acknowledge and enhance the unique lifestyle within the Plan Area; ▪ to encourage the preservation of history and heritage within the Plan Area.	The Hummock Hill Island Development seeks to utilise both natural and scenic qualities of Hummock Hill Island and its surrounds to create a unique living environment wherein the built environment exists in harmony with the natural environment. A cultural heritage management plan has been developed with the traditional owners and has been signed by Qld DNRW.

The Plan includes objectives for broad land use areas and matters for consideration throughout the Shire. The objectives fall under the following headings, all of which are relevant to the proposed development:

- Rural Areas;
- Tourism;
- Infrastructure;
- Transportation; and
- Environment and Lifestyle.

Each of these objectives is addressed in Table 2.4.

Table 2.4 – Objectives

Land Use Area Objectives	Comment
Rural Areas	
Further fragmentation of rural holdings will not be supported.	The purpose of this objective is to maintain rural productivity by protecting the fragmentation of rural holdings. Land within the proposed Hummock Hill Island Development has been classified as poor quality agricultural land in accordance with the SPP1/92 Guideline for Development and Conservation of Agricultural Land. This is addressed in Section 5. Pursuant to this classification, the Hummock Hill Island Development would not result in the loss of valuable rural land and rural productivity would not be adversely affected. The implementation criteria of this objective state that development and associated subdivision within the Rural Area will not be supported other than where such subdivision clearly satisfies a demonstrated need and is associated with development which is in accordance with the provisions of the Strategic Plan. Council's approval of the integrated tourist/residential development in 1988 indicates the Council's acceptance that the development of the land for tourism and residential related purposes would not result in the unacceptable fragmentation of rural holdings.

Land Use Area Objectives	Comment
	The implementation criteria allow for development and associated subdivision within the Rural Areas to be supported in respect of proposals such as appropriate tourism or recreational development. The Hummock Hill Island Development will include a range of tourism and recreational facilities including accommodation, for example resort apartments, hotel, camping ground and recreational facilities including a golf course, two boat ramps pedestrian beach access and picnic parks. These facilities will rely upon the 'naturalness' of Hummock Hill Island in providing unique tourism experiences. Housing also forms a main component of the proposed community and this will provide a residential population to support the viability of ancillary services that also service the tourist and recreation population.
Visually and/or environmentally significant areas, including higher areas, steep land, foreshores and wetlands shall be preserved and protected from inappropriate development.	Strategic Plan Map 1 in the Transitional Scheme identifies areas of significance in the Shire and those relevant to the Hummock Hill Island Development are: ▪ fish habitat reserves; ▪ erosion prone areas; and ▪ mining leases. Colosseum Inlet and the tidal estuary that divides Hummock Hill Island is a declared fish habitat areas. The fish habitat area is discussed further detail in Section 15. Erosion Prone Areas exist on the northern coastline of Hummock Hill Island. There are two mining leases over parts of Hummock Hill Island however Strategic Plan Map 1 does not acknowledge these as areas of significance that should be protected from inappropriate development. Whilst the proposed Hummock Hill Island Development seeks to avoid development in environmentally significant areas, the two proposed boat ramps and bridge have the potential to impact on the declared fish habitat areas and erosion prone areas. Section 15 addresses the potential impacts of these works and recommendations are made to mitigate identified impacts.
The retention, maintenance and enhancement of a comprehensive open space network within the rural areas will be supported.	The proposed Hummock Hill Island Development sets aside approximately 50% of the site as environmental protection areas. These areas will remain free of development and in their natural state. In particular, the visually prominent Hummock Hill, 135 metres in height, is included in the protection area. An additional area equating to approximately 25% of the site will be taken up by recreational open spaces including the golf course, town park and green spaces. Together these areas take up approximately 75% of the proposed Hummock Hill Island Development area, which represents a significant portion of the site that will be preserved and enhanced to form an extensive open space network.
Existing and possible future water supply catchments and storage areas shall be identified and protected.	Existing water supplies and possible future water supplies are addressed in Section 3 and Section 8. In particular the proposed integrated water supply and management is outlined.
Tourism	
The establishment of a significant tourism industry as a major contribution to the future economic well being of the Plan Area is supported.	Hummock Hill Island and surrounding estuaries currently provide limited low key tourist and recreational resources that cater for fishing, boating, swimming and basic camping. The development will significantly expand and diversify the range of recreational and tourism facilities provided on Hummock Hill Island including the following: ▪ Two boat ramps; ▪ Two golf courses and associated golf clubs; ▪ Camping area;

Land Use Area Objectives	Comment
	▪ Picnic parks; ▪ Walking trails; and ▪ Lookouts. The implementation criteria identify the provision of facilities for boating related activities, which will be provided for with the new boat ramps and marine precinct. Agnes Water/Seventeen Seventy is identified as the principal tourism focus for the Shire. The Plan does not identify Hummock Hill Island as a location for tourism facilities. However, Hummock Hill Island has been earmarked for an integrated development for a considerable period of time. The Island was once designated as a Future Urban Zone and in 1998, Council resolved to approve the rezoning of part of the Island under pastoral lease 19/129 from Rural A Zone to the General Business Zone. Council also resolved to grant town planning consent for the purpose of an integrated tourist resort on the Island subject to a Special Lease. The Hummock Hill Island Development would propose a similar range of tourism facilities as proposed in the previous development and it does not preclude the development of Agnes Water/Seventeen Seventy as the tourism focus for the Shire. The proposed facilities will contribute towards strengthening the tourism industry in Miriam Vale Shire, for the benefit of tourists and residents of the Shire. The strengthened tourism industry will, in turn, contribute to the economic well being of the Shire. This is discussed in further detail in Section 3.
All tourism proposals shall conform with the objectives and implementation criteria of the Strategic Plan, particularly those relating to conservation and ecological sustainability, as may be relevant to the particular proposal.	The planned tourism and recreation opportunities are predominantly environmentally based in that they will base tourism and recreation experiences around the natural and amenity values of Hummock Hill Island and surrounds. To achieve this focus and maintain the viability of tourism and recreational opportunities, the Hummock Hill Island Development seeks to protect the natural systems from intrusion and degradation.
All tourism proposals shall conform with the objectives and implementation criteria of the Strategic Plan, particularly those relating to conservation and ecological sustainability, as may be relevant to the particular proposal.	The key objective of the Hummock Hill Island Development is to develop a residential/tourist community that coexists with the natural environment and utilises the natural resources as the basis for the lifestyle, tourism and recreational opportunities. Technical studies have been undertaken of the existing environment to identify potential impacts and measures to mitigate and manage impacts on the environment have been recommended in the EIS.
Infrastructure	
The provision of adequate and appropriate infrastructure, including road access, water supply, waste disposal, stormwater and electricity and including State supplied infrastructure such as educational facilities, shall be an essential component of all development.	The infrastructure and services required to service the proposed Hummock Hill Island Development have been identified in Section 3 and Section 6. The Hummock Hill Island Development has been planned to function as a self-sufficient centre in which services and facilities that will support the residential and tourist population are integral components. These support uses include commercial, retail, education uses, emergency services and a private airstrip.
Transportation	
The establishment and maintenance of an appropriate hierarchy of roads throughout the Plan Area is supported.	The existing mainland road network will require upgrading to provide adequate access to Hummock Hill Island in conjunction with the new bridge. A new network of roads will be constructed on Hummock Hill Island to provide access to various precincts of the Hummock Hill Island Development.

Land Use Area Objectives	Comment
Environment and Lifestyle	
To create, maintain or reinforce the desired character of local areas within the Plan Area	The proposed Hummock Hill Island Development seeks to preserve the natural character of the locality by incorporating an extensive network of open space throughout the development and basing recreation and tourism experiences around the natural resources both on and surrounding Hummock Hill Island.
To initiate design controls for the built environment	A Plan of Development will be compiled for the proposed Hummock Hill Island Development that sets out design controls for the built environment that will achieve the desired design outcomes of the Transitional Planning Scheme
To recognise and protect specific places, sites, buildings and structures which are of importance to the natural, Aboriginal or Non-Aboriginal heritage because of their recreational, historic, architectural or cultural value.	An approved Cultural Heritage Management Plan has been developed for the proposed Hummock Hill Island Development and signed off by Qld DNRW
To recognise, establish and maintain an open space network that includes areas of high scenic quality, remnant vegetation, core habitat areas, existing open space, riparian areas and, where feasible and possible, linkages of these areas within the network.	The Hummock Hill Island Development seeks to maintain expansive open space networks throughout the development, integrate natural and built environments and reinforce the 'naturalness' of the location. Areas of significance, for example remnant vegetation, have been identified in Section 14. The Master Plan seeks to protect these areas from incompatible development by including them in conservation areas or provide offsets as required under the South East Queensland Regional Vegetation Management Code.
To protect core areas of conservation value such as national parks, state forests and reserves, Marine Parks, World Heritage Properties and National Estate Areas from nearby incompatible uses.	Hummock Hill Island lies within the Great Barrier Reef Marine World Heritage Area and is located adjacent to the Great Barrier Reef Marine Park and Great Barrier Reef Coastal Marine Park. Potential impacts to these areas are discussed in the EIS and provide mitigation actions that minimise identified impacts. The Environmental Management Plan prepared in association with the Hummock Hill Island Development sets out recommended measures to protect the environmental values of the World Heritage Area and marine parks.

Strategic Plan Area Designations

The preferred land use structure under the Strategic Plan divides the Shire into twelve land use designations and these are:

- Urban;
- Commercial;
- Mixed Use;
- Industry;
- Small Town;
- Rural;
- Rural Service Centres;
- Good Quality Agricultural Land;
- Extractive Industry;
- Open Space and Recreation;

- Water Supply; and
- Main Transport Routes.

The Hummock Hill Island Development and all of Hummock Hill Island to the high water mark are included within the Preferred Land Use designation of Rural. This designation is the most geographically extensive of the preferred land uses throughout the Shire.

Land in the Rural designation is intended to be developed for rural purposes such as grazing and agriculture, extractive industry as well as recreation and tourist related activities. This area may also include low density residential areas. Objectives of the Rural designation relevant to the Hummock Hill Island Development are addressed in Table 2.5.

Table 2.5 – Preferred Land Use Objectives – Rural

Objective	Comment
The amenity and character of the rural area shall be maintained, preserved and enhance	The key feature of the proposed Hummock Hill Island Development is an integrated tourist and residential community on Hummock Hill Island. Tourist and recreation related activities offer experiences based on enjoyment of the Islands natural characteristics, often described as 'naturalness', therefore protection and enhancement of natural amenity and character is of high importance. Adverse impacts on the natural environment as a result of the proposed Hummock Hill Island Development will be avoided in order to preserve the amenity and rural character of the area. The design and visual appearance of buildings will be controlled by performance criteria contained in the approved Plan of Development for the Project. Performance criteria may address design aspects such as building height, mass, site coverage and building materials to ensure that the design of buildings creates a strong identity both within precincts and throughout the community as a whole and creates a high standard of amenity and character.
Rural development shall be supported and protected through the maintenance of an appropriate land use structure which avoids potential conflict between incompatible development.	The Hummock Hill Island Development will not result in the loss of Good Quality Agricultural Land and in this regard the potential of the site for rural development will not be compromised.

While Hummock Hill Island is designated as 'Rural', which is generally for rural and non-urban uses, the proposed development does not result in the loss of good quality agricultural land and satisfies many of the broader aims and objectives of the Strategic Plan as demonstrated above.

2.2.1.2 Planning Scheme Zoning

The preferred land uses within the Shire of Miriam Vale are broadly expressed into two zones, Urban and Rural. The area comprised of the Hummock Hill Island Development is included within the Rural Zone.

The intent of the Rural Zone is:

> *To provide for development outside the urban centre including:*
>
> *(a) rural development such as agriculture, forestry, grazing, intensive agriculture and intensive animal husbandry;*
>
> *(b) extractive industry and higher intensity at appropriate locations; and*
>
> *(c) open space, recreational and tourist development at suitable locations.*

The intent of the Rural Zone is supported by the Table of Zones, which sets out the level of assessment for the establishment of land uses in the zone. The intent of the Rural Zone can be achieved through fulfilment of two objectives, which are addressed in Section 2.2.2.

The Hummock Hill Island Development is generally inconsistent with the rural objectives, given the range of proposed land uses and reconfiguration of the land into a range of lot sizes. Consequently, an application for preliminary approval for material change of use will be made to Miriam Vale Shire Council.

Despite this, The Hummock Hill Island Development area is not classified as good quality agricultural land in accordance with SPP1/92 Development and Conservation of Agricultural Land. The land is isolated from the mainland and the absence of a permanent connection to the mainland has fragmented the rural area and severely limited its viability for rural activities on Hummock Hill Island.

The proposed Hummock Hill Island Development seeks to establish an integrated tourism and residential development with supporting recreational facilities. The tourism and recreational facilities are the focus of the development and this is reflected in the proportion of the development site that will be taken up by these facilities. Excluding tourist accommodation, the tourism and recreational facilities will take up approximately 75% of the development area. Residential uses, supporting facilities and infrastructure will take up only 25% of the development area.

The residential and supporting facilities, including those to be established in the Hummock Hill town centre and village centre will nonetheless be vital elements of the Hummock Hill Island Development. They will support a permanent population, many of whom will be employed in association with the tourism and recreational facilities on Hummock Hill Island. Other uses that provide for shopping, eating and entertainment will support the viability of the recreational and tourist facilities by providing ancillary services to tourists and recreation users. The residential and support facilities will rationalise the cost to the developer of providing the necessary infrastructure to Hummock Hill Island.

Protection and enhancement of the character and amenity of Hummock Hill Island is a primary objective of the concept of the Hummock Hill Island Development and the majority of the tourist and recreational facilities focus experiences around the 'naturalness' of the environs. In support of this objective, the Master Plan for the Hummock Hill Island Development dedicates approximately 50% of the area as environmental protection area. This area will be valuable for its scenic qualities.

2.2.1.3 Planning Scheme Definitions

Section 6.2 of the Transitional Planning Scheme sets out the purpose (land use) definitions that may be carried out in the Shire. Table 2.6 summarises the purpose definitions that are applicable to the Hummock Hill Island Development.

Table 2.6 – Purpose Definitions

Purpose	Definition
Accommodation Building	Premises used for accommodation that is not self contained such as motels, boarding houses, guest houses, hostels, unlicensed hotels, homes for the aged, handicapped, poor or disadvantaged, service rooms, or residential club and attached accommodation for the family of the owner, or the manager but does not include caretaker's residence, dwelling house, hotel, multiple dwelling or visitor accommodation.
Caretaker's Residence	A dwelling unit used for accommodation for a person having the care or premises lawfully used for business, commercial, charitable or sporting purposes where those premises are on the same lot as the dwelling unit.
Catering Premises	Premises used for the sale of food and refreshments such as restaurants, take-away food shops, cafes, kiosks and reception lounges but not include hotel or indoor recreation.
Commercial Premises	Premises used for business offices or for other business or commercial purposes but not for professional offices.
Dwelling House	A building which comprises a single dwelling unit on any one site.
Educational Establishment	Premises used for a school, college, university, technical institute, academy, educational centre, public library, lecture hall, art gallery or museum.
Home Occupation	A dwelling unit used by a person who is resident therein for an occupation, industry, trade or profession.
Hotel	Premises used for a general licence issued under the Liquor Act 1992.
Indoor Recreation	Premises used for any activity or pursuit which affords or is calculated to afford interest or amusement irrespective of whether or not food or refreshment is provided, where such use is primarily indoors.
Industry	Premises used for: (a) An industry such as: ▪ A manufacturing process whether or not such a process results in the production of a finished article; ▪ The breaking up or dismantling or any goods or article for trade, sale, or gain, or ancillary to any business; ▪ The extraction of sand, gravel, clay, turf, soil, rock, stone or similar substances from premises; ▪ Repairing, servicing and cleaning of articles, including vehicles, machinery, buildings or other structures but not including on-site work on buildings or other structures; or ▪ An operation connected with the installation of equipment and services but not including on-site work on premises; and ▪ The following activities when carried out in connection with an industrial activity: ▪ the storage or goods used in connection with or resulting from an industrial activity; ▪ the provision of amenities for persons engaged in an industrial activity; ▪ the sale of goods resulting from but ancillary to an industrial activity; and ▪ any work of administration or accounting.

Purpose	Definition
Multiple Dwelling	Premises which comprise or are intended to comprise two or more dwelling units on any one lot such as flats, duplexes, home units, retirement villages, town houses and ancillary facilities, but does not include an accommodation building, caretaker's residence, dwelling house, hotel or visitor accommodation.
Outdoor Recreation	Premises use for any activity or pursuit which affords or is calculated to afford interest or amusement irrespective of whether or not food or refreshment is provided, where such use is primarily outdoors.
Park	An area of land and associated buildings or structures used solely for passive recreation, picnic areas or gardens, which are open without charge to the public.
Professional Offices	Premises used for the provision or professional services or the giving of professional advice but does not include commercial premises or home occupation.
Public Utility	Premises used by a government, semi-government, statutory or local government for the supply of water, hydraulic power, electricity or gas, or provision or telephone, sewerage, postal or drainage services or the provision or maintenance of roads or traffic controls.
Service Station	Premises used for: ▪ the fuelling of motor vehicles involving the sale by retail of motor fuel; and ▪ the following activities when carried out in connection with the fuelling of motor vehicles: ▪ the sale by retail of petroleum products, automotive parts and accessories and goods for the comfort and convenience of travellers; and ▪ the servicing and minor repairs of motor vehicles. The term does not include shop or industry.
Shop	Premises used (not elsewhere defined) for the displaying or offering of goods for sale by retail or hire to members of the public. The term includes an integrated development commonly referred to as "shopping centre" involving shops and other uses such as catering premises, commercial premises and professional offices.
Tourist Facility	Premises providing entertainment, recreation or similar facilities for use mainly by the general tourist or holidaying public.
Transport Terminal	Premises used for the loading, unloading and temporary storage of goods or people and the garaging and basic maintenance of vehicles engaged in the transport of such goods and people.
Visitor Accommodation	Premises used for the temporary accommodation of and rendering services to travellers or tourists and includes uses such as cabin parks, camping grounds, caravan parks and host farms.

2.2.1.4 Planning Scheme Provisions

The planning scheme includes special requirements in relation to development that provide guidance to achieve an acceptable standard of land use and development. Table 2.7 addresses the general requirements in relation to the proposed development. The proposed development generally complies with these requirements.

Table 2.7 – General Requirements

Requirement	Comment
General	
Development must be carried out in accordance with the conditions of the development permit	The EIS for the Hummock Hill Island Development forms part of the development permit process under the *Integrated Planning Act 1997*. All necessary approvals will be obtained for the development and it will be carried out in accordance with the conditions of those approvals.
Development shall not be carried out until the applicant has provided or made provision for, to the satisfaction of the Council: ▪ alterations to public utility mains, services or installations made necessary by the development; ▪ external works, required by Council, such as: ▪ concrete kerbing and channelling or table drains; ▪ forming, grading and construction of footpaths; ▪ construction or paving of roads; ▪ crossings over the channels and footpaths; ▪ access; ▪ water supply and sewerage; and ▪ drainage; ▪ contributions as required by Council for: ▪ water supply and sewerage works in accordance with the requirements of the Act and the relevant local planning policy; ▪ parkland in accordance with the requirements of the Act and the relevant local planning policy; ▪ roadworks; and ▪ other matters where reasonably necessary; ▪ an agreement for works between the Council and the applicant in accordance with the requirements of the Act; ▪ suitable landscaping and the maintenance of that landscaping as required by the Council; ▪ adequate screening and buffering between potentially conflicting uses as required by Council; ▪ adequate buffering between development and any adjoining or nearby environmentally sensitive area, including: wetlands, waterway corridors, conservation areas or marine areas; ▪ the dedication of land for road widening purposes, including corner truncation, as required by Council; ▪ appropriate performance criteria and operational standards to ensure that any emissions from such development are within acceptable standards; and ▪ appropriate disposal or all waste products from such development.	▪ The alterations, upgrades and new infrastructure required to service the Hummock Hill Island Development are detailed in Section 3 and Section 6. ▪ External works that will be required by the Council have been incorporated into the design of infrastructure for the proposed Hummock Hill Island Development. It is anticipated that detail design drawings will be subject to the approval of the Council and this will provide the mechanism for the Council to ensure that external works meet Council standards. ▪ The Council has not advised of contributions applicable to the Hummock Hill Island Development. It is expected that the Council would impose conditions requiring the payment of reasonable and relevant contributions on any development approval. ▪ An agreement for works between the Council and the applicant will be negotiated at a later date and do not form part of the EIS scope of works. ▪ Details of landscaping and a maintenance program will be included as part of subsequent applications to the Council and do not form part of the EIS scope of works. ▪ The provision of adequate screening and buffering between potentially incompatible uses will be addressed by development standards that will be contained in the Local Plan specifically for the Hummock Hill Island Development. ▪ Adequate buffering between the Hummock Hill Island Development and listed wetlands, mangroves, erosion prone areas and significant fauna habitats will be provided, the details of which are included in the Environmental Management Plan. ▪ The dedication of land for road widening purposes will be negotiated with the Council during the assessment of the EIS and detail design drawings of any upgrade works will need to be approved by the Council. ▪ The Environmental Management Plan will address how emissions both during and after construction will be managed to acceptable standards. ▪ The method of disposing waste generated by the Hummock Hill Island Development is addressed in Section 11.

Requirement	Comment
Council may require the preparation of an environmental management plan in respect of any proposed development which, in the opinion of Council, may have deleterious effect on the environment.	An Environmental Management Plan has been prepared in relation to the proposed Hummock Hill Island Development and is included in Section 20. The Environmental Management Plan details recommendations to mitigate the adverse impacts of the development on the environment.
Council may require the preparation of a social impact assessment in respect of any development, particularly significant residential or tourism proposals, which, in the opinion of Council, may have significant social impacts or consequences.	The social impacts of the Hummock Hill Island Development are discussed in Section 16 and measures to manage the impacts of the development are included in the Environmental Management Plan in Section 20.
Where proposed includes land which is in a control district, Council may require as a condition or approval that the land within the control district be transferred to the State.	Hummock Hill Island is included in the Wide Bay Coast Region under the *State Coastal Management Plan 2001* and Erosion Prone Areas are designated around Hummock Hill Island. The Erosion Prone Areas on the seaward side of Hummock Hill Island include the 80 metre wide dunal buffer zone extending along sandy ocean beach's and 55 metre wide buffer zone at the headland. On the inland side of the Hummock Hill Island that part of Hummock Hill Island up to Highest Astronomical Tide (HAT) or 40 metres above Mean High Water Springs (MHWS). The proposed bridge across Boyne Channel and the boat ramps will be constructed within the Erosion Prone Areas and the impact of these works is discussed in Section 9.
Drainage and Filling	
Development shall comply with Council's requirements, local laws and relevant local planning policy relating to drainage and filling.	The Hummock Hill Island Development seeks to avoid filling in order to maintain the natural topography and adverse impacts of land disturbance, clearing and runoff. The local laws and planning policy relating to drainage and filling have been taken in consideration in identifying the preferred layout of the Master Plan.
Development including the depositing of fill on the premises or the carrying out of any drainage works shall not cause any private or public nuisance or unacceptable levels of environmental harm.	The Environmental Management Plan will include measures to prevent unacceptable nuisance or harm as a result of any filling that may be proposed as part of the Hummock Hill Island Development.
Lighting	
Development shall not detrimentally affect the amenity of adjoining or neighbouring premises as a result of glare or light overspill from any light source on the premises the subject of the development.	Lighting throughout the Hummock Hill Island Development is not detailed at this stage. Specific lighting requirements will be included in the Plan of Development for the Hummock Hill Island Development to prevent adverse impacts on neighbouring properties and overly obtrusive lighting when viewed from the mainland.
Where lighting associated with development may impact on turtle nesting or hatching, Council will impose conditions on such development so as to ensure that artificial lighting is or an appropriate type, or where considered necessary by Council, may refuse the application.	Liaison with Qld Parks and Wildlife, who have conducted a survey of turtle nesting on Hummock Hill Island, has revealed that low density turtle nesting is present. Recommendations from Qld Parks and Wildlife in relation to lighting will be incorporated into the headland precinct of the proposed development and is discussed further in Section 5.

Requirement	Comment
Aesthetics	
Development shall not adversely affect the amenity or likely future amenity of the locality; and The aesthetics of the development shall be consistent with the character of the locality; and Development shall incorporate appropriate design features, including building type, scale, appearance, colour and materials, consistent with the local character and shall conform to the requirements of relevant local planning policies.	The Hummock Hill Island Development seeks to preserve the character and amenity of the locality through the dedication of approximately 50% of the development area as environmental protection area, which will be protected from development. The future amenity of the Hummock Hill Island Development seeks to incorporate the 'naturalness' of the environment into the built environment. The desired amenity of the development will be achieved through development requirements contained in a Plan of Development specific to the Hummock Hill Island Development that will control the design and location of buildings and vegetation removal.
Parking and Access	
Development shall comply with the following requirements: ▪ provision for access to the premises, on-site servicing and on-site car parking to the satisfaction of Council; ▪ the provision of parking spaces to be in accordance with the relevant local planning policy; ▪ the design or parking spaces in accordance with the relevant Australian Standards and Council's requirements, local laws and relevant local planning policy; and ▪ parking area gradients, layout, surfacing, accessibility and maintenance shall be to the satisfaction of the Council.	The details of parking and access within the Hummock Hill Island Development have not been finalised at this time. Car parking rates and access will be covered in the Plan of Development for the development. Alternative requirements to those specified in the transitional Plan will need to be approved by the Council.
The Council may, upon application being made to it, relax or amend, all or any, of the parking and access requirements if it considers that relaxation or amendment is justified in the particular circumstances.	Where alternative parking and access requirements are sought in relation to the Hummock Hill Island Development, approval of these will be sought from the Council.
Development for the purposes of dwelling house shall incorporate adequate provision for off-street car parking adequate for the size of the dwelling house to the satisfaction of Council.	Requirements for the provision of off-street parking in relation to dwelling houses will be referred to in the Local Plan for the Hummock Hill Island Development.
Home Occupation	
Development for home occupation shall not: ▪ be carried out other than in conjunction with lawful residential occupancy of the premises; ▪ involve the employment of more than one person other than residents except as otherwise approved by Council; ▪ use, whether temporarily or otherwise, more than thirty-six square metres of the floor area of the dwelling unit except as otherwise approved by Council; ▪ include retailing activities other than where such retail sales are ancillary to and necessarily associated with other activities on the site; ▪ impose any additional load on any public utility undertaking;	The level of assessment and specific requirements for Home Occupations within the Hummock Hill Island Development are set out in the Plan of Development, which (once approved by Council) will provide the framework for further development on the Island.

Requirement	Comment
▪ adversely affect the amenity of the neighbourhood as a result of the emission of noise, vibration, smell, fumes, smoke, vapour, steam, soot, ash, dust, grit, oil, waste water, waste products, radio or electrical interference or otherwise; ▪ operate other than in accordance with appropriate performance criteria including house of operation, provision of screening and landscaping, limitations on the nature, scale or intensity of the activities and traffic related aspects; ▪ ordinarily involve the presence at the dwelling unit at the one time of two or more persons not being residents; ▪ display goods, whether in a window or otherwise except as otherwise approved by Council; ▪ exhibit any notice, advertisement or sign exceeding 0.3 square metres in size; or ▪ generate traffic significantly above that which could be reasonably expected by the residential development.	
Industry	
Development for Industry shall; ▪ not exceed a site coverage of 75% except as otherwise approved by Council; ▪ not operate outside the hours of operation specified by Council having regard to the location of the industry; ▪ be designed or screened to ensure the amenity of the local area is not detrimentally affected as a result of visual intrusion or the emission of noise, vibration, smell, fumes, smoke, vapour, steam, soot, ash, dust, grit, oil, waste water, waste products, radio or electrical interference or otherwise; and ▪ not emit noise, odours, dust, waste water effluent of any other emission in excess of limits specified by Council.	Industry is not envisaged on the Island. The Plan of Development discourages industrial development by making development applications for industrial uses impact assessable.
Residential	
Development for accommodation building, dwelling house, multiple dwelling, visitor accommodation or other residential development shall: ▪ be required to dedicate land or make monetary contributions for park purposes in accordance with the Act and the relevant local planning policy; ▪ comply with the requirements of the Building Code; ▪ comply with the residential design standards specified by Council having regard to the Model Code and the nature of the development; ▪ in the case of an accommodation building, multiple dwelling or visitor accommodation incorporate the objectives of the Model Code; ▪ comply with the requirements of a Plan of	The Hummock Hill Island Development proposes the dedication of 50% of the site as environmental conservation area and an additional 25% as open space. This represents a significant portion of the site and on this basis, it would not be a reasonable requirement of the Council to require a monetary contribution for park purposes. Subsequent applications for building works will be required to comply with the Building Code. The Plan of Development for the Hummock Hill Island Development will require compliance with the design standards of the Plan unless alternative standards are set out in the Plan of Development in order to achieve the specific character and built form desired for the development in accordance with the approved Plan of Development.

Requirement	Comment
Development where approved by Council; ▪ in the case of a dwelling house, be limited to one dwelling house on each allotment except where Council otherwise approves the construction of an additional dwelling house on an allotment in association with rural development; and ▪ incorporate adequate provision for water supply which may include on-site storage facilities, to the satisfaction of Council.	Adequate potable water will be supplied to all residential dwellings in accordance with the Council standards. This is discussed further in Section 3.
Service Stations	
Development for a service station shall make provision for: ▪ the access to the premises to be located so as to minimise the impact on traffic flows internal and external to the premises; ▪ the setback of buildings and structures so as to enable the premises to function safely and adequately; ▪ on-site loading and unloading areas to be located so as not to disrupt local streets or on-site operation; and ▪ the premises to be screened and buffered so as to minimise any adverse impact on the amenity of neighbouring development.	These requirements for Service Stations are incorporated into the Plan of Development.
Development within the Rural Zone	
Development within the Rural Zone shall comply with all relevant requirements of the Scheme including: ▪ the Strategic Plan in Part 1 of the Scheme; ▪ the special requirements for specific development in Section 4.7 of the Scheme; ▪ Section 5.5 of the Scheme, whether or not the development involves the reconfiguring of a lot; and ▪ an agricultural land assessment and/or other investigations as may be relevant to the proposal.	Compliance with the Strategic Plan is addressed in Section 1.2.1. Section 1.2.1.5.1 addresses the proposals compliance with the special requirements of the Plan. The proposal has been justified in accordance with the Strategic Plan. Section 5.5 of the Plan relating to reconfiguring a lot is addressed in Section 1.2.1.5.2. The Hummock Hill Island Development can meet the relevant requirements of this Section. An assessment of the Hummock Hill Development area for agricultural capability in accordance with SPP1/92 has been carried out and the land as discussed in Section 5. This assessment demonstrates that the proposed Hummock Hill Island Development would not result in the loss of good quality agricultural land and would not compromise the State or Local government's interest in this regard.
Development on existing lots within historical subdivisions in surveyed town areas within the rural Zone and outside of the town area on the Strategic Plan will only be approved by Council, where: ▪ the lot is provided with appropriate services; ▪ adequate provision can be made for the disposal of wastes and for drainage of the site; ▪ the lot is in Council's opinion not likely to be affected by flooding.	Not applicable as the Hummock Hill Island Development area does not contain historical town areas.

Requirement	Comment
Cultural Heritage	
All development proposals shall include an assessment of the site for cultural heritage values and the likely impact of the proposal on such values. A report on such assessment shall be submitted to Council where appropriate. The development shall make provision for the conservation and management of any items and/or places of cultural or heritage significance so identified.	The proposed Hummock Hill Island Development is accompanied by a cultural heritage assessment. This assessment identifies sites of cultural heritage significance that will be affected by the Hummock Hill Island Development and recommends measures and actions to protect the identified significant areas.
In order to effect site assessment for cultural heritage values, the proponent of the proposed development shall consult with relevant referral agencies, in accordance with relevant local planning policy. This requirement shall not apply in respect of proposed development: ▪ within a town area as defined in subsection 4.8.3; ▪ which is minor in nature; or ▪ which is in respect of redevelopment of or an extension to existing premises.	The cultural heritage assessment identifies those agencies that have been consulted in the process of identifying sites and determining their cultural heritage value, including the appropriate protection measures. An approved Cultural Heritage Management Plan has been developed for the proposed Hummock Hill Island Development and signed off by Qld DNRW
Within the town area, all development shall recognise and incorporate relevant aspects of cultural or heritage significance and shall complement the existing character of the town.	Not applicable as the Hummock Hill Island Development does not include a town area as identified in the Strategic Plan.
Prior to the determination by Council of an application for consent, permission or approval under the Scheme, the applicant shall supply to Council details of any consultation undertaken pursuant to subsection 4.8.2 and of the manner in which aspects of cultural or heritage significance have been incorporated in the proposal, pursuant to subsection 4.8.1 and 4.8.4.	Details of the consultation undertaken to comply with sub-Section 4.8.2 will be provided to the Council. The environmental management plan will detail measures to protect the identified sites of cultural heritage significance that were identified in sub-Section 4.8.1. Sub-Section 4.8.4 is not relevant as it related to town areas, of which the Hummock Hill Island Development area is not one.
Development in the vicinity of aerodromes	
Development in the vicinity of aerodromes shall be assessed in terms of the principles established in the Planning Guidelines to SPP 2/92 Planning for Aerodromes and other aeronautical facilities.	The proposed Hummock Hill Island Development will incorporate an airstrip. The proposed airstrip is not subject to the requirements of SPP2/92 however the general principles of this policy, that seek to protect noise sensitive development from unacceptable aircraft noise and limiting the height of buildings and structures, will be referenced during planning of the proposed development. Planning for the airstrip will be conducted with reference to Civil Aviation Authority Publication No. 92-1(1) Guidelines for Aeroplane Landing Areas.

Appendix A2 demonstrates how the proposed Hummock Hill Island Development responds to (and complies with) specific requirements in regard to 'urban design and environmental aspects' and 'reconfiguration of land in the Rural Zone' of the Transitional Planning Scheme.

2.2.2 Draft Miriam Vale Shire Council Planning Scheme

In accordance with the provisions of the IPA, every local government in Queensland is required to prepare a planning scheme compliant with the provisions of the Act. Miriam Vale Shire Council is

currently in the process of finalising their IPA planning scheme, with the plan having been on public display during 2006. As the draft planning scheme has been on public display, its provisions are considered as part of this EIS.

2.2.2.1 Desired Environmental Outcomes

The Draft Miriam Vale Shire Council's Desired Environmental Outcomes (DEOs) are statements of the overarching strategic planning intentions for the Shire. The DEOs are quoted in italics below and demonstration of how the Hummock Hill Island can help achieve the DEOs is provided for each of the DEOs.

***DEO 1 - Economic Development**. Miriam Vale Shire continues to develop, enhancing its role as a district centre in the region, and providing activities to service community needs and providing opportunities for employment and economic support to the rural, resource and tourism sectors. In achieving this, development will contribute to the maintenance and strengthening of a strong and productive economy based upon:*

- *the existing strengths and employment base in rural production and tourism, while also encouraging new and diverse opportunities associated with property and construction, and the associated professional service industries and home occupations;*
- *growth in the range of products for tourists and visitors, including back-packer and tourism accommodation, in preferred locations;*
- *protection of local employment and skills development opportunities;*
- *maintenance and consolidation of the existing settlement hierarchy; and,*
- *protection of extractive and mineral resources, good quality agricultural land, water supply sources and other natural resources.*

The proposed Hummock Hill Island Development generally supports the achievement of Desired Environmental Outcome 1, as it contributes to the maintenance and strengthening of a strong and productive economy. This is achieved through enhancing tourism opportunities in the shire as well as increasing employment.

The proposed development of Hummock Hill Island would contribute significantly to the social and economic activities of the Shire, ultimately contributing to the regions economic growth.

The proposed Hummock Hill Island Development includes two tourist accommodation resorts as well as a tourist park (caravan and camping park) and hotel. In addition, the development includes a golf course, which would meet some of recreational needs for the tourist population. The development would also provide access for tourists to the nature based recreation opportunities offered by the island and adjacent marine parks such as bushwalking, swimming, recreational boating and fishing.

The development is situated in a preferred tourist location. This is supported by previous development approval decisions given by Miriam Vale Shire Council for the site as well as the State Government development lease that exists over the site.

It is argued that the site has been earmarked for an integrated tourist and residential development for a considerable period of time. The Island was once designated as Future Urban Zone and in 1988, Miriam Vale Shire Council resolved to approve the rezoning of part of the Island under Pastoral Lease No. 19/129 from the Rural A Zone to the General Business Zone. Council also resolved to grant town planning consent for the purpose of an integrated tourist resort on the Island subject to a Special Lease.

In 1991, applications to modify the rezoning and consent approvals were lodged. These applications sought to provide a greater component of residential use and recreational facilities and a reduction in extent of resort uses. An extended period of time was also sought to comply with the conditions of approval, along with some minor modifications. The Council resolved to approve the modification applications with conditions.

The proposed Hummock Hill Island would enhance local employment opportunities with an estimated total direct and indirect contribution to the regional economy, value-added, is estimated as $350 million ($210 million in NPV terms). Excluding construction workers, the Hummock Hill Island Development is expected to generate peak employment for approximately 320 persons.

With regard to the existing settlement hierarchy, the proposed Hummock Hill Island Development should not detract from the role of the existing centres within Miriam Vale Shire. The pattern of development within the Shire focuses predominantly on the developed areas at Agnes Water and Miriam Vale. Agnes Water will remain as the major centre of higher-order commercial, industrial and community facilities for residents of the Shire. The commercial and retail services to be established on Hummock Hill Island are only intended to serve the Island's resident and visitor population.

In regard to the protection of natural resources, the development would minimise impacts on the Island's natural values by:

- not developing within the coastal management district (erosion prone areas) to conserve and maintain the biophysical coastal processes;
- establishing residential building envelopes (50% of Lot area maximum) that are sensitive to significant natural vegetation; and
- conserving approximately 50% of the development lease area as a 'conservation precinct'

DEO 2 - Residential Development*. Residential development in the Shire achieves a balance between growth in existing, established areas and the maintenance of local character. A variety of housing choice is available, and residential areas have a high level of amenity, accessibility and safety.*

The Hummock Hill Island Development provides for a range of housing choice. This includes apartment accommodation, townhouse style dwellings and detached dwellings. The development will be 'master planned', and developed in accordance with an approved plan of development to ensure the Island has a unique character while also achieving high levels of amenity, accessibility and safety.

DEO 3 - Transport & Access *.The Shire's road hierarchy and transport system is efficient and adequate to cater for all land uses and associated road users, as appropriate to each land use and its location.*

The proposed development includes a new road system which will be designed to Miriam Vale Shire Council engineering standards and will be designed to meet the specific needs of the development.

DEO 4 – Open Space, Natural Environment & Cultural Heritage*. The Shire's coastal, semi-rural and rural values and the natural environment and ecosystems are managed to ensure:*

- *areas of visual and ecological importance are conserved or rehabilitated; and,*
- *biodiversity is protected and maintained.*

Open space networks are established and maintained with emphasis upon areas of high scenic quality, remnant vegetation, habitat areas, existing open space, riparian areas, coastal foreshores and where possible, linkages of these areas within the network.

Places of local cultural or important townscape significance are conserved, and local cultural heritage values are not compromised.

The proposed development would minimise visual impacts by restricting the height of buildings on the Island. Residential dwellings will be restricted in height, such the rooflines of buildings will be generally below the canopy line of the Island's endemic vegetation. Areas of high conservation value will not be developed.

DEO 5 – Community Wellbeing. *Development in the Shire provides for a quality lifestyle, community identity and pride, and provides a high level of safety, convenience and amenity for both residents and visitors.*

Within three years of the development commencement, a medical centre and emergency services infrastructure will be built within the town centre for the development. These services will enable both permanent residents, adjacent populations in Turkey Beach and Foreshores Estate and tourists access to essential medical facilities and health care.

The proposed development will include community facilities, such as an educational centre/community centre as well as recreational facilities such as school/recreation camp ground and golf course and golf club.

In addition, the town and village centres will accommodate retail and commercial services to meet the convenience needs of the Island and adjacent community.

Further opportunities exist within the town or village centres for additional essential services to be established based on demand within the local and regional community.

DEO 6 – Infrastructure Provision*. The Shire's population is provided with engineering, transport and community infrastructure, being appropriate to each land use type.*

Existing infrastructure is utilised and operated in a safe and efficient manner, including roads, water and sewerage systems, and energy supplies, and protected from inappropriate development. New and future infrastructure is provided in an efficient and equitable manner.

Proposed infrastructure for the Hummock Hill Island Development will utilise existing infrastructure corridors (such as Clarks road) and existing track alignments (such as those on the Island) to the extent practicable. The proposed development includes a local road network, including bridge to the mainland, water, sewage and electricity. All infrastructure will be supplied in accordance with the Miriam Vale Shire Council's Planning Scheme Policy No. 1 - Engineering Standards for Development Works.

2.2.2.2 Zoning

The site was included in the 'Conservation Zone' under the Draft Miriam Vale Shire Planning Scheme Policy. On behalf of the Proponent, Sinclair Knight Merz made a submission on the Draft Miriam Vale Planning Scheme to Miriam Vale Shire Council on July 19 2006 as part of the IPA plan making process. In response to the submission, Council confirmed that Hummock Hill Island was included in the Conservation Zone in error, and that Council would correct the error and include Hummock Hill Island in the Rural Zone[1].

Despite the above, the Hummock Hill Island Development is generally inconsistent with the intent for land in the Rural Zone. As such, it is proposed to seek a preliminary approval for development of the Hummock hill Island following approval of the Draft EIS. A preliminary approval (varying the effect of the planning scheme on the land) varies the effect of the planning scheme for subsequent development on the land the subject of the approval and substitutes different provisions on that land for the life of the approval or until the development approval is completed. In this instance, the application will seek to vary the Hummock Hill Island site from a 'rural zoning' to a range of detailed precincts to reflect the mixed use nature of the proposed development.

As such, the provisions for the Rural Zone Code have not been addressed in this report. The proposed Plan of Development is included in Appendix A2. The Plan of Development will need to be reviewed once the new Miriam Vale Shire Planning Scheme has been adopted and publicly released.

2.2.2.3 Development Codes

The draft planning scheme codes are not addressed in this report as detailed design is not yet available to undertake a meaningful assessment against the relevant codes. Furthermore the codes are likely to be amended as part of the finalisation of the new planning scheme. Assessment against the approved codes will be undertaken as part of future development applications.

However, the proposed Plan of Development makes particular codes contained within the Draft Miriam Vale Shire Planning Scheme, applicable to the assessment of subsequent development on the

[1] Miriam Vale Shire Council letter dated 12 March 2007. Council Ref: DB:rlm. Reg No: 06/08848

Plan of Development Area. Codes that are proposed to be used for the assessment of subsequent development applications on the Island include:

- Advertising Devices Code;
- Caravan Park Code;
- Dwelling House Code;
- Multiple Residential Development Code;
- Parking and Access Code;
- Parking and Access Code; and
- Works, Services and Infrastructure Code.

The Plan of Development including its references to the draft codes will be reassessed once Council approves and releases the new planning scheme, to ensure consistency and appropriate use of the codes.

2.2.2.4 Overlay Codes

The draft Miriam Vale Planning Scheme contains Overlay Codes. The applicability of the Overlay Codes are determined by the Draft Overlay Plans. These codes are not 'called up' by the proposed Plan of Development as the issues raised are addressed within this EIS.

Acid Sulfate Soils Overlay Code

Acid sulfate soils are found on Hummock Hill Island in the intertidal zone, mangroves and potentially in the sands below the water table on the north-west side of the Island. Acid sulfate soils are likely to be disturbed around the existing causeway during the construction of the bridge to Hummock Hill Island and the construction of a boat ramp located adjacent to the bridge. The amount of disturbance is likely to be low and easily managed. However, the sediments have a moderate to high acid generation potential that will require management if disturbed.

For works involving acid sulfate soils an Acid Sulfate Soil Management Plan will be used regardless of whether the final quantity of acid sulfate soils to be disturbed triggers SPP02/02. The management plan will apply to construction activities (boat ramp and bridge) around the causeway. The management plan should be developed in accordance with the Acid Sulphate Soils Overlay Code and also in accordance with the principles of the *Queensland acid sulfate soils technical manual - soil management guidelines* (Dear et al. 2002) and *Instructions for the treatment and management of acid sulfate soils, 2001* (EPA 2001). An outline of the Acid Sulfate Soil Management Plan for Hummock Hill Island can be found in Section 5.

Coastal Management Overlay Code

Development on the Island will not encroach into the Coastal Management District apart from the bridge, boat ramps, public pedestrian access infrastructure and other minor infrastructure. Impacts from these infrastructure on coastal processes and resources have been addressed within this EIS (refer to Section 9).

Environmental Management Overlay Code

The proposal complies with the Environmental Management Overlay Code as demonstrated within Section 2.2.2.3, for example:

- Development activities do not involve the clearing of vegetation, with the exception of that required for a building envelope and site access; and
- A buffer of 100 m is provided between buildings and coastal wetlands (as shown on Map 4.39.1 of the Draft Miriam Vale Shire Council Planning Scheme) and the Highest Astronomical Tide. The Bridge to the mainland will be located within a wetland as shown Map 4.39.1, however, management measures will be implemented to ensure the protection of the wetland's vvegetation, habitat and biodiversity values. The project Environmental Management Plan is included in Section 20.

Extractive Resources Overlay

The Extractive Resources Overlay applies to Hummock Hill Island due to a listed Mineral Occurrence, Inactive Prospect (Ref: 486524) being registered with the Qld Department of Mines and Energy (DME). The Special Lease overlaps 12% of the EPM area. The mineral occurrence is listed as small, being 750,000 tonnes of Heavy Mineral (HM).

Development in accordance with the Special Lease would prevent the extraction of 12 % of the mineral resources and in doing so, conflict with the purposes of the mineral development lease. Higher grade HM deposits on the eastern and central portions of the Island will remain accessible.

However, mineral deposits on the Island are not currently economically viable in their own right and require inclusion of larger deposits south of Bustard Head and north east of Rockhampton (currently within a National Park). It is unlikely that HM deposits within the National Park will be made available for mining which puts in doubt the viability of HM deposits on the Island (refer to Section 5).

The Hummock Hill Island Development does not comply with the Extractive Resources Overlay Code. This is because the proposed development would sterilise 12% of the identified mineral resources by locating development (i.e. residential development with regard to extractive industry) on or near to the resource area. However, the commercial viability of the mineral deposit requires utilisation of additional resources to the south and north, the northern deposits being within a National Park and unlikely to be released for extractive purposes. As such mineral deposits on the Island are not considered a viable resource in their own right.

2.2.3 Local Laws

The following Miriam Vale Shire Council local laws may apply to the project:

- *Local Law No. 12 (Caravan Parks) 2003* – A licence would be required to operate the proposed tourist park on the Island. Under this local law, a person must not operate a caravan park unless authorised by a licence;

- *Local Law No. 15 (Domestic Water Carriers) 2004* – A person must not carry on the business of domestic water distribution unless:
  - the person holds a licence under this local law; and
  - the water tanker or water tankers used for the purposes of the business are approved by the local government;
- *Local Law No. 21 (Roads) 2002* – A person (other than the local government) must not make an alteration or improvement to a local government road unless authorised by a licence.

2.3 Draft Hummock Hill Island Plan of Development

As indicated in preceding sections, a Draft Plan of Development has been prepared to guide future development on Hummock Hill Island. It provides specific direction on how development should occur, based on the extensive investigations undertaken for this EIS, to achieve environmental protection and a sustainable and vibrant community.

The Draft Plan of Development includes the Hummock Hill Island Plan of Development - Assessment Tables (Plan of Development) and Precinct Codes and the Hummock Hill Island Plan of Development Overlays (Plan of Development Overlays) and Overlays Code. The proposed Plan of Development is presented in Appendix 2.

The overall outcomes of the Draft Plan of Development for Hummock Hill Island are that the:

- Areas of conservation significance are retained and the human population can enjoy living in close proximity to, and harmony with the natural ecosystems.
- Social environment will be based on a vibrant, dynamic and diverse community that has a strong environmental awareness and is committed to sustainable living and self development. Individuals and households will come to Hummock Hill Island seeking quality of life in its fullest sense and fulfilling educational and outdoor recreational experiences.
- Built environment will be appropriate to the scale of the development and the natural environmental setting. Infrastructure systems will be based on latest advances in sustainable living, but will be suitable for management and basic maintenance by the householders.

The Plan of Development includes a Land Use Plan which identifies five land use precincts, which are the:

- Residential Precinct;
- Town and Village Centres Precinct;
- Tourist Precinct;
- Community and Education Precinct; and
- Open Space Precinct.

The preliminary approval being sought for this project would establish a framework for all future works requiring assessment against the planning scheme to be assessed against the Plan of

Development. This means that each stage and component of the proposed development would be assessed against the Plan of Development.

Generally, development proposals that are consistent with the Plan of Development, are to be subject to either self assessment or code assessment. Development proposals that are inconsistent with the Plan of Development would require impact assessment, and would be assessed against the relevant provisions of the Miriam Vale Shire Planning Scheme.

The Draft Plan of Development would be reviewed once the new IPA planning scheme has been finalised, to ensure consistency and compatibility.

2.4 Conclusions

The proposed Hummock Hill Island Development is a Controlled Action under the *EPBC Act (Cth)* and a Significant Project under the *SD&PWO Act (Qld)* which requires the preparation of this EIS to investigate and manage potential benefits and impacts.

The majority of the proposed development is located with a development lease granted by the State Government. Specific development approvals, permits and resource allocations would be required to be obtained for this development in relation to the proposed residential, tourism and commercial buildings and facilities as well transport, access and water cycle management infrastructure on and connected to the Island. These are required under a range of Queensland legislation related to coastal management, environment protection, fisheries habitat, water resources and marine parks.

Consultation with the local Aboriginal people has resulted in the preparation and approval of a Cultural Heritage Management Plan to guide the proposed development of the Island.

The key land use approval required is a preliminary approval for a material change in use under the Miriam Vale Shire Transitional Planning Scheme. This application would be assessed by Council as the assessment manager with the Coordinator-Generals Report on this EIS having the status of a concurrence agency response.

Under the IPA, the State Government has established a number of State Planning Policies that are relevant for the proposed development related to:

- Protection of good quality agricultural land;
- Management of disturbance of acid sulfate soils;
- Mitigating the adverse impacts of flood, bushfire and landslide; and
- Coastal management.

The proposed development seeks to avoid or minimise and manage impacts on good quality agricultural land, acid sulfate soils and coastal processes and resources. Potential impacts from natural hazards would also be minimised through the location and design of the proposed development.

A Wide Bay Regional Coastal Management Plan is under preparation for the region, however, it has not yet been released for public consultation and could therefore not be fully considered in this EIS.

The Wide Bay-Burnett Regional Plan provides further policy direction for development in the Wide Bay-Burnett Region. While this plan does not identify Hummock Hill Island for urban or tourist development, the proposed development generally complies with the key objectives established for the region, particularly in relation to tourism. The southern boundary of the Curtis Coast Regional Coastal Management Plan occurs to the north of Hummock Hill Island. The proposed development would not adversely affect the environmental objectives sought by this plan for the water within its boundaries.

While Hummock Hill Island is not physically part of the Central Queensland region, the Central Queensland Regional Growth Management Framework is of relevance due to its role in managing the significant industrial and residential growth of Gladstone and surrounding areas. This project can assist in achieving the outcomes of this plan, particularly in regard to managing the residential and tourism needs of Gladstone. The proposed local government amalgamations enhances this relationship.

The Miriam Vale Transitional Planning Scheme provides local planning policy and direction for future development such as the proposed Hummock Hill Island Development. Council and the State Government are finalising a new planning scheme for the shire and the draft version of this plan has been considered in preparing this EIS. The Transitional Planning Scheme identifies the current and future preferred land use designation for the Island as rural. This rural land use designation is carried into the new planning scheme. The proposed development is therefore a 'material change in use' that requires a preliminary approval under the planning scheme. A draft Plan of Development, including tables of assessment and codes, has been prepared to provide specific direction for the proposed development to achieve environmental protection as well as sustainable community outcomes.

A range of more detailed material change of use, reconfiguration or a lot and operational works approvals would be required from the Council following the granting of the preliminary approval.

The key strategic objectives and development requirements identified by the Transitional Planning Scheme and the new planning scheme have been assessed in relation to the proposed development and compliance can generally be demonstrated. There are also a number of local laws relevant to the proposed development.

The critical policy issues relevant to the proposed development identified through the local, regional and state policy frameworks are:

- The use of the land for other than rural or non-urban purposes. This EIS demonstrates a need for the development through the provision of a range and diversity of residential and tourism opportunities that are unlikely to be available in the current urban areas. This is addressed in detail in Section 4; and
- Protection of environmental values, particularly significant coastal resources. To the extent possible impacts to significant environmental values are avoided. Where not possible, the

impacts are minimised and management arrangements are identified. The proposed development would also provide significant benefits to the shire, region and State. This is addressed in detail in Section 4.

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3. Project Description

3.1 Introduction

Development of Hummock Hill Island provides a unique opportunity to combine state of the art tourist, urban and recreational development with a natural environment that is well suited to supporting development founded on principles of sustainability at a location ideally situated with respect to existing and emerging economic centres and communities.

With this in mind, and to maximise outcomes for environmental, social and economic aspects of the project, the following development goals have been identified:

- Natural environment is maintained, protected and enhanced so that areas and features of conservation significance are retained and the human population can enjoy living in close proximity to, and harmony with the natural ecosystems;
- Social environment will be based on a vibrant, dynamic and diverse community that has a strong environmental awareness and is committed to sustainable living and self development. Individuals and households will come to Hummock Hill Island seeking quality of life in its fullest sense and fulfilling educational and outdoor recreational experiences. Visitors will include residents of the region and will experience holiday and recreational opportunities focussed on family and outdoor activities; and
- Built environment will be appropriate to the scale of the development and the natural environmental setting. Infrastructure systems will be based on latest advances in sustainable living, but will be suitable for management and basic maintenance by the householders.

Section 3.2 addresses each of these development goals and identifies performance targets and development principles to achieve the stated goals.

Development principles are intended to be incorporated into design, construction and operation phases of the project, with particular emphasis on the design phase. This approach recognises that the most effective means to minimise negative impacts associated with any development is to incorporate measures to avoid or reduce impacts into project design. Environmental impacts that cannot be “designed out” must then be addressed through appropriate management during construction and operation.

3.2 Targets and Development Principles

3.2.1 Natural Environment

Hummock Hill Island is a continental island separated from the mainland by Boyne Creek an inter-tidal channel connecting Colosseum Inlet to the west and Seven Mile Creek to the east. A causeway has been constructed across the channel from logs and borrowed fill material that remains partly or wholly submerged on all but spring low tides. Colosseum Inlet runs between the western side of Hummock Hill Island and the southern end of Wild Cattle Island.

Figure 3.1 – Boyne Creek Causeway at Low Tide

Colosseum Inlet is a deep sandy estuary with shallower sand bars at its mouth. North and north east of Hummock Hill Island is Rodds Bay. The southern coastline of Hummock Hill Island is fringed with mangroves and supra-tidal salt flats while the western and northern coastline features sandy beaches. There is a prominent rocky headland on the north coast.

A range of hills runs north-south across the Island, separating the western third from the eastern two thirds. Otherwise, the Island is flat to gently undulating. Soils range from marine muds and sands on the Island fringes to shallow gravely duplex soils and lithosols on granodiorite hills. Soils associated with the coastal marine muds on the southern side of the Island are potential acid sulfate soils (PASS).

A pastoral lease was granted over the Island from 1887 to 1990. As part of lease renewal "improvements" were required, resulting in applications for land-clearing and ring-barking occurring over that period (refer to Section 13). Modification to the Island environment during pastoral activity has resulted in a patchwork of cleared land and regrowth vegetation with grazing activity occurring over the entire Island at one point or another. Lantana infestation occurred over much of the western portion of the Island in the early part of the 1900's with Government intervention during the 1930's to halt the infestation. Pastoral activity legacies include fences, a cattle dip, several sheds and other remnants of this activity. Several access tracks remain in reasonable condition and a grass airstrip is still discernible on aerial photographs and on the ground.

A dam, located in a saddle of the main ridge bisecting the Island, appears to hold water throughout the dry season. A number of other turkey nest dams have been created on the site but do not hold permanent water. There are no permanent water courses or natural freshwater wetlands on the Island although there are some low-lying areas that receive surface run off.

Natural systems and features of Hummock Hill Island vary with soil types and topography and include:

- Low frontal dune & beach system with sparse *Casuarina* spp. and *Pandanus* spp. with a sparse ground cover of *Spinefex* spp;
- Undulating low dunes and relict beach ridges with intervening depressional swales, with moderate dense littoral vine scrub, large emergent Melaleuca spp. and Moreton Bay Ash;
- Coastal wetlands, consisting of supratidal saltpans and mangrove forests adjacent to sheltered estuaries; and
- Open and closed woodland including endangered and of concern regional ecosystems

While vegetation is reasonably diverse, the range of native animals on the Island is limited, with most diversity seen in bird populations. Hummock Hill Island does not provide extensive wader bird habitat, but does offer habitat to a limited range of listed migratory species (refer to Section 14.1).

Current and past flora and fauna surveys have identified 'endangered', 'of concern', 'threshold', regional ecosystems and vulnerable species listed under Commonwealth and State legislation. Beaches along the northern side of Hummock Hill Island are considered suitable for marine turtle nesting, with low density nesting recorded as discussed in Section 15.2.

Hummock Hill Island is wholly contained the Great Barrier Reef World Heritage Area (WHA), the boundary of which lies at the highest astronomical tide mark along the mainland coast. Although within the WHA, Hummock Hill Island does not have any formal conservation status, nor has it come under any kind of management plan in relation to its World Heritage status. The adjacent Wild Cattle Island is a National Park but does not have any formal management plan.

The Island is surrounded by the Great Barrier Reef Coastal Marine Park (State) and is bounded by the Great Barrier Reef Marine Park (Commonwealth) along the northern coastline. Colosseum Fish Habitat Area includes Wild Cattle Creek, Colosseum Inlet, Boyne Creek, Sandfly Creek and Seven Mile Creek as discussed in Section 15.1. Estuarine and marine waters surrounding Hummock Hill Island are part of the larger Rodds Bay Dugong Protection Area.

Air quality in the area is very good, being typical of relatively undeveloped coastal areas. There is no sign of effects from the Gladstone industrial area.

Overall Hummock Hill Island offers a pleasant natural setting for coastal development which, if targeted to more tolerant locations on the Island, can be achieved wit minimal loss of the particular environmental values of the Island itself, and also without impact on the ecosystems of the surrounding waters. The area's natural assets become an important feature of the development, both highlighting the importance of sustainable infrastructure and enhancing lifestyles of the Island's residents and visitors.

The value of 'inclusiveness' of such natural assets is now recognised as an intrinsic component of property development, such that development need not result in loss of conservation values.

This holistic approach is the underlying philosophy of the development strategy for Hummock Hill Island. Specific responses to natural environmental features are described in Table 3.1 in the form of performance targets and development principles for the proposed development.

Figure 3.2 – Vegetation within the Centre of the Lease Area

Table 3.1 – Natural Environmental Development Principles

Feature	Performance Targets	Development Principles	Development Strategies
World Heritage Values (refer Sections 4, 12 and Appendix A3)	World Heritage Area values are not degraded and are enhanced wherever possible.	World Heritage values of Hummock Hill Island are identified and documented Refer to Appendix A3.	The Plan of Development is designed to control the built form of the proposed development including controls on building heights and appearance.
Beaches and active dunes	Erosion prone areas are secured and protected from disturbance. Functions of beaches and active dune systems in protecting inland development from erosional forces are maintained. Biophysical values of active coastal dune systems are conserved. Recreational access and enjoyment of beach is catered for.	No direct disturbance to beaches or active coastal dunes. No interference with coastal processes that regulate beach formation. Public access to beach is created through controlled beach access points through littoral rainforest and dune systems. Low key public facilities (barbecue, shelters, picnic areas) to be provided away from erosion prone coastal areas.	Master Plan and development footprint avoids active dune systems and remains outside defined erosion prone areas and buffer zones. Controlled beach access points along the northern coastline are for pedestrian access only. Open Space Development Code in Plan of Development addresses activities and uses in coastal zone.
Terrestrial native vegetation including endangered, of concern and not of concern regional ecosystems.	Clearing of vegetation is minimised. Clearing of vegetation does not reduce biodiversity. New weeds are not introduced and extent of existing weeds is reduced. Development landscaping utilises native species on the Island.	Maximise use of already cleared or degraded areas. Avoid disturbance to areas where the dominant ecosystem is endangered. Minimise disturbance to areas where dominant ecosystem is of concern. Where subdominant ecosystem is “endangered” or “of concern”, protect these areas and linkages between them and manage for habitat value. Provide guidelines for gardens. Include weed control in maintenance programs. Establish conservation areas and manage for conservation values.	Overall area of development is 19% of Island Master Plan and development footprint avoids all endangered regional ecosystems. Area of “of concern” ecosystem disturbed is 254 Ha (21 % of Lease). Development Codes for residential development include <50% building footprint in Lot and minimum clearing of native vegetation. Landscape plan specifies planting in public open space and residential and commercial premises; planting of local indigenous species only. Landscape plan addresses weed maintenance. Conservation precinct code in Plan of

Feature	Performance Targets	Development Principles	Development Strategies
		Provide controlled access to designated conservation areas to ensure that the community can enjoy these areas without damaging them. Master Planning is cognisant of maintaining ecosystem connectivity and wildlife corridors between undisturbed areas of vegetation.	Development addresses use and management of remnant vegetation within lease. SE Qld Regional Vegetation Management Code performance requirements are met. Riparian vegetation buffers and wetland buffers maintained in accordance with SE Qld RVMC 'endangered', 'of cconcern' and threshold vegetation off-set in accordance with SE Qld RVMC
Native animals, including migratory bird species. Potential nesting habitat for marine turtles.	Diversity of species occurring on Hummock Hill Island is not reduced (note that diversity is low compared to nearby areas). Individual native animals are not killed or injured. Animal nesting, feeding and reproductive activities are not disrupted by noise or physical disturbance. Potential for marine turtles to use beaches for nesting is not reduced.	Incorporate wildlife corridors into development footprint and manage for fauna movement, including artificial devices where appropriate. Establish conservation areas and manage for habitat value. Control access to conservation areas. Establish fauna management controls for vegetation clearing.	East-west habitat linkages maintained along riparian corridors and green corridors, bird movements maintained by use of native vegetation in landscaping. Ground dwelling fauna is minimal, and traffic levels are low, so fauna crossings of roads are not proposed; can be provided later if road deaths are a problem. Ephemeral watercourse crossings will include fauna passage within riparian corridor.. Conservation precinct code in Plan of Development addresses maintenance of wildlife corridors. Residential precinct code addresses effects of residential development on adjacent conservation areas. Lighting mitigation on headland, development to protect low density turtle nesting, educational signage and awareness raising.

Feature	Performance Targets	Development Principles	Development Strategies
Slopes, hills and drainage	Topographic and geomorphic features are retained. Ephemeral watercourse systems are not altered. Use of natural features is maximised.	Design and conduct earthworks to avoid significant changes to topography and minimise cut and fill. Natural catchments and flows are maintained through earthworks and stormwater management. Principles of Water Sensitive Urban Design are followed for all stormwater management. Avoid areas that are naturally waterlogged and/or avoid widespread clearing. Avoid unstable slopes where significant engineering solutions are required to ensure stability. Views from headland and Hummock Hill are retained and public viewing areas provided.	Master Plan avoids steep slopes. Development on hillsides is minimal. Hillsides and ridgelines are not altered by bulk earthworks. Stormwater management system maintains existing quality and quantity of flow. Public access is to headland and hill top areas in accordance with Code for Conservation Precinct. Erosion prone area and estuarine area is retained as an undeveloped corridor.
Soil resources	Soil resources are not lost or degraded. Acid sulphate soils are not disturbed.	Residual soil contamination does not occur following remediation. Existing soil contamination is not mobilised to the environment prior to or during remediation. Soil is not exposed to erosive forces unless erosion and sediment control devices are implemented. Mechanical clearing does not occur on slopes of 30%. Clearing does not occur or is minimised in groundwater discharge zones. Good Quality Agricultural Land not lost. Development in areas of acid sulphate soils is avoided except for public boat ramps and	Development codes include an earthworks code. Erosion and sediment controls are designed in accordance with Engineering Guidelines for Queensland Construction Sites (Qld Inst. Eng. 1996) Maximum retention of vegetation in identified discharge zones within the Golf Course. Development footprint avoids all potential acid sulfate soil areas except for the access bridge and public boat ramps – minor quantities only and will be managed in accordance with SPP2/02.

Feature	Performance Targets	Development Principles	Development Strategies
		bridge. Acid sulphate soils at boat ramps and bridge are managed to avoid any acidic releases to the environment. Erosion and sediment control plans are used during any earthworks.	
Groundwater resources	Groundwater quality is not degraded. Groundwater recharge is not changed.	Groundwater is not used for water supply Potential groundwater contaminants are strictly controlled from entering estuarine and marine waters of the GBR WHA. Permeability of ground surface over recharge areas is not altered. Development at toe of slopes does not affect discharge zones in the golf course area.	Water supply options excludes groundwater. 50% site cover over potable sandy aquifer within lease, no development over this aquifer outside Special Lease Area. Development on groundwater recharge and discharge zones are avoided and/or minimised.
Marine plants and aquatic habitat. Coastal wetlands. Colosseum Fish Habitat Area.	Extent of marine plants and fish habitat is not significantly reduced. Water quality in coastal wetlands of Colosseum Inlet, Boyne Creek, Sandfly Creek and Seven Mile Creek are not changed from current conditions	Development does not take place in within Colosseum FHA, intertidal and subtidal areas except for bridge, public boat ramps and associated pontoons. Development in mangroves minimises long term disturbance and reinstates where possible. Clearing does not occur within 100 m of any wetland. Access to mangroves is not increased. No significant change in volume of discharge up to and including the Q100 rainfall event. Water quality is not degraded.	Footprint of development avoids all coastal and palustrine wetlands (no freshwater wetlands on Island). Ephemeral watercourse discharges to coastal areas are maintained. Nutrient levels slightly reduced adjacent to developed areas, reductions in suspended solids after development. Only minimal clearing of mangroves for bridge and boat ramp (outside Colosseum FHA) – negligible in terms of overall area of mangroves, utilises existing disturbed area. Discharge of treated wastewater occurs only in extreme rainfall events greater than the 3 times average dry weather flow storage capacity and plant redundancy failure. Designed stormwater drainage system will be based on Water Sensitive Urban Design

Feature	Performance Targets	Development Principles	Development Strategies
			Principles in accordance with Healthy Waterways WSUD Guidelines (2006).
Air Quality	Air quality is maintained to protect ecosystem functioning.	Air pollutants do not exceed NEPM (Air) guidelines for sensitive vegetation. Dust deposition does not affect plant growth.	No impacts predicted. Compliance with construction environmental management plans
Resource use and waste	Consumption of non-renewable resources is minimised during Construction and operation. Consumption of renewable resources is within sustainable yield. Waste is not released to the environment except in accordance with conditions of Development Approvals.	Use of renewable energy sources is maximised, including solar and wind at the Island scale. Water harvesting and consumption is strictly controlled. Wastewater is treated and reused. Waste avoidance and reduction strategies are introduced. Buildings conform to 5 star sustainable design standard.	Mains power is proposed supplemented by renewable energy sources. No harvesting of surface water flows. Water cycle includes 100% reuse of grey water, rainwater tanks and potable top up from desalination plant. Plan of Development includes requirements for water and energy efficiency. Greenhouse emissions from the development are minimised by maximising renewable energy sources.

D = Development Phase; C = Construction Phase, O = Operation Phase.

3.2.2 Social Environment Context

Hummock Hill Island is currently uninhabited. A fishing shack is located midway along the main beach that is used during weekends and holidays. Historically the Island has been subject to pastoral activities under a pastoral lease with associated clearing and logging since the 1880's to the early 1980's. A homestead and associated workers accommodation was located on the northern headland (refer to Section 13).

The Island is used informally by a small number of local visitors for camping and day visits, with visitors accessing the Island by boat. The nearest settlement is located at Bangalee on the northern side of Colosseum Inlet and located on the southern tip of Wild Cattle Island, consisting of a number of coastal holiday houses.

A small permanent settlement of around seven homes is located at Mundoolin Rocks east of Clarks Road on the mainland. A rural residential subdivision has been developed along Foreshores Estate and Intrepid Drive. Known as the Foreshores Estate, this is the next closest permanent settlement to Hummock Hill Island and contains approximately 20 households.

The nearest city to the site is Gladstone, with a population of approximately 27,500. Gladstone is centred on the Port of Gladstone, one of the largest ports in Australia, and the Gladstone State Development Area, a 21,000 ha area of land in Calliope Shire Council designated for industrial development and associated infrastructure. Several major mineral processing facilities are located in Gladstone, including the Boyne Island aluminium smelter, Queensland Alumina Limited refinery and Rio Tinto's alumina refinery. Gladstone is also an important centre for commercial and light industrial activities servicing industrial development in Gladstone and mining in Central Queensland.

Tannum Sands/Boyne Island, located in Calliope Shire, has become a significant suburb for Gladstone. The urban area of Tannum Sands includes a major shopping centre, high school and range of community services and facilities. The beach at Tannum Sands is the region's only easily accessible swimming beach. Tannum Sands is has continuing development south of the current Town and west of Wild Cattle Creek. Limited opportunity for further expansion southwards of Tannum Sands is available due to the proximity of Colosseum Inlet.

Apart from Tannum Sands, the nearest settlements to Hummock Hill Island are:

- Turkey Beach, a small coastal community of about 200 permanent people with a general store and public boat ramp; and
- The towns of Miriam Vale and Bororen on the Bruce Highway. These towns have basic shops and service stations as well as primary schools, and in the case of Miriam Vale, a lower Secondary School.

The Island's location is within easy driving distance of Gladstone and mining areas to the west, close proximity to the Bruce Highway, and its pleasant coastal setting and climate create significant opportunities to enhance locally available tourism, residential and recreational opportunities. Tannum Sands provides the only other coastal development opportunity between Agnes Waters and Boyne Island where settlement near the coast is possible without disturbance to coastal and

intertidal ecosystems such as mangroves and supratidal salt flats and National Parks such as Wild Cattle Island and Eurimbula.

3.2.3 Built Environment Context

Road access to Hummock Hill Island is possible through existing gazetted roads; from Bruce Highway, Turkey Beach Road, Foreshores Road and Clarks Road. Foreshores Road provides access to the Foreshores Estate, a rural residential subdivision that is the closest settlement to Hummock Hill Island. Clarks Road is a dirt track in poor condition, providing access to several private properties at Mundoolin Rocks and ultimately to the causeway to Hummock Hill Island. The Island itself is separated from the mainland by Boyne Creek and there are no road reserves on the Island. A single dirt track connects the causeway at the south of the Island to the Northern Headland and fishing shacks located midway along the northern beach.

Power is available to Foreshores Estate and houses along Foreshores Road. The nearest power station is the coal fired Calliope Power Station at Gladstone.

There is no current water supply to Hummock Hill Island; the nearest reticulated water supply is at Miriam Vale township, however this does not have capacity to be extended to service any further developments in the Shire. Many of the hamlets and houses in Miriam Vale Shire rely on household level rainwater collection. This is not due to a shortage in water supply in the region, but to the cost of supplying reticulated water over large areas of lower residential density.

The main source of regional water supply is Awoonga Dam, operated by the Gladstone Area Water Board (GAWB). Awoonga Dam has a storage capacity of 777,000 ML. The current [licenced] yield of the dam is 78,000 ML per year and GAWB anticipates that demand will reach this level in about 2022/23. About 16% of the region's water demand is from residential and light industrial uses. The remainder of the demand is from power generation and heavy industrial development in Gladstone.

Reticulated wastewater collection and treatment is available at smaller communities such as Bororen and Miriam Vale with areas such as Foreshores Estate relying on septic tank systems. Most townships and hamlets in Miriam Vale Shire have household level septic tanks.

There is a disused air strip on the Island which is overgrown with pasture grasses. The nearest commercial airport is Gladstone; this airport has frequent connections to Brisbane and also regional cities to the north. Gladstone airport also provides access to several offshore island resorts, including Heron Island. There is a private airstrip at Agnes Water.

The daily Brisbane-Rockhampton tilt train services stops at Miriam Vale and Bororen. Regional and interstate buses also service Miriam Vale and other towns along the Bruce Highway.

Kerbside waste and recycled material collection is a sub-contracted service of Miriam Vale Shire Council, occurring in the Foreshores and Turkey Beach area on a weekly basis. Collected waste is currently transported to four facilities within Miriam Vale Shire where it is processed. The nearest regulated landfill to Hummock Hill Island is Calliope Shire Councils Benaraby Landfill.

Table 3.2 – Social Environment Development Principles

Feature	Performance Targets	Development Principles	Development Strategies
Coastal setting and visual amenity	High visual amenity is maintained. Visual amenity of the Great Barrier Reef WHA is not degraded. Landscape characteristics are retained as high quality rural/coastal/vegetated landform.	Remnant vegetation is retained as much as possible throughout the development. Landscaping uses indigenous native species. Height controls ensure that views of the Island are not degraded. Building materials and designs blend with natural environment setting. Infrastructure is located so as to be as unobtrusive as possible	Plan of Development includes building design requirements, building materials and building heights. Landscape plan includes indigenous plantings and landscape maintenance. Bridge design will be a striking entry statement. Other infrastructure will be low key and managed through location and landscaping.
Amenity	Residential amenity on Hummock Hill Island is very high.	Noise levels are below background + 10 dB(A) in residential, accommodation and recreational areas. Noise levels are below background + 10 dB(A) in commercial and retail areas. Air pollutants do not exceed NEPM/ EPP(Air) targets for human health	Noise levels will achieve required levels in accordance Construction EMP and relevant Codes. Plan of Development Codes require development to consider noise impacts on adjacent developed areas and conservation areas. Construction and operational air quality will achieve required targets in accordance with EMP and relevant Codes.
Existing and proposed communities	Economic and social benefits to local and regional communities are maximised. Development of Hummock Hill Island enhances opportunities available to local and regional communities. Negative impacts on local and regional communities are avoided or offset by benefits. A diverse and sustainable community is created on Hummock Hill Island	Availability of low income housing is not compromised. Participation of local and regional businesses is maximised. Employment opportunities for local and regional population are maximised. The range of housing and accommodation types available complements local and regional demographic profile. Outdoor and recreational opportunities	Range of housing types and affordability (e.g. Hillside Terraces, Boyne Channel Apartments, Resort Village Townhouses are intended to be affordable by workers on the Island). Contracting arrangements during construction will maximise local labour opportunities. Plan of Development controls development design and maintains development principles outlined in Section 3.2.

Feature	Performance Targets	Development Principles	Development Strategies
		(formal and informal) are maximised. High quality educational opportunities that meet regional needs are provided. Access to the coast is enhanced. Community services (including health, education, and recreation) are available for temporary and permanent residents of the proposed development and existing residents of the region.	Master Plan includes educational and research facilities plus essential services such as medical centre and specialised centre for emergency services.

Table 3.3 - Built Environment Development Principles

Feature	Performance Targets	Development Principles	Development Strategies
Roads and traffic	Internal and external road systems are safe and efficient. Construction and operation does not harm the environment.	Roads conform to Main Roads Road Planning and Design Manual and Queensland Streets Design Guidelines. Greenhouse gas emissions are minimised.	External road network meets required 'Main Roads' performance requirements (refer to Section 3.5). Internal road network meets design guidelines and Planning Scheme requirements (refer to Section 3.5).
Energy	A reliable power supply is available. Availability of power to existing regional residents is not compromised. Carbon footprint is minimised.	Use of renewable energy sources is maximised, including solar, wind and gas energy.	Solar hot water systems at the household level. Energy efficient natural gas for cooking and heating. Gas cogeneration plant to be considered for supplying power and cooling resort facilities. Mains power to provide reliable base load supply. Construction based on Building Codes of Australia energy efficiency measures (DEH, 2003) to reduce energy consumption during construction and operation.
Water and wastewater	A reliable water supply is provided. Quality of water is appropriate for designated uses. Natural hydrological cycles are not undermined. Environmental quality is not degraded. Water management infrastructure meets best practice urban design standards.	Natural catchments and flows are maintained through earthworks and stormwater management. Principles of Water Sensitive Urban Design are followed for all stormwater management. Groundwater is not used for water supply. No significant change in volume of discharge up to and including the Q100 rainfall event. Quality of stormwater input to coastal wetlands is not changed. Discharge of treated wastewater occurs only in high rainfall events (3 time ADWF). Water harvesting and consumption is strictly controlled. Wastewater is treated and reused. Limited reliance on water	Existing ephemeral watercourses on the Island are maintained unchanged with appropriate riparian buffers (refer to Section 8). Permanent stormwater management utilises existing drainage pathways and is based on Water Sensitive Urban Design principles (Healthy Waterways, 2006)(refer to Section 3.4.2.1). Stormwater discharges to ephemeral watercourses will meet existing water quality of receiving estuarine and marine waters (refer to Section 8.2). Treated wastewater is irrigated to green space at sustainable rates (refer to Section 3.4.1). Potable water is supplied from reliable and sustainable source such as desalination plant (with zero brine discharge to waters).

Feature	Performance Targets	Development Principles	Development Strategies
		resources from the mainland. Provision of a safe potable water supply that meets Australian Drinking Water Quality Guidelines. Site based water management is maximised including collection from roof catchments and reuse of wastewater. A reliable water supply is available for fire fighting.	Rainwater tanks are included at the household and commercial level to provide supplementary non-potable water.
Telecommunications	Reliable telecommunications systems are available.	Residents have access to latest technology for telephone, internet, television, radio and other communications means.	Microwave relay tower proposed.
Waste Management	Waste collection and disposal to licensed off-site facility for construction, commercial and domestic waste.	Waste avoidance and reduction strategies are introduced.	Waste collection services are implemented in accordance with the Waste Management Plan. Construction waste management will be based on Waste Reduction Guidelines (DEH, 2000)

3.3 Master Plan

3.3.1 Development Principles

Master planning of the proposed integrated tourist and residential development for Hummock Hill Island Development is the central strategy to ensuring that social and environmental objectives are met in a way that maximises gains for both. In other words, master planning must ensure that those areas of high environmental value on Hummock Hill Island are protected and also that a high quality development which offers an attractive lifestyle is achieved.

The proposed Master Plan recognises the environmental constraints of the Island and adjacent sensitive environments such as intertidal wetlands (State and commonwealth listed), Fish Habitat Areas, Dugong Protection Areas and Marine Parks (State and Commonwealth). Master Planning has responded to such constraints by:

- Minimising development within intertidal wetlands to existing transport corridors;
- Avoiding development within essential habitat of the Colosseum Fish Habitat Area;
- Maintaining existing buffer zones between proposed developed areas and intertidal wetlands;
- Avoiding development within current erosion prone areas/coastal management districts;
- Maintaining required buffers from ephemeral watercourses on the Island and maintaining existing flow regimes;

- Avoiding development within "endangered" ecosystems to the maximum extent practicable and minimising development in "of concern" and threshold ecosystems and providing a no net loss of vegetation through vegetation off-sets in accordance with the *South East Queensland Regional Vegetation Management Code*;
- Minimising bulk earthworks and constructing in sympathy with existing topographic features;
- Utilising existing vegetation screens and buffers to minimise visual impacts to the World Heritage Area; and
- Managing the proposed development form with a Plan of Development that is concordant with the Miriam Shire Council transitional Planning Scheme.

The proposed Master Plan for the Integrated Tourist and Residential Development on Hummock Hill Island is presented in Figure 3.3.

3.3.2 Master Planning Approach

The Master Planning approach is to ensure sympathy and harmony with the natural environment has been to propose a number of different development "units" which provide a combination of high, medium and lower density development and various recreational, educational and commercial activity centres which have been arranged to fit with the natural environmental features. The parameters for building design and construction will be established through architectural guidelines and/or covenants specific to the development type.

The guidelines will function as instruments of assistance to developers/owners, establishing a high quality level of construction and a cohesive architectural character. They are also intended to preserve a 21st century economic, social and aesthetic vision for the Island community. They will be integrated with marketing strategies promoting a 'user friendly' philosophy. The basic intent of the guidelines will be to provide information regarding acceptable choices of materials, finishes and architectural character, as well as building constraints such as setbacks and building envelopes. Controls over on-going construction in neighbourhoods will preserve the established lifestyle during development phases. They will provide options for dealing with distinctive site characteristics such as sloping sites, beach front sensitivity, hydrological issues, geotechnical conditions and soil types.

They will also provide guidance for (ESD) principles and compliance with broader sustainability issues and infrastructure. Design principles for each of the key components are discussed further below.

3.3.2.1 Overall Development

Development will be restricted, to the maximum extent practicable, to non endangered regional ecosystems and will be contained wholly within Lot 3 on 841442, thus avoiding erosion prone areas on the ocean front and wetland buffers in the estuaries. Areas within the development footprint will be planned to maximise preservation and maintain existing ecological systems and avoid identified ephemeral creeks. Appropriate guidelines will be developed to provide strategies and methods to reduce disturbance to a minimum. Where disturbance does occur, guidelines will

establish criteria for the rehabilitation and ongoing maintenance, with an emphasis on compatible species and water efficient irrigation.

The land use elements of the proposed development have been located with careful consideration to the existing regional ecosystems, topography of the site, utilisation of views and vistas and integration within the natural landscape.

The development has been designed to fit in and around the environment, with minimal disturbance, ensuring a sustainable outcome has been achieved. Ecologically Sustainable Development (ESD) principles have been the driver behind the design with Hummock Hill Island supporting a low impact master planned community.

3.3.2.2 Landscape Strategy

The proposed landscape strategy is concordant with the overall intent to develop Hummock Hill Island in an environmentally respectful way, preserving all significant habitat and natural features, linking this patchwork of parcels of significant habitat through the open space network, and developing the remaining land in a "least disturbance approach".

In keeping with this guiding principle, landscape strategies have been developed and incorporated into the master planning for each development zone and will endeavour to minimise impact on the environment, while creating an attractive and unique place in which to live and holiday. Proposed landscaping strategies are incorporated into each development precinct or feature description.

3.3.2.3 Access Road and Bridge

The proposed access road to the development will follow the existing Clarks Road alignment and be contained wholly within the existing road reserve, stretching some 15 km from the Bruce Highway to the existing causeway. Vegetation is limited to regrowth along the majority of its length that resembles the vegetation predominant in the surrounding region i.e., sub-dominant Open Eucalypt Woodland and Grassy Woodland.

The concept landscape strategy will ensure that within the road reserve, minimal disturbance will be caused to existing vegetation. The culling of trees will be conducted only as necessary to satisfy safety criteria as stipulated by the Department of Main Roads. Any necessary revegetation will be limited to local provenance species with frangible stems (<80mm when reaching maturity), planted at minimum distances from the traffic lane as determined when proposed speed limits are set following the design of the roadway.

Disturbed road shoulders will be hydro seeded. The hydro-seed will consist of a grass/ groundcover mix, with grass seed to limit erosion by overland flow in the short term, and native groundcover seed to revegetate in the long term. Approaching the site, mono-specific copses of Eucalypt will be planted in the verge at focal points on bends in the road- increasing in frequency as the site is approached to give a subtle, subliminal sense of arrival. As above, the trees will be planted in accordance with Main Roads guidelines in terms of sight lines and distance from the traffic lane.

The proposed landscape strategy for the access bridge will provide a structured, progressive journey. Rather than a typical wall or signage feature at the bridge, the entry experience will be subtle, in keeping with the innovative design philosophy of the project. The approach along the access road from the highway will be planted with the stands of trees which will become more dense and more frequent as the Island draws nearer. Upon arrival at the bridge, any disturbed tidal areas surrounding the boat ramp and bridge will be revegetated with mangroves, and the abutments of the bridge will be planted with deep green, evergreen native trees. This will lessen the visual impact of the built form upon the channel, and create a cool green visual landscape to welcome residents and visitors to the Island. It will not be until crossing the bridge and entering the village that the more obvious visual hardscape features will provide a welcoming sub-tropical, sea-side village entry to Hummock Hill Island, reflecting the relaxed coastal character of the development.

3.3.2.4 Tourist Hotels

Two locations have been chosen to accommodate these 'resort style' hotels that are aimed at catering for tourists and local demand. These locations are shown in Figure 3.3 and Figure 3.5 with approximate areas of 2.63 ha and 7.5 ha respectively.

Both hotels are situated in beachfront locations with one in close proximity to the Town Centre and the other in a more secluded north western part of the development. The development parameters for Hotels will be related to:

- Hotel type (resort);
- Interface with public facilities, residential areas, (e.g. sharing retail with other facilities) open space and maximisation of view potential;
- Servicing strategies;
- Traffic & parking issues (cars, trucks, buses);
- Sustainability guidelines;
- Amenity consideration (noise, odours, privacy);
- Aesthetic criteria (building envelopes, heights, signage, lighting, architectural style);
- Compliance with environmental initiatives; and

Construction constraints related to the environment and statutory requirements.

Resort Hotel

The resort hotel is located within the town centre and designed as a 4 star hotel with a site area of 2.63 ha. While the detailed configuration of the resort would ultimately be determined by the operator, it is planned to be 3 storeys along the street address and 3 or 4 storeys within the site. The hotel master plan would include central facilities, convention facilities, specialty dining restaurants, recreational activities and guest wings.

LEGEND

1 BRIDGE ENTRY TO HUMMOCK HILL
2 VILLAGE CENTRE
3 BOAT RAMP
4 BOYNE CHANNEL RESIDENTIAL
5 BOYNE CHANNEL APARTMENTS
6 SALT DRYING AREA
7 GOLF COURSE
8 GOLF COURSE RESIDENTIAL
9 GOLF COURSE APARTMENTS
10 GOLF CLUBHOUSE
11 DRIVING RANGE
12 GOLF MAINTENANCE FACILITIES
13 SEWAGE TREATMENT PLANT
14 AIR STRIP
15 HILLSIDE TERRACES
16 RIDGETOP RESIDENTIAL
17 EDUCATION CENTE / SPORTS / FACILITIES
18 TOWN CENTRE
19 VILLAGE TOWNHOUSES
20 SEASIDE COTTAGES
21 BEACHFRONT HOLIDAY HOMES
22 HEADLAND RESORT APARTMENTS
23 HEADLAND RESORT HOLIDAY HOMES
24 BEACHFRONT APARTMENTS
25 HEADLAND RESORT
26 RESORT TOWN APARTMENTS
27 PUBLIC FACILITIES
28 BEACHFRONT TOURIST HOTEL
29 RIPARIAN ECO HOME SITES
30 LAGOON VILLAS
31 SCHOOL RECREAIONAL CAMP GROUND
32 BUSHLAND RESIDENTIAL
33 TOURIST PARK
34 TO BOAT RAMP AT BOYNE CHANNEL

0 50 100 200 300 600

Figure 3.3 - Hummock Hill Island Master Plan

HUMMOCK HILL

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LEGEND

1 BRIDGE ENTRY TO HUMMOCK HILL
2 VILLAGE CENTRE
3 BOAT RAMP
4 BOYNE CHANNEL RESIDENTIAL
5 BOYNE CHANNEL APARTMENTS
6 SALT DRYING AREA
7 GOLF COURSE
8 GOLF COURSE RESIDENTIAL
9 GOLF COURSE APARTMENTS
10 GOLF CLUBHOUSE
11 DRIVING RANGE
12 GOLF MAINTENANCE FACILITIES
13 SEWAGE TREATMENT PLANT
14 AIR STRIP
15 HILLSIDE TERRACES
16 RIDGETOP RESIDENTIAL
17 EDUCATION CENTE / SPORTS / FACILITIES
18 TOWN CENTRE
19 VILLAGE TOWNHOUSES
20 SEASIDE COTTAGES
21 BEACHFRONT HOLIDAY HOMES
22 HEADLAND RESORT APARTMENTS
23 HEADLAND RESORT HOLIDAY HOMES
24 BEACHFRONT APARTMENTS
25 HEADLAND RESORT
26 RESORT TOWN APARTMENTS
27 PUBLIC FACILITIES
28 BEACHFRONT TOURIST HOTEL
29 RIPARIAN ECO HOME SITES
30 LAGOON VILLAS
31 SCHOOL RECREAIONAL CAMP GROUND
32 BUSHLAND RESIDENTIAL
33 TOURIST PARK
34 TO BOAT RAMP AT BOYNE CHANNEL

Figure 3.4 - Hummock Hill Island Key Plan

JOB NO: 4489-01-C 15/11/07 A-MP-00-07(E) SCALE: NTS

HUMMOCK HILL

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The central facilities would include a porte cochere, reception, and coffee shop/restaurant and associated back of house requirements. The convention/seminar facilities would be located on the ground floor with a separate entry and basement parking. A speciality restaurant would be located within the site to best showcase the landscaped gardens and the ocean views. Recreational facilities would include tennis courts, pools and gymnasium and associated wellbeing centre with spa and treatment rooms. Guest wings would accommodate 240 guest rooms and would be planned to create landscaped passive recreational courtyard spaces and activity zones including pool environments. Depending on the operator, the suites would be single and dual key of approximately 35 m^2 and designed to address the ocean views and internal landscaping.

The architectural style would be contemporary, sensitive to subtropical environment, feature balconies that provide privacy, weather and shade protection and contribute to the principles of energy efficiency. The construction would most likely be light coloured rendered masonry with low pitch roofs.

The hotel addresses the main street with a retail component on the ground level consisting of a tavern, food & beverage, souvenirs, etc. The tavern addresses the plaza to the north west which interfaces directly with the beach.

Servicing would be independent of the main entry and located to reduce noise and odours from the prevailing breezes. Parking for guests would be provided in basements with surface visitor parking and bus circulation/parking adequately screened.

The hotel would aim for maximum self sufficiency in water management with rainwater harvesting and grey water re-use. Being close to the beach, utilisation of sub soil systems related to water recycling will be governed by the constraints of water tables and aquifers. The architectural designs would incorporate energy efficiency measures including solar management, orientation of buildings and natural ventilation where achievable. The design would recognise regional material availability and construction opportunities and constraints in a practical and beneficial manner. The selection and installation of materials and products would recognise the importance of carbon emissions.

Beachfront Tourist Eco-Hotel

The tourist hotel eco resort is located in a beachside setting at the western end of the northern beach development with a site area of 7.5 ha. The location and setting would be appropriate for a 4-5 star exclusive resort utilising the secluded outlook and carrying this restrained theme through the treatment of the architecture and the landscaping. The buildings would be a maximum of 3 storeys with basement parking (depending on geotechnical and hydraulic conditions).

The planning emphasis would be to highlight ocean views and intimate landscape environments of pools, dining and recreational facilities. The central facilities would include a porte cochere, reception and coffee shop/restaurant. The back of house facilities would also serve separate seminar rooms connected to the back of house facilities. A specialty restaurant, beach bar and guest rooms would address the beach to the north. A specialty well being studio retreat would be located in garden settings. The guest wings would address the beach and/or the internal landscaping including secluded pools and active spaces and they would accommodate 150 to180 rooms. Depending on the operator, the suites would be single and dual key of approximately 40 m^2.

Proposed architecture would be contemporary, with a tropical character that blended with the environment utilising a mix of masonry and timber elements to reinforce the relationship. Building design will be sensitive to the subtropical environment, featuring balconies that provide privacy, weather of shade protection and contribute to the principles of energy efficiency. The construction would most likely be light coloured rendered masonry with low pitch roofs.

The emphasis on public interaction would be limited to the restaurants and seminar facilities. Servicing would be independent of the main entry and located to the south west to reduce noise and odours from the prevailing breezes.

Parking for guests would be provided in basements with surface visitor parking and bus circulation/parking adequately screened. Visitor parking and bus circulation would be located to the south.

The hotel would aim for maximum self sufficiency in water management with rainwater harvesting and grey water re-use. Being close to the beach, utilisation of sub soil systems related to water recycling will be governed by the constraints of local water tables and aquifers. Proposed architectural designs would incorporate energy efficiency measures including solar management, orientation of buildings and natural ventilation where achievable. The design would recognise regional material availability and construction opportunities and constraints in a practical and beneficial manner. The selection and installation of materials and products would recognise the importance of carbon emissions.

3.3.2.5 Community Centres

The Community Centres (Town Centre and Village Centre) will be designed to function as multi purpose environments catering for local residents, visitors, special interests groups and related commercial activities. They will create development anchors and focal points at both ends of the development, positioned to promote and sustain highly visible activity and community services for each locality whether for permanent or holiday residents.

The main Town Centre located in the north west of the development will create an integrated relationship between the Resort/Convention Centre, Retail, Motel, Educational Facilities, Sporting Fields and the Public Parks. The multi purpose role of the Education Facility and the Convention Centre will provide a valuable flexibility of use, contributing to the long term sustainability of the community. Figure 3.5 presents detail of the proposed Town Centre precinct.

The Town Centre, in view of the beach, will re-create the traditional 'Main Street' with adequate street parking, blended pedestrian movement, ample shade structures and trees. This main street will feature various retail outlets including those associated with the hotel which will address the street rather than face inward. This strategy enriches the street activity and conforms to resort hotel operations. Shared traffic arrangements, incorporating 'slow zones', will allow for the safe integration of pedestrians with vehicles. Adequate on-street and off-street parking areas in close proximity to the Town Centre have been allowed for in the design.

The range of facilities envisaged for the Town Centre includes:

- Food & Beverage;
- Convenience retail;
- Tourist retail;
- Supermarket;
- Display centre;
- Main Plaza;
- Beachfront Restaurant;
- Medical Centre; and
- Community Hall.

The Town Centre will also include a community services building that will contain a Fire Station, Ambulance Station and Police Station. Details of proposed components of the Town Centre are outlined in Table 3.4 below.

Table 3.4 – Town Centre Precinct Development Details

	Site Area	Description	GFA m^2
Site A & C Supermarket & Retail Shops			
		MAIN SUPERMARKET RETAIL SHOPS COMMUNITY SERVICES FACILITIES (Post Office, Fire Brigade, Police Station, Library) 270 Car parking spaces provided	2000 2000 1000
Total	2.5 ha		5000 m^2
Site B Main Plaza			
		DISPLAY CENTRE TOURIST INFORMATION CENTRE RESTAURANT 21 Car parking spaces provided	200 50 200
Total	0.5 ha		±450 m^2
Site D Beachfront Apartments			
		OFFICES @ MAIN STREET 64 Apartments 132 Car parking spaces provided @ Basement	1100 m^2
Total	1 ha		1100m^2
Site E Resort Hotel			
		240 ROOMS,4-STAR CONVENTION FACILITIES,F&B SHOPS,RECREATIONAL AREA Car parking spaces provided @ Basement	9500 m^2 2000 m^2
Total	2.7 ha		11500m^2
Site F Beachfront Restaurant			
		BEACH FRONT RESTAURANT KIOSK 17 Car parking spaces provided	300m^2 50m^2
Total	0.2 ha		350m^2
Site G Community Centre			
		MULTI-PURPOSE HALL AND SUPPORT FACILITIES CHILD CARE CENTRE Car parking @ grade	1500 m^2
Total	1.0 ha		1500m^2

Site H Medical Centre			
		MEDICAL CENTRE AND DOCTORS SURGERY (Dental surgery) (Childcare Centre) Car parking at grade	1500 m^2
Total	0.4 ha		1500m^2
Site J Surf Life Saving Hut			
		BEACH PAVILLION (Storage and other Facilities)	200 m^2
Total			200 m^2

The south eastern Village Centre, in close proximity to the Gateway Bridge, will cater for permanent residents who live and work on the Island (hotels, etc.) as well as commercial and light industrial (marine) facilities. This service based precinct would complement and balance the range of services available to the entire Island community. Figure 3.6 presents detail of the proposed Village Centre precinct. Reinforced as a 'gateway' from the mainland, the Village Centre has been designed to adopt a rustic fishing village character and includes a public access boat ramp and trailer parking area. Nearby residential components such as apartments and houses create a population which will be provided for by essential services such as supermarket/convenience store, retail, and food and beverage outlets. A service station is intended to be located in this precinct also to provide fuel and mechanical services to residents and visitors.

Development parameters for the Community Centres will be influenced by the subtropical character and geographical features of the Island. The architecture will reflect contemporary lifestyles and promote economic, social and environmental sustainability.

Emphasis will be placed on:

- Climate comfort, including street and footpath shading, utilising landscaping, large overhangs, awnings etc;
- Good visual access to and from the town centre and village centre;
- Lightweight construction where appropriate;
- Pedestrian permeability and safety;
- Landscaping to enhance and integrate the development with the environment; and
- A distinctive architectural character to create a unique island identity

Urban design features of the Town and Village Centres will focus on their strategic location as hubs for activity throughout the community. The Town Centre is positioned to enhance the experience of a seaside village with commercial, retail, resort and educational facilities clustered around public open spaces.

Resident's surveillance of public spaces will be encouraged through Architectural guidelines and planning. These will identify view and surveillance corridors and encourage lighting of public areas as part of landscape strategies to manage access and use of public spaces.

LEGEND

A	SUPERMARKET / RETAIL SHOPS / COMMUNITY SERVICES FACILITIES
B	MAIN PLAZA DISPLAY CENTRE/ TOURIST INFORMATION/ RESTAURANT
C	RETAIL SHOPS
D	BEACHFRONT APARTMENTS WITH RETAIL SHOPS AT GROUND FLOOR
E	RESORT HOTEL
F	BEACH FRONT RESTAURANT
G	COMMUNITY HALL
H	MEDICAL CENTRE
I	LINEAR PARKS / WALKWAYS
J	SURF LIFE SAVING HUT
//	EROSION PRONE

PRELIMINARY

Figure 3.5 - Town Centre Precinct

JOB NO: 4489-01-C 15/11/07 A-MP-00-06(F) SCALE: 5000 @ A3

0 20 40 80 120 160m

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Figure 3.6 - Village Centre Precinct

JOB NO: 4489-01-C 15/11/07 A-MP-00-04(E) SCALE: 4000 @ A3

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3.3.2.6 Residential Development

A broad range of residences will be developed to meet a range of demands, markets and property price ranges, based on the following assumptions:

- 50 to 60% of the residential properties will be holiday homes/apartments and used by their owners for holidays or rented to holidaymakers;
- 20 to 30% of the properties will be purchased by people who will take up employment or business opportunities in servicing the tourism market or by investors who will rent the properties to people employed in the tourism and services industries on the Island; and
- The remaining (up to) 20% of the properties will be sold to persons who will take up permanent residence on the Island and working in the Gladstone region.

Parameters for building design and construction will be established through architectural guidelines and/or covenants specific to the development type. The guidelines will function as instruments of assistance to developers/owners, establishing a high quality level of construction and a cohesive architectural character. They are also intended to preserve a 21st century economic, social and aesthetic vision for the Island community. They will be integrated with marketing strategies promoting a 'user friendly' philosophy. The basic intent of the guidelines will be to provide information regarding acceptable choices of materials, finishes and architectural character, as well as building constraints such as setbacks and building envelopes. Controls over on-going construction in neighbourhoods will preserve the established lifestyle during development phases. They will provide options for dealing with distinctive site characteristics such as sloping sites, beach front sensitivity, hydrological issues, geotechnical conditions and soil types. They will also provide guidance for (ESD) principles and compliance with broader sustainability issues and infrastructure.

3.3.2.7 Golf Course

An 18 hole, par 72 "Wild Golf Course" will be designed and constructed in accordance with the general principles of the *Society of Australian Golf Course Architects (SAGCA)*. In regards to the environment a well designed Wild Golf Course will:

- Utilise natural features to the maximum extent whilst minimising the need for bulk earthworks;
- Minimise any clearing required for construction;
- Maintain native vegetation to provide wild life sanctuaries;
- Preserve open space and remnant vegetation within urban environments;
- Protect topsoil from degradation;
- Protect water resources;
- Rehabilitate degraded landscapes;
- Promote indigenous flora and fauna and the Australian Landscape Experience;
- Improve air quality and moderate temperature; and
- Utilise and treat water resources such as; sewage, stormwater and urban runoff thereby reducing pollutant loads on ephemeral watercourses.

The Wild Golf Course will be an important community facility as well as a significant tourist development in the Gladstone region. The course will be open to the tourists and the public for a daily fee. Club memberships will be also available to residents of the Island and the adjacent region.

The two storey Golf Club House or "Country Club" will incorporate other recreational facilities including bowling greens and tennis courts. The Golf Club will provide the usual club functions including meals and entertainment for members and visitors.

The Country Club is strategically located to maximise views over the 18 hole golf course. Future golf course residential population supplied by the apartments and home sites are well positioned to utilise the Club facilities. The visual quality and impact on adjacent land uses, roads and pathways should create a positive identity for the residents of the neighbouring precincts and visitors to the golf course and Country Club.

3.3.2.8 Educational Campus

A site has been made available for the establishment of a Primary School with associated recreational facilities and an educational centre that will support research in environmental management and provide facilities for residents and tourists to undertake study programs linked to a major Queensland university. Ancillary sporting facilities associated with the education campus will be available to the community after hours and includes access to sports fields, tennis courts, swimming pool and community hall.

The parameters for building and construction will be delineated within specific architectural guidelines. These guidelines will function as instruments of assistance in establishing a high quality level of construction and a cohesive architectural character. They will also provide guidance for implementation of (ESD) principles and compliance with broader sustainability issues and infrastructure.

3.3.3 Key Plan Elements

The Master Plan presented in Figure 3.3 consists of a number of key land use elements that contributes towards the overall attraction and character of Hummock Hill.

3.3.3.1 Boyne Channel Village Centre

The proposed Boyne Channel Village Centre is located close to the main access bridge that links Hummock Hill Island to the mainland. Typical of the lower lying areas of the area to the east of the central spine, the site to be occupied by the village centre has been previously cleared for grazing. Grassland is dotted with sparse Eucalyptus crebra regrowth.

The proposed Centre has been designed as an activity centre for the boating facilities and provides a boat ramp at the Boyne Creek below the access bridge. The village is proposed as a retail precinct and work hub for marine services catering for small to medium sized boats. The Village Centre will incorporate a variety of facilities including, but not limited to:

- Boat storage facilities and workshops;
- Supermarket, convenience store, retail and marine services; and
- Petrol Station.

The buildings will be one and two storey in height and of a style that is contemporary yet domestic in scale. This will allow for the character of an upmarket version of the 'rustic' village to be created. The proposed potable water desalination plant is also located within this precinct. Figure 3.6 presents the concept plan for the Boyne Channel Village Centre.

As the "entry" point to the project, the landscape associated with this area will exemplify the relaxed, coastal village aesthetic, balanced with the highest standards of quality development. This will be demonstrated by high quality, natural finishes in the hardscape, and a sub-tropical, "resort' style softscape. The proposed planting will consist of copses of endemic shade trees to open spaces; medium sized native street trees; native palms to focal points; and hardy, native shrubs and groundcovers to mass planted garden beds and medians. The town and village centres will also display the mass planting of non-invasive, drought tolerant exotic shrubs and groundcovers in medians and underplanting street trees to create a long term, low maintenance solution.

3.3.3.2 Boyne Channel Apartments

The proposed apartments are located beside the village centre and along the ridges overlooking Boyne Channel. The Boyne Channel apartments will occupy the higher elevations of the undulating plain that surrounds the village centre, and these are consequently typified by the same grassland with sparse specimens of Eucalyptus crebra.

The Boyne Channel apartments are oriented toward the residents who will be living and working on the Island. Medium density residential dwellings are proposed, overlooking the surrounding tidal wetlands and channel. The proposed height of development will be two storeys high in keeping with the low impact goals of the development. The landscape for these complexes will be "eco-resort" styled, revegetated with native planting endemic to the region.

Figure 3.6 shows the location of the apartments in the Village Centre Precinct.

3.3.3.3 Golf Course Resort Home Sites

Golf course resort home sites are situated on undulating plains previously utilised for grazing, and consequently consists of eucalyptus woodland regrowth. The low elevation of the site and location toward the centre of the Island render the proposed building locations of little concern with regard to visual impact external to the site. The proposed golf estate is designed to overview the fairways and greens of the golf course and open spaces.

It is proposed that lots range in size from 600 to 1,000 square metres with the average lot size 850 square metres. The built form will be controlled by landscaping strategies and architectural guidelines relating to materials and colour. The large lot sizes allow for the retention of vegetation and incorporation of new plantings to assist in achieving a low impact outcome.

The streetscape leading to the golf course resort homes will be in keeping with the golf course resort theme, with informal copses of medium sized, endemic trees under-planted with native groundcover. The strips of open space between the rear of the allotments will be treated in the same manner as the golf course (retention and revegetation), so that the vegetation remains unbroken wherever possible throughout the precinct. These buffers serve not only to promote environmental linkages between isolated pockets of habitat, but also act as overland flow paths, and visual buffers between residences.

Within allotments- building covenants will be created to ensure that outside the building footprint, clearing of significant native vegetation will not be permitted prior to approval being attained from the appropriate authority. Refer to Figure 3.7 for the Golf Course precinct concept plan.

3.3.3.4 Golf Course Resort Apartments

As an integral part of the golf course development, the Clubhouse and Golf Course Apartments will be situated on undulating plains previously utilised for grazing toward the interior of the Island. The area consists of eucalyptus woodland regrowth. Located throughout the golf course site, these residential dwellings offer future residents an apartment style living option within the golf course and open spaces in close proximity to a clubhouse and other recreational facilities.

The low elevation of the site and location toward the centre of the Island render the proposed building locations of little concern with regard to visual impact external to the site. The proposed height of development is two storeys high in keeping with the low impact goals of the development.

The landscape to the clubhouse will form the first “taste” of the proposed golf course, and hence will reflect the environmentally sympathetic theme of a development in harmony with the Island. Although some of the understorey plant material may not necessarily be local provenance species, the underplanting will consist of species endemic to the region.

As with all other development outside the resorts and town/village centres, the trees will be based on a palette of species local to the immediate region- ideally- sourced locally, and “grown on”, on the Island. The aim of the landscape to the clubhouse and the golf course apartments-where building bulk is necessarily of medium density- is to create a landscape with a native sub-tropical flavour, with a high quality resort theme. To achieve this, the understorey will be mass planted in swathes of the same species rather than an homogeneous mix.

Figure 3.7 - Open Space Precinct (Golf Course)

HUMMOCK HILL

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0 25.0 50.0 100 150 200 250m

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3.3.3.5 Ridgetop Houses

The proposed ridgetop residential development is sited to overview Rodds Bay and Boyne Channel. The Hillside Terrace residential allotments occupy the eastern slope of the central spine of the Island to take advantage of views to Rodds Bay. The ridgetop residential allotments follow the crest of the central spine of the Island allowing views to Rodds Bay and Boyne Channel. Typically these slopes have endured little pastoral activity.

The lack of depth and fertility of the soils in this location has resulted in eucalyptus woodland lacking significant height- even at maturity. These premium residential lots have been sited with consideration to the natural topography and landscape. The upper elevations of the site may have limited visual exposure to sea traffic to the north.

Similar to other residential areas within the site, it is intended that the streetscaping shall include random copses of native street trees, under-planted with indigenous groundcovers. The muted colours of the native plants will assist in lessening the visual impact of the development.

Drainage flow paths will be retained between allotments in the form of natural swales. These swales will be stabilised with on-site rock where necessary, and planted with native grasses and tubestock to replicate natural, dry creeks. Proposed swales will help slow the stormwater flowing downhill in rain events, assist the efficiency of the natural "soaks" at the base of the hill, and preserve open space linkages/corridors throughout the precinct. Significant tree specimens will be retained in the open spaces to assist in the filtering of views of the proposed homes from vantage points external to the site.

Within allotments building covenants will be created to ensure that building footprints are no greater than 50% of the lot and clearing of significant native vegetation will not be permitted prior to approval being attained from the appropriate authority. This will assist with visual amelioration of the buildings, and habitat retention.

Future residents will have the responsibility of siting houses to minimise the visual impacts and will be assisted by the existing natural vegetation and architectural guidelines relating to materials and colour. Figure 3.8 presents the concept plan for low density ridgetop housing.

3.3.3.6 Hillside Terraces

Located to overlook Rodds Bay and a further cluster located to capture the views to the Boyne Channel and beyond, these hillside lots provide building envelopes within the existing landscape to enable sensible and environmentally sensitive development to occur. The Boyne Channel residential allotments occupy the lower slopes of the southern knoll of the central spine of the Island to take advantage of views of the Boyne Channel. Typically these slopes have endured little pastoral activity. The lack of depth and fertility of the soils however has resulted in the eucalyptus woodland lacking in significant height even at maturity. Lot sizes average 750 square metres allowing modest homes to nestle within the natural surrounds.

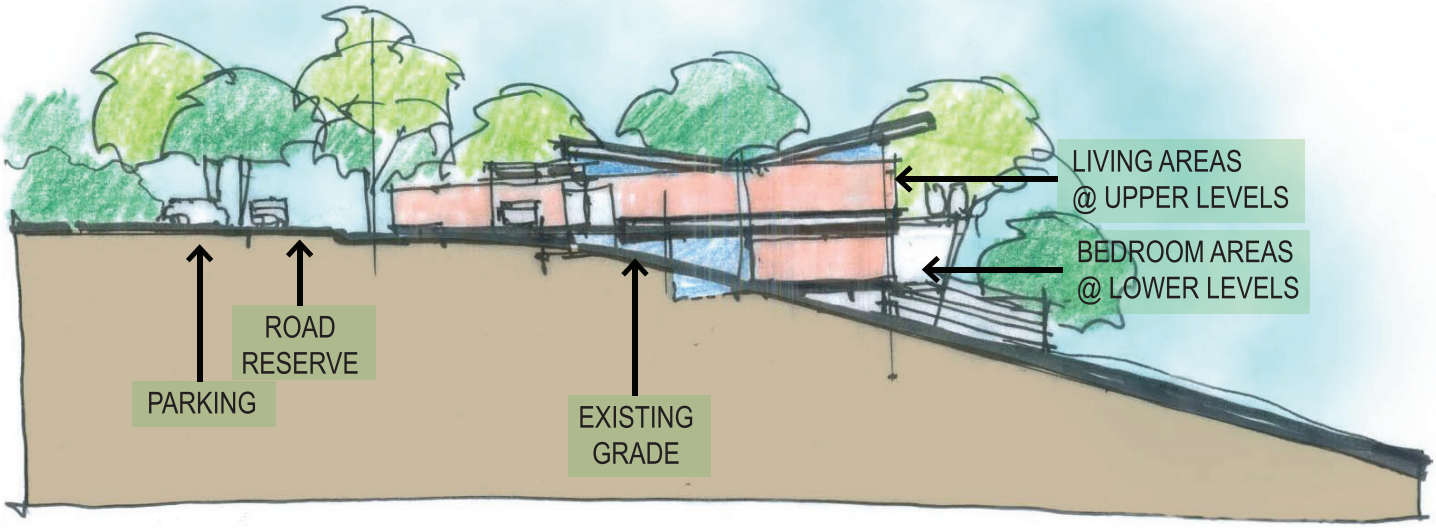

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Figure 3.8 - Low Density Ridgetop Housing Concept Plan

1:500

It is intended that the streetscaping shall be in an informal "bushland" style. This will include random copses of native street trees, under-planted with indigenous groundcovers rather than regularly spaced street trees as found in the more formal, town centre landscaping. Significant tree specimens will be retained in the open spaces to assist in the filtering of views of the proposed homes from potential vantage points external to the site.

Within allotments building covenants will be created to ensure that the building footprint is less than 50% of the lot. Clearing of significant native vegetation will not be permitted prior to approval being attained from the appropriate authority. This will assist with visual amelioration of the buildings, and habitat retention.

Refer to Figure 3.8 for a possible design outcome for this type of residential component. Note the slope sensitive urban design promoting lightweight building materials and limited cut/fill.

3.3.3.7 Beachfront Holiday Homes/Headland Holiday Homes

The first row of Beach Front Holiday Home allotments on the eastern side of the headland will be located on the crest of the small hill behind the littoral vine thicket that dominates the inland side of the fore dune of the oceanfront beach. The balance of the Beach Front Holiday Homes, and the site for the Seaside Cottages is on the open woodland behind the small hill. This site has been cleared for grazing. These eucalypts provide visual buffering of the proposed homes when viewed from the water.

Headland holiday home lots have been designed to accommodate residents and tourists alike, whether they are rental or 'weekend' type dwellings, and will offer absolute ocean views. The location in close proximity to the Town Centre allows for access to services and facilities. The average lot size of 1,000 square metres allows for a low impact, low density residential outcomes to be achieved. Prime views will be available to seaside vistas, beaches and bays.

Although differing in size of allotment, the rationale for the landscape of the seaside cottages and the beachfront homes is consistent. Within allotments building covenants will be created to ensure that the building footprint is less than 50% of the lot and clearing of significant native vegetation will not be permitted prior to approval being attained from the appropriate authority. This will assist with visual amelioration of the beachfront homes from the water, and provide habitat retention throughout the precinct.

In common with all other residential areas within the development, the streetscaping shall include random copses of native street trees in the verges, under-planted with indigenous groundcovers. Access ways to the beach will not be permitted from individual allotments. Public access ways will be constructed to prevent informal paths to the beach being created by residents and visitors. These pathways will be limited in number, positioned to avoid the loss of specimen plants within the vine thicket, and be of low impact construction. Construction will include sand ladders at the beach access points, and short sections of boardwalk through particularly vulnerable areas such as natural flow paths.

3.3.3.8 Seaside Cottages

A higher density residential precinct located in close proximity to the Town Centre and essential services, the Seaside Cottages offer an alternative living option for future visitors and residents. The smaller lot size provide an opportunity to create low maintenance, compact seaside residential dwellings of an affordable nature and adds to the mix of housing types offered at Hummock Hill.

3.3.3.9 Headland Resort Hotel/Conference Centre

A 'resort' style hotel providing a holiday destination for tourists and incorporating a conference centre. Envisaged to be an appealing option for business and varied parties seeking a secluded destination that offers all the facilities associated with a resort of this standard.

3.3.3.10 Headland Resort Apartments

The headland is an exposed, harsh environment for flora. Shallow soil depths, lack of retained moisture in the shallow soils, and salt laden winds create conditions that shape the composition of the vegetation. The majority of the original vegetation on the headland has been cleared for previous cottages/shacks. The resultant cleared site is open grassland, spotted with exotics such as Mango trees, and consequently has little ecological value.

The site is not visually exposed to neighbouring land based vantage points, but is visible from locations out to sea. Although one is a resort and the other domestic, the size and quality of the homes envisaged for the site and the shared environmental conditions would suggest that the landscape requirements will be similar for both the private residences and the resort.

The development will be offering apartment style accommodation with ocean views in close proximity to the Town Centre and link to the beach via nature corridors. Located at the end of the 'main street' with a retail component at ground level, these apartments offer the visitor an alternative to the 'resort' style hotel accommodation adjacent. A three storey maximum building height applies to this development.

The sub-tropical, "resort style" landscaping planned for this area will include a mixture of native and exotic planting, with covenants placed on planting design with regard to exotic species. The limitations will ensure that plants with the potential to negatively impact upon the existing habitat are precluded. The informality of the streetscape undertaken in other precincts will continue, with emphasis on hardy, salt tolerant, native trees and groundcovers. Within the public open spaces, the planting will be designed to assist in visual amelioration of the proposed built environment over the medium to long term. This will include the planting of a homogenous mix of medium to large trees native to the immediate region. This planting will be undertaken prior to the development of this precinct of the Island, to allow the trees to gain as much height as possible before construction on the headland commences.

3.3.3.11 Resort Town Apartments

Aimed at providing an urban style of accommodation adjacent to the Town Centre and in close proximity to the beach, these apartments offer an alternative to the resort style rooms. Located further from the beach these apartments are linked to the Town Centre and beaches by a

pedestrian network. The buildings will be two storeys in height and achieve an average unit size of 120m^2. A basement carpark will be provided to accommodate resident and visitor requirements.

3.3.3.12 Resort Village Townhouses

Providing a residential alternative to apartment and 'house on lot' living the intention for these townhouse sites is to accommodate modern open living dwellings with reduced open space and therefore maintenance requirements.

Refer to Figure 3.9 which illustrates the promotion of minimum street widths in conjunction with a rear service lane. The environmental corridor/linkage assists in integration of the natural landscape of the nearby conservation area.

It is envisaged that the dwellings will be predominantly two storeys in height and incorporate undercover car parking in order to avoid vehicle dominated road frontages.

3.3.3.13 Motel

Aimed at providing budget accommodation for travellers to the area, the Motel will also provide 'spillover' lodgings for persons attending the conference centre attached to the Headland Resort Hotel. Centrally located to allow for walkable access to the Town Centre and its various services, the Motel provides another accommodation option. The town centre-based accommodation facilities are proposed in an area typical west of the headland, being woodland dominated by Eucalypt sp., with some Melalueca sp., *Livistonia decipiens* and wattle. Although grazing is not recorded in this area, the woodland is common to the region, with specimen plants not evident. Consequently, the vegetation is not considered to be "of concern" with regard to conservation.

The proposed 70 room building will be single storey in height and architecturally designed to integrate with the surrounding built form and environment. Although differing in function, the town based tourist facilities share many of the same strategic landscape goals. It is expected that the commonality of purpose to achieve a unique Hummock Hill seaside resort village, will be attained with a diversity of design techniques. This will be encouraged to avoid a blandness, which can result from "rubber stamp" design. However, certain basic principles and standards will form constraints to the designers in order to maintain the required goals of excellence required. This will be enforced through an approval process with regard to quality landscape design. The sub-tropical, "resort style" landscaping will include a mixture of native and exotic planting, with covenants placed on planting design with regard to exotic species. The limitations will ensure that plants with the potential to negatively impact upon the existing habitat are precluded.

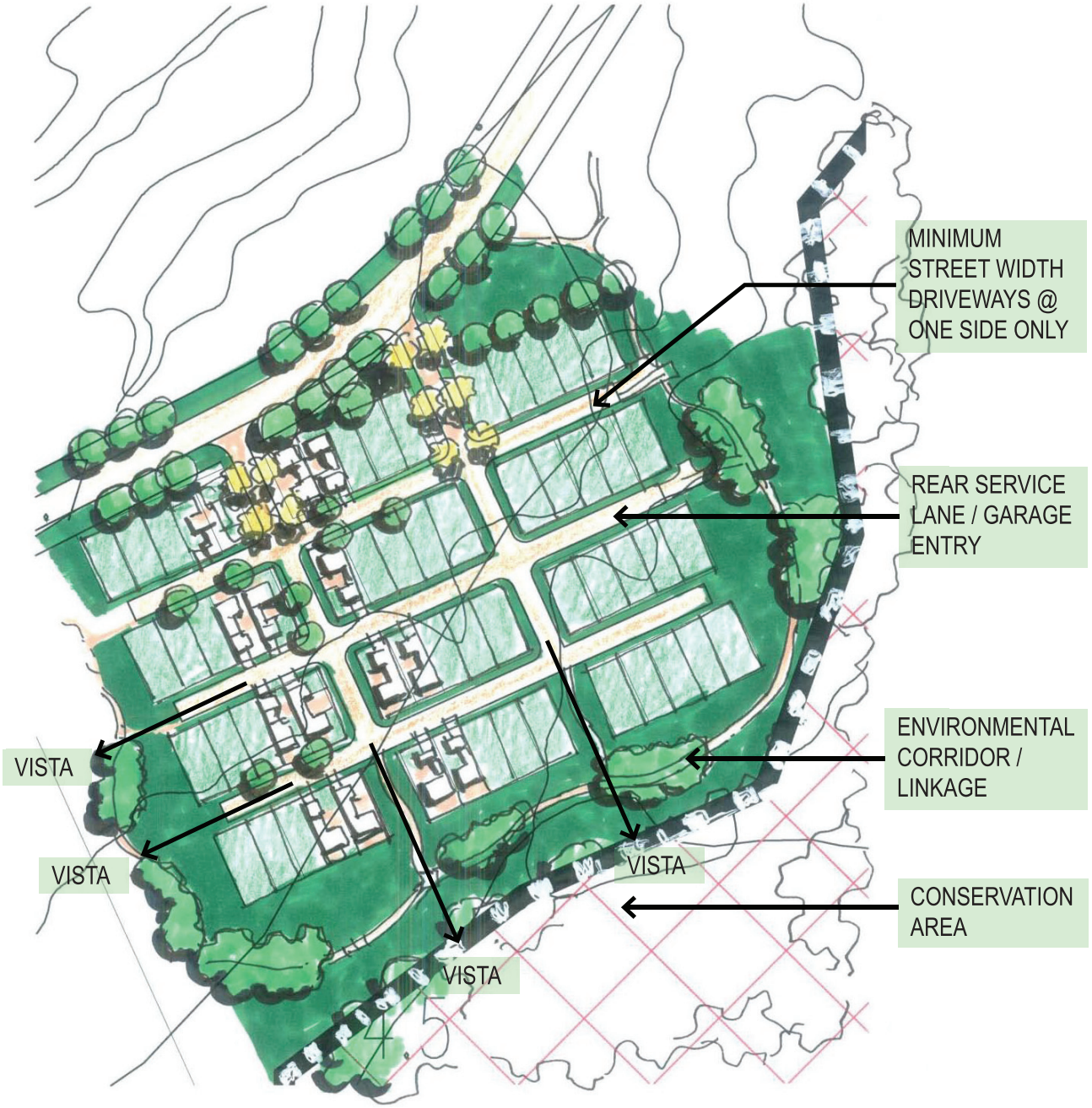

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Figure 3.9 - Resort Village Townhouses

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3.3.3.14 Eco Homesites

Geographically contained in the relict beach ridge system, this residential precinct sits delicately amongst the natural landscape. This space will also allow for vegetation to provide linkages and wildlife corridors through the precinct. Road access will be from the south and road length will be limited to preserve a neighbourhood scale. The main entry boulevard assists residents identifying with their neighbourhood and screens the residential dwellings from the adjacent connector road. Refer to Figure 3.10 for an indication of the neighbourhood components.

A mix of single and two storey dwellings will be constructed throughout this precinct in order to integrate with the natural environment and assist in providing a low visual impact within the landscape. The landscaped neighbourhood park is an extension of the natural drainage system whilst the preserved landscape performs the role of a wildlife corridor. Existing vegetation will be retained under covenants limiting building footprints to less than 50% of the lot. Native species will be retained to prevent a visual impact of small-scale clearing and affect the visual amenity of the area.

3.3.3.15 Beachfront Tourist Eco Hotel

The Beachside Tourist Hotel is the second 'resort' style hotel proposed for the Hummock Hill development, providing a more secluded holiday destination for tourists whilst still allowing pedestrian connections to the beach and Town Centre as discussed in Section 3.3.2.4.

The Hotel faces the beachfront to the western boundary of the development. Separated from the other accommodation facilities and away from the activity of the town centre, the intent of the hotel is to offer an alternate experience for the visitor.

Similarly, the landscape strategy will be to offer the visitor be this same alternate resort experience. A true "on the beach" resort, the landscape will flow unbroken from within the resort to the water's edge while limiting access to controlled access points. The aim of the landscape strategy for the Beachside Tourist motel will be to create a character unique to this hotel, using the location and a palette of local endemic plants to create a unique visitor experience.

The existing landscape is typical to the west of the development site. The existing woodland is dominated by Eucalypt sp., with some Melaleuca sp., *Livistonia decipiens* and wattle. Some dune vegetation is also present, including Casuarina and Spinifex, this vegetation type is not uncommon to the region. Consequently, the vegetation is not considered to be "of concern" with regard to conservation.

The resort is separated from the beach by a 100 m development exclusion zone, which will be preserved and enhanced by dune revegetation where necessary. Limited access ways will be constructed to prevent informal paths to the beach being created by Hotel visitors. These pathways will be limited in number, and be of low impact construction. Construction will include sand ladders at the beach access points, and short sections of boardwalk through any vulnerable ecological features.

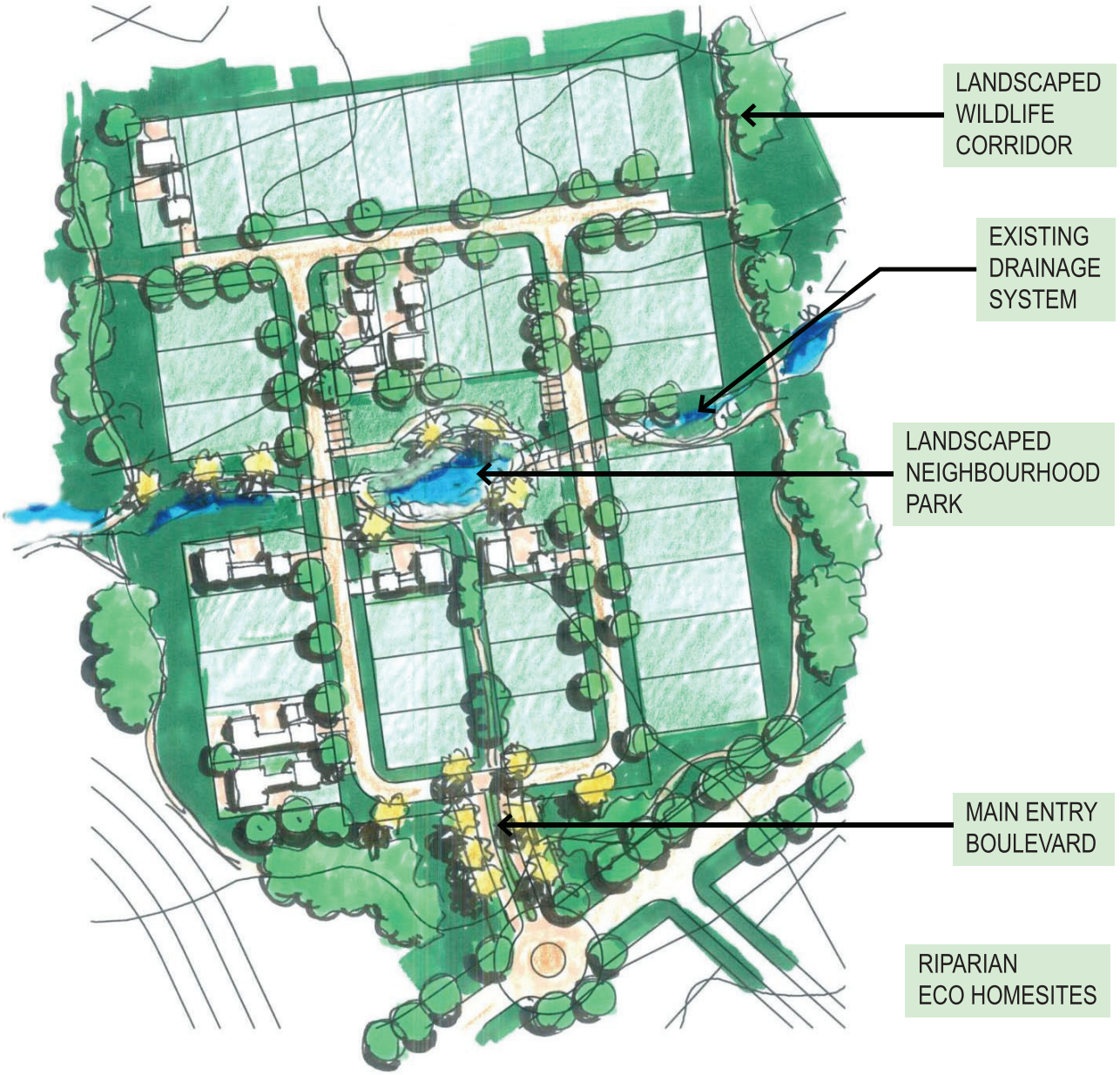

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Figure 3.10 - Eco Homesites Concept Plan

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3.3.3.16 Beachfront Apartments

These premium apartments offer residential and tourist accommodation of the highest standard located to capture the unobstructed ocean views and vistas of Rodd's Bay and beyond. Proposed buildings will be two storeys in height and achieve an average unit size of 120 m^2. A basement carpark will be provided to accommodate resident and visitor requirements and assist in maintaining the visual amenity of the area.

3.3.3.17 Lagoon Villas

Taking advantage of the natural features of the landscape these lots have been created to allow the placement of 'villa' type dwellings in a lakeside environment. It is envisaged that the dwellings will be a maximum of two storeys in height and incorporate undercover car parking in order to avoid vehicle dominated road frontages. The proposed lagoons provide habitat for wildlife, facilitate a water management role and add to the visual amenity of the precinct.

Refer to Figure 3.11 for visual confirmation of proposed attributes of this residential component. Note the linked environmental corridors which allow fauna and pedestrian movement and the 'pocket park' inclusive of amenities for the residents of the neighbourhood to utilise. The water features are created by enhancing the natural existing drainage system.

3.3.3.18 Bushland Residential Lots

Bordering the conservation area it was felt that these lots integrate with the natural bushland whilst providing an urban residential living option.

The proposed neighbourhoods consisting of single dwelling lots will benefit from the retention and enhancement of the existing creek and natural vegetation. These lots are set back from the conservation area to provide a sense of privacy and to integrate with nature. The incorporation of building materials and colours that compliment the natural surrounds will be a feature to these single and two storey dwellings.

Although differing in outlook, the Lagoon Villas, Eco Homesites and Bushland Residential home sites share many similarities in structure, and consequently share many of the same parameters for landscape strategy. The vegetation for much of this site is typical to the west of the headland being woodland dominated by Eucalypt sp., with some Melaleuca sp., *Livistonia decipiens* and wattle. The woodland is common to the region, with specimen plants not evident, consequently the vegetation is not considered to be "of concern" with regard to conservation. Swales will meander throughout the open space network and will serve as an integral part of the stormwater control of the development, forming a major component of the drainage system. They will also form wildlife corridors, serving to connect the mosaic of habitats which will be preserved and protected throughout the Hummock Hill development.

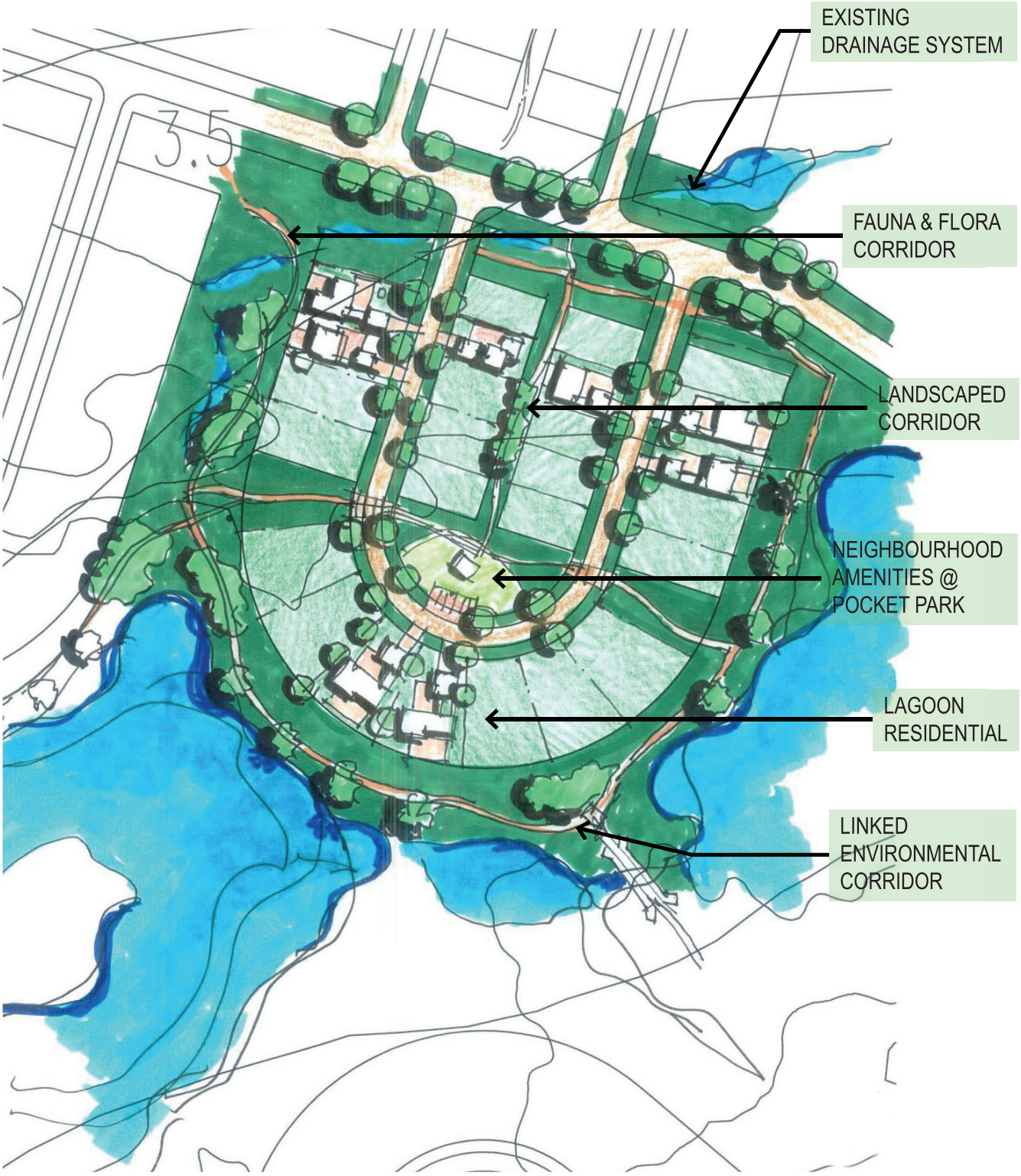

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Figure 3.11 - Lakeside Villas Housing Concept Plan

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Similar to other residential areas within the development, it is intended that the street scaping here shall include random copses of native street trees, under-planted with indigenous groundcovers. Buffer zones between allotments and the preserved bushland habitat will be enhanced by weed eradication and revegetation where necessary. Drainage flow paths emulating natural watercourses will be created between allotments. These watercourses will be stabilised with on-site rock where necessary, and planted with native grasses and tubestock to replicate natural, dry creeks. They will help to retain stormwater in rain events, maximising its benefit to the immediate environment, and preserve open space linkages throughout the precinct.

Within allotments, building covenants will be created to ensure that outside the building footprint, clearing of significant native vegetation will not be permitted prior to approval being attained from the appropriate authority. This will assist in enhancing the native bushland setting of the residential precinct of the Island. It will further serve as the major initiative in habitat retention. A pathway network with public access to seating and viewing areas will be created to a limited portion of the lagoons within the public open space. This will ensure that the area will be able to be appreciated by residents and visitors to the Island while being protected for the benefit of the Island ecology in the long term.

3.3.3.19 Tourist Park

The Tourist Park is located on the western boundary of the site, abutting the tidal wetlands to the south. The vegetation of the site is typical to the west of the site. The existing woodland is dominated by Eucalypt sp., with some Melaleuca sp., *Livistonia decipiens* and wattle. The woodland is common to the region, with specimen plants not evident, consequently the vegetation is not considered to be "of concern" with regard to conservation. The Tourist Park will provide a unique Hummock Hill Island "eco-tourism" experience for the holiday maker. A budget, family oriented camping ground offering a low-cost holiday option. Facilities are expected to include tent and caravan sites and associated amenities.

With the retention of a large percentage of the natural landscape, the tourist park offers a camping option with an ecologically integrated approach. The intent of the landscape in this precinct is to offer the visitor an insight into the beauty of the ecology of the Island by displaying the innate aesthetic qualities of the local flora. Sites will be located wherever possible to keep as much of the existing vegetation in tact as practicable. This will benefit not only the indigenous ecology, but the retention of the canopy will also assist in the shading of the sites. Only local provenance species will be selected for landscape works. Irrigation harvesting will be undertaken from hard surfaces within the park for the planting to the surrounds of the common buildings. Irrigation to the balance of the landscape will be minimised to replicate local conditions.

3.3.3.20 School Recreational Camp Ground

The site for the School Recreation camp lies on the western boundary of the site, mid-way between, the beachside resort and the tourist park. Reserved for schools, sporting teams and the like, this area provides camping and associated facilities similar to the Tourist Park but also caters for recreational needs with a sporting field and associated ancillary buildings. The site has the potential to maximise the educational opportunities of the natural resources and environment of Hummock

Hill Island. The vegetation of the site is typical to the west of the site. The existing woodland is dominated by Eucalypt sp., with some Melaleuca sp., *Livistonia decipiens* and wattle. Although grazing is not recorded in this area, the woodland is common to the region, with specimen plants not evident, consequently the vegetation is not considered to be "of concern" with regard to conservation.

The school recreation camp mirrors the principles outlined in the Education/ sporting precinct strategy. The intent of the landscape in this precinct to encourage and inspire the visiting children to acknowledge and appreciate the ecology of the Island by displaying the innate aesthetic qualities of the local flora. Buildings within the precinct will be sited wherever possible to keep as much of the existing vegetation in tact as practicable. Only local provenance species will be selected for landscape works. Interpretative material will be included landscape for the education of the users. An emphasis will be placed on creating as much shade as possible within the facility.

3.3.3.21 Public Amenities

Located at strategic points throughout the development public amenities consist of infrastructure and facilities such as boat ramps, BBQ areas, beach access points, toilets, playground and a lookout.

Education and sports facilities have been located in an area of grassy woodland on the hinterland side of the proposed town centre. This site is separated from other activities by an encompassing open woodland buffer. Typical of a site west of the headland, the woodland is dominated by Eucalypt sp., with some Melaleuca sp., *Livistonia decipiens* and wattle. Although grazing is not recorded in this area, the woodland is common to the region, with specimen plants not evident, consequently the vegetation is not considered to be "of concern" with regard to conservation. It is the intent of the landscape in this precinct to encourage and inspire the local residents to acknowledge and appreciate the ecology of their island by displaying the innate aesthetic qualities of the local flora. Buildings within the precinct will be sited wherever possible to keep as much of the existing vegetation in tact as practicable. Only local provenance species will be selected for landscape works. Interpretative material will be included landscape for the education of the users. An emphasis will be placed on creating as much shade as possible, within carparks, around sporting fields, and within the school grounds. Best practice sports field design will be undertaken, with an emphasis on hydrology, and limitation of nutrient run-off.

A surf lifesaving club and beach pavilion will be located at the base of the headland near the Town Centre to provide facilities for beach safety and public amenities.

The proposed Town Centre lies in the shelter of the headland, nestled behind the low frontal dune of a shallow, shelving beach. This beach differs significantly to the beach to the east of the headland, as it is protected from wave action by a shallow sand spit. The land has been partially cleared, with the balance being open woodland dominated by Eucalypt sp., with *Melaleuca dealbata*, and wattle. As the retail and holiday accommodation hub of the Island, the town centre will be the focus of a wide range of activities centred on a traditional "Main Street". The landscape of the town centre will reflect the relaxed seaside village character- constructed with high quality materials, with an emphasis on the colour and light of the beach. The "hardscape" of the main street will be constructed with natural, tactile materials such as light coloured stone and weathered

timbers, taking advantage of their ability to look better over time, low maintenance requirements, and ease on bare feet. The "softscape" will be designed for shade and coolness, with shade trees incorporated into the street profile as a dominant attribute of the streetscape. Native trees and palms will form the canopy, complimented with the mass planting of non-invasive, drought tolerant exotic shrubs and groundcovers, combined with hardy varieties of native shrubs and groundcovers. Although a shared precinct, pedestrian movement will take precedence over vehicular traffic. This will be reflected in the design of the pavements and street furniture.

Running the length of the development from south to north along the base of the hills to the east, the central axis road follows an existing track which has remained predominantly cleared for the duration of the occupation of the Island. As the major roadway linking all facets of the development, the landscape treatment of the axis road is a key element in promoting the desired relaxed, natural, seaside resort "feel" of Hummock Hill Island. The street tree planting will be more formalised than on other roadways on the Island to assist with the legibility of the street hierarchy. These street trees will be of a larger species of endemic tree in keeping with the scale of the road, and will be placed at a more regular spacing to create a boulevard. Beyond the street trees, the road reserve and associated open spaces will allow for the planting of copses of endemic shade trees and hardy, native shrubs and groundcovers to mass planted garden beds and medians.

The area to be used as the airstrip lies parallel to, and east of the central spine of the Island. The area has been cleared previously, both for grazing and as an airstrip, and is not of significant ecological conservation value. It is therefore ideally suited to task. At this early stage prior to detailed design, little clearing is proposed to locate the airstrip in approximately its previous location, where the clearing of trees has already been undertaken for this same purpose. Following the design of the airstrip- whereupon the flight paths will be determined- an exclusion zone for the planting of flowering plants will need to be undertaken to lessen the possibility of bird strike. Landscaping to the Airport Services facility will be in keeping with general public facilities/ major roadway landscaping. Planting will consist of copses of endemic shade trees to open spaces; medium sized native street trees; native palms to focal points; and hardy, native shrubs and groundcovers to mass planted garden beds and medians.

3.3.4 Plan of Development

A Plan of Development has been prepared for the proposed Hummock Hill Island Development, consistent with the Miriam Vale Shire Council Planning Scheme. The Plan of Development sets out the approvals frameworks that will apply to the Hummock Hill Island Development, and is consistent with the requirements of planning schemes under the *Integrated Planning Act 1997*. A copy of the Draft Plan of Development is provided in Appendix A2.

The Plan of Development sets up five land use precincts or zones as follows:

- Residential Precincts, including
    - Low Density Residential;
    - Medium Density Residential; and
    - High Density Residential;

- Town and Village Centres Precinct;
- Tourist Precinct;
- Community and Education Precinct; and
- Open Space Precinct, including:
    - Golf Course Open Space; and
    - Conservation and Natural Areas.

The Plan of Development also establishes Development Codes that guide any development on Hummock Hill Island and overlays which describe constraints on development. Each of these is discussed further below.

3.3.4.1 Residential Precinct

Residential development is a component of each of the Master Plan precincts and is the main focus of all precincts except for Precinct 4 (town centre). Figure 3.7 to Figure 3.9 provides concept plans for the various housing types proposed for the Residential Precinct. The Plan of Development achieves the following outcomes for the Residential Precinct:

- The residential precinct is to provide for a range of housing options to meet the individual needs of different household types. The Residential Precinct will include a combination of densities and styles to maximise diversity of the development;
- Single detached dwellings on lots of with a size greater than 700 m^2 is the preferred land use in low density sub-precinct;
- Attached housing comprising cottages and townhouses on lots between 400 m^2 and 700 m^2 are accommodated in the medium density sub-precinct;
- Multiple unit dwellings are accommodated in high density sub precinct;
- Residential development is to be compatible with the landform and vegetation of individual sites;
- To achieve maximum protection of vegetation:
    - a building envelope will be identified to provide sufficient area for building and access purposes;
    - the building envelopes will to the extent possible exclude identified significant vegetation;
    - necessary clearing on lots will be undertaken prior to sale to remove the need for individual owners / builders to undertake any clearing; and
    - subsequent clearing outside of building envelopes will not be allowed unless where identified for bushfire management or emergency services vehicles access;
- The natural shape of the landscape will be maintained by minimising cut and fill;
- All structures, including the dwelling house, recreational structures, pools and water tanks are to be located within the cleared, nominated building area for that site;

- Development is accompanied by sufficient parking to accommodate the needs of residents and visitors;
- Residential areas will be kept fuel free and emergency services access is maintained for bushfire management purposes (including the use of easements);
- Advertising signs in residential areas will be limited particularly temporary signage;
- Houses will use water tanks and recycled water for gardens and other outside usages; and
- Natural water cycles will be maintained.

Some particular requirements of the development plan include:

- Clearing envelopes such that native vegetation is retained on medium and low density lots
- 5 Star energy efficient housing;
- Restrictions on earthworks to minimise impacts on natural contours; and
- Specifications for building appearance to retain high visual amenity and consistency.

3.3.4.2 Town and Village Precinct

The Town and Village Precinct cover the town centre (Master Plan precinct 4) as well as the smaller Boyne Creek village area in Master Plan precinct 9. Figure 3.5 and Figure 3.6 present the Town Centre and Village Centre precincts respectively. The Plan of Development sets up the overall outcomes for these areas as follows:

- The business and administration needs of residents and visitors are accommodated in the Town Centre and Village Centre;
- The Town Centre will provide for low level retail and commercial development, restaurants, cafes, community and professional services;
- The town centre will have a "Main Street" character with an active street frontages as the focus of commercial activity;
- The Village Centre will for the convenience retail needs of the local population and also provide services associated with the Boyne Creek boat ramp and boating activities;
- Quality of the built environment is achieved through a high standard of building design and material selection, compatible signage, extensive landscaping of endemic species, and a streetscape not dominated by car parking; and
- The Town and Village Centres will provide approximately 8,000m^2 of retail and commercial floor space.

Outcomes are specified for visual appearance of buildings as well as the streetscape and community feel of the area. Buildings are required to be energy efficient and maximise natural ventilation. Rainwater and recycled water is required to be used for external uses and non-contact internal uses (toilet flushing).

3.3.4.3 Tourist Precinct

Tourist facilities at the site include a range of accommodation from camping through to resort style hotels. Conference centres and a caravan/camping park with provision for school and youth groups are also envisaged. Camping and cabin accommodation will not allow for long term residents.

Outcomes sought for the tourist precinct are as follows:

- The Tourist Precinct will provide for the tourism aspects of the overall development. The Tourism Precinct is to provide for a range of tourist accommodation types and styles to maximise ability of the proposed development to meet the range of demands in the region.
- The precinct will provide for a headland resort hotel, which is envisaged to be established the earlier stages of the project and will be a focal point for much of the subsequent development. A key focus of the headland hotel will be an interface with other uses of the proposed development including retail, entertainment and recreational facilities.
- Resort style accommodation comprising an approximate total of 500 resort units is provided;
- A beachfront tourist hotel, with approximately 150 units, is provided on the western edge of the Plan of Development Area. The beachfront hotel will not have direct beach frontage so as to adversely affect erosion prone areas.
- A caravan park and camping ground in the south-western corner of the Hummock Hill Island Development. Permanent cabins and on-site caravans are envisaged, however, the camping ground is only intended to provide for visitors and not long term residents.
- Approximately 1,500 m^2 of associated retail and commercial space providing for the personal and retail needs of visitors may be accommodated in the Tourist Precinct;
- The Tourist Precinct may incorporate the provision of community facilities to cater for the needs of residents and visitors; and
- Development within the Tourist Precinct minimises impacts on the natural environment and scenic values of coastal landscape.

3.3.4.4 Community and Education Precinct

The plan of development achieves the following outcomes for the Educational and Community Precinct:

- Educational facilities and community infrastructure are provided for in the Education and Community Precinct;
- Hummock Hill Island is provided with community services and educational facilities to meet the needs of Hummock Hill Island's residential and tourist population; and
- The built form of community uses and education facilities is consistent in scale, height and bulk with surrounding development.

3.3.4.5 Open Space Precinct

Open space includes landscaped parks, sports fields and the golf course (Refer to Figure 3.7). Some open space may double as flood mitigation, for example detention basins in Master Plan precincts 4 and 5 and the lagoon system in Master Plan Precinct 1.

Outcomes sought for the open space precinct are as follows:

- The Open Space Precinct includes the conservation areas, parks, sports fields and golf course.
- The Conservation Sub-precinct is provided to protect habitats and native flora/fauna communities in order to maintain and enhance the Island's biodiversity, landscape values and visual quality, and to provide opportunities for sustainable nature based, recreation.
- The Parkland Sub-precinct is intended to provide for the Island's parks, sports fields and golf course.
- Facilities such as kiosks and small-scale catering premises which complement the use and enjoyment of open spaces may be suitable in some locations;
- Open space areas provide opportunities for sporting clubs, including playing fields, a golf course and associated club facilities in suitable locations;
- Recreational or club facilities do not affect the amenity of adjacent areas, particularly residential areas, via the sensitive design and sitting of facilities and through buffering of facilities from sensitive land uses such as a dwelling house; and
- Recreational activities do not adversely affect surrounding areas or the traffic environment.
- Activities occurring in the Conservation Sub-precinct are low intensity facilities based on appreciation of the natural environment or on nature-based recreation, do not have any detrimental effects on the conservation or scenic values of the area.

3.3.4.6 Conservation and Natural Areas

This precinct consists of undeveloped areas of the Island, near and adjacent to residential areas and will include some minor limited community infrastructure such as:

- Walking tracks;
- Signs including interpretive signs;
- Composting toilets; and
- Car parks.

All such community infrastructure will be subject to assessment by an ecologist and will specify management requirements and corridors to be retained and managed.

The bushland on the summit of the Island has remained relatively unscathed by pastoral activity, with reports of logging for railway sleepers being the only recorded activity. Unfortunately, there are consequently few specimen trees present. Common to all of the hill slopes of the Island, the lack of depth and fertility of the soils has resulted in Eucalyptus woodland lacking significant height-

even at maturity. The hill has significant visual exposure to the surrounding vantage points in the region and has consequently been omitted from the development footprint.

Hummock Hill will be preserved in its natural state, with a long term weed eradication programme in place, and revegetation to take place if required. It is intended that the value of the bushland be promoted to the community via low impact walking trails, interpretative material, and potential lookout nodes at key vantage points. This trail will be located following consultation with the relevant authorities.

Activities occurring in the Conservation Sub-precinct will be low intensity facilities based on appreciation of the natural environment or on nature-based recreation occurring in the Zone, do not have any detrimental effects on the conservation or scenic values of the area. Overall outcomes for the Conservation Zone will be consistent with those for the Open Space Precinct in Section 3.3.4.5.

3.3.4.7 Development Controls

For Hummock Hill Island, a comprehensive set of controls and guidelines for living within the natural environment will be produced. These are likely to include:

- Building envelopes on larger lots requiring retention of vegetation outside the area designated for construction of houses and outbuildings
- Conservation covenants or similar controls over land of high conservation significance
- Guidelines advising on preferred landscaping species and maintenance of remnant vegetation on and adjacent to residential lots.

The Plan of Development for the proposed Hummock Hill Island Development is presented in Appendix A2. This includes Hummock Hill Island Plan of Development Codes and also calls up Planning Codes from the Draft Miriam le Shire Panning Scheme for each of the Precincts established for Hummock Hill Island.

3.3.5 Land Tenure

3.3.5.1 Current Land Tenure

Current land tenure for the Proposed Hummock Hill Island Development is Lot 3 on FD841442, subject to a Special Lease SL/52155 (Refer to Figure 3.12). Conditions of the Development Lease include the right to make land within the Development Lease freehold, subject to the lease conditions.

The proposed development will take place entirely within Lot 3 on FD841442 with the exception of a proposed public boat ramp and access road on Lot 1 on FD841442, currently unallocated State Land. The special development lease requires that development approvals be substantially progressed by November 2006 (extended by 1 year to 2007).

The Island consists of 11 Lots as described in Table 3.5. Erosion prone areas and estuarine wetland buffer zones adjacent Boyne Creek, Yacht Creek and Sandfly Creek are located on separate land tenure from Lot 3 and the Special Lease.

Table 3.5 – Lot and Plan Descriptions for Hummock Hill Island and Access Road

Lot No.	Plan	Area (Ha)	Location
Hummock Hill Island			
1	FD841442	310	Western Section of the Island
2	FD841442	30	Tidal area west of the northern headland
3	FD841442	1160	Central section and proposed development area
4	FD841442	560	Eastern end of the Island
5	FD841442	7	Tidal Flat area at E end of Yacht Creek
6	FD841442	-	Tidal flat area east of Lot 3
7	FD841442	12	Erosion prone area behind North Beach
8	FD841442	28	Erosion prone area behind Main Beach
9	FD841442	30	Buffer zone east of Lot 3 next to Sandfly Creek
10	FD841442	100	Buffer zone along southern edge of Lot 3
11	FD841442	15	Buffer zone between Lot 3 and Yacht Creek
Land Adjacent to Clarks Road			
1	USL43258	2.46	Small island at the end of Clarks Road
6	SP129343	114	East and North of Clarks Road
7	SP100501	681.1	East of Clarks Road
8	SP100501	665.62	West of Clarks Road

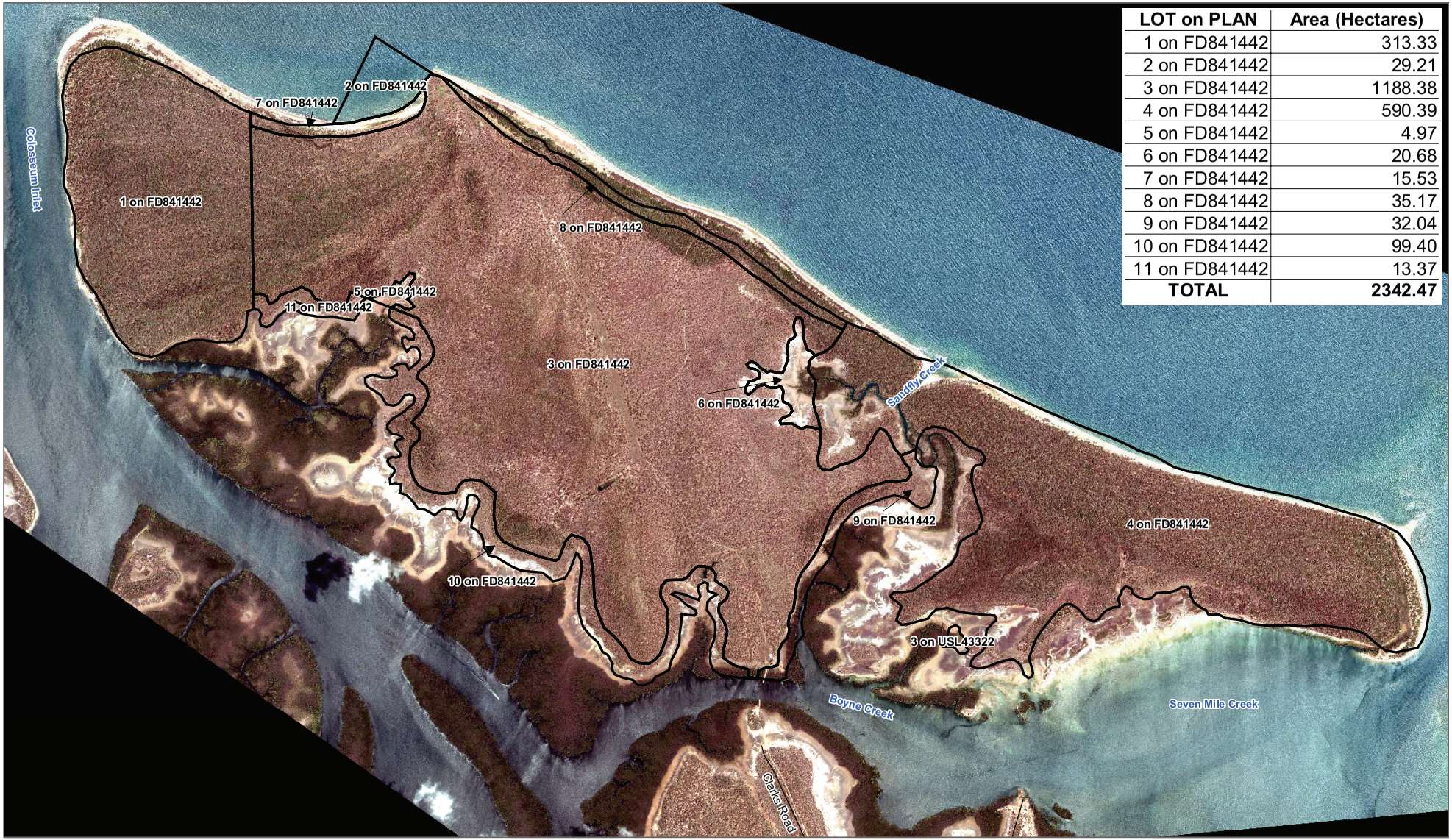
It is noted that Clarks Road is currently nominated as a dedicated road reserve extending from Foreshores Road to the current causeway. This will be extended to cover the bridge across to Hummock Hill Island. Native title has been extinguished over Lot 3 (development lease) and an approved cultural heritage management plan is in place. Infrastructure such as the bridge and road corridors will be dedicated as road reserves and thus not subject to Native Title.

3.3.5.2 Proposed Land Tenure

All land to be developed for tourism, industrial, commercial and residential use (including the golf course) is proposed to be held under freehold title. A number of these freehold precincts may be further sub-divided and developed under group or strata title. All land developed for public facilities including roads, drainage, water supply, power, sewerage, solid waste, public parkland, beach access, public boat ramps, educational facilities will be dedicated to the Local Government Authority. Management arrangements are discussed in more detail in Section 3.6.3.

A buffer of open space will be maintained around the fringes of the development except where the development aligns with the edge of the lease. The developer will maintain this open space until completion of development in each precinct and for 12 months after completion. Maintenance will include repair of any damage such as weed invasion that may have occurred during development and establishment of any fire breaks required. Open space will ultimately come under control of Council and funding for maintenance of this will come from rates. Rates are expected to include a levy for open space management that reflects the high level of amenity provided to landowners by this open space.

All areas outside the proposed development footprint/open space buffer will be converted to another leasehold tenure after consideration by Qld DNRW of future uses of this land. Trusteeship and management will be determined at this time.



LOT on PLAN	Area (Hectares)
1 on FD841442	313.33
2 on FD841442	29.21
3 on FD841442	1188.38
4 on FD841442	590.39
5 on FD841442	4.97
6 on FD841442	20.68
7 on FD841442	15.53
8 on FD841442	35.17
9 on FD841442	32.04
10 on FD841442	99.40
11 on FD841442	13.37
TOTAL	**2342.47**

LEGEND

Cadastre

Figure 3.12 - Existing Land Tenure - Hummock Hill Island

This figure must be read in conjunction with the data disclaimers located at the front of this report . The data acquired for this project is known to be of low spatial resolution and as such no representation or warranties about its accuracy, reliability or suitability are given. Assumptions and conclusions made from this figure and the associated data must be made with full understanding of the data limitations. SKM accepts no liability or responsibility whatsoever for or in respect of any use of or reliance upon the figure and the associated data

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N W E S

Hummock Hill

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3.4 Infrastructure

3.4.1 Water Cycle – Water and Wastewater

3.4.1.1 Development Principles

Water and wastewater are examined together, reflecting modern approaches to water cycle management, where wastewater is as much a resource as freshwater.

Management of the water cycle for the proposed development is critical to managing environmental impacts and achieving sustainability. Impacts of inappropriate harvesting of water and disposal of poor quality wastewater are particularly significant for this development as the most sensitive natural environmental features of Hummock Hill Island are its coastal wetlands and the surrounding Colosseum Fish Habitat Area and Great Barrier Reef Marine Park and Coastal Marine Park.

Relevant targets and development principles are summarised in Table 3.6.

Table 3.6 – Water Cycle Design Objectives

Design Objective/Development Principles	Response
Limited reliance on water resources from the mainland	Supply of potable water from a small desalination plant combined with rooftop capture and third pipe reticulation of Class A+ treated waste water for non-potable use
Provision of a safe potable water supply that meets Australian Drinking Water Quality Guidelines	Potable water from desalination plant will meet ADWQG
Sustainable utilisation of on-Island water resources to ensure that groundwater and wetland resources are not depleted or degraded	Maximise opportunities for collection of rainwater at the household and commercial level
Maximisation of site based water management including collection from roof catchments and reuse of treated wastewater	Inclusion of rainwater tanks at the household and commercial level Use of treated greywater (Class A+) for irrigation and third pipe reticulation to the household level
Protection of human health and in particular avoidance of exposure to pathogens and coliforms	Use of Class A+ treated water is suitable for intended use as irrigation of public spaces
Minimisation of discharges of treated water to natural systems, with no discharge in dry weather	Wastewater treatment plant will be designed to contain 3 times Average Dry Weather Flows (ADWF) and have a wet weather storage capacity for 3 days in-flow.
Maintenance of a reliable water supply for fire fighting	A 100 ML storage will provide sufficient water for fire fighting purposes

3.4.1.2 Water Supply Demand

The bulk of water supply demand for the proposed development will arise from accommodation units, both tourist and permanent. Types of units range from stand alone houses on varying lot sizes to villas, apartments and hotel rooms.

Internal water consumption for accommodation units in the proposed development includes water used for drinking, cooking, showers, hand basins, toilet flushing, dishwashing and laundry uses. Allowing for water efficient appliances to be installed in all household units and assuming all household units have 100% occupancy, water demands for this component of the development are shown in Table 3.7. External water consumption is an average across the range of household lot sizes. Household sizes are assumed to be 2.2 persons/household for all household units.

Table 3.7 – Water Demands – Household Type Accommodation Units (Source: Cardno, 2007)

Location		Typical Uses	Consumption	
			L/p/d	L/hh/d [1]
Internal	Kitchen	Drinking, cooking	13	29
	Bathroom	Washing hands, cleaning teeth, shower	55	121
	Toilets	Toilet flushing	24	53
	Laundry	Washing Machine, hand clothes washing	27	59
	Hot Water	Shower, Dishwashing, hand basins	58	128
External	Garden	Garden irrigation		175
	Other	Car washing, etc		25
Total Use			177	589

It is noted that considerably lower household water consumption can be achieved with strict water restrictions and public education, as is the case in South-East Queensland in 2007, where household use is falling below 140L/p/day. However, this is in response to a severe drought and would be difficult to sustain over long periods of time when drought conditions were not present.

Non-household uses include:

- Units, apartments and hotel rooms, whether occupied by permanent residents or visitors (occupancy rate of 100 % assumed);
- Commercial and retail components, including offices;
- Golf course and other external recreation areas;
- Camp sites; and
- Airstrip.

Non-residential demand calculations are based on rates from the Department of Natural Resources Planning Guidelines for Water Supply and Sewerage (March 2005). The Golf Course irrigation

demands have been based on the sustainable irrigation rates for the site soils (refer also to Section 4). The demand estimates are shown in Table 3.8.

Table 3.8 – Non Household Water Demands

Location	Typical Uses	Category	Rate (daily)	Demand (kL/day)
Golf Course	Irrigation of course	External	14 kL/ha	630
	Club House - Toilet flushing	Internal	150 L/100sqm	0.45
	Club House - Drinking, cooking, showers, etc	Internal	350 L/100sqm	1.05
Hotels	Irrigation of grounds	External	5 kL/ha	10
	Toilet flushing	Internal	50 L/room	15
	Hot water	Internal	130 L/room	39
	Drinking, food prep, etc	Internal	120 L/room	36
Education campus	Irrigation of grounds	External	5 kL/ha	10
	Toilet flushing	Internal	15 L/student	6
	Drinking, food prep, etc	Internal	35 L/student	14
Airstrip	Irrigation of strip and surrounds	External	As required	0
	Facility use	Internal	200 L/100sqm	0.4
Tourist Park	Drinking, food prep, toilet flushing,	Internal / External	300 L/site	60
School Camping Ground	Drinking, food prep, toilet flushing, showers	Internal / External	150 L/site	4.5
Town Centre		Internal / External	500 L/100sqm	23.15
Marine Centre & Retail		Internal / External	500 L/100sqm	4.4
Resort & Other Retail		Internal / External	500 L/100sqm	9.5
Boyne Channel Offices		Internal / External	250 L/100sqm	0.75
Total Non Residential Demand				865

(Source: Cardno, 2007)

In terms of water demands for the proposed development, three levels of water quality have been identified, being:

- Potable water, that meets Australian Drinking Water Guidelines (ADWG);
- High contact water, where water does not need to meet ADWG but must be low in human health risk factors such as pathogens; and
- Irrigation water, where some human contact occurs and where environmental risk factors such as nutrients and heavy metals become important.

The estimated demand for each of the above classifications are detailed in Table 3.9, based on an ultimate development population of 4,019.

Table 3.9 – Quantity of Water Required

Required Quality	Demand (kL/d)	Annual Demand (ML/yr)	% of Total
Potable	441	161	23%
High Contact	556	203	29%
Irrigation and toilets – low contact	897	328	47%
Total	1894	691	99

Less than one quarter of the total demand for the development is for potable supply. This provides the opportunity to supply over 75% of the water requirements for the development from Class A+ recycled and untreated sources of water such as rainwater tanks.

3.4.1.3 Wastewater Generation

Wastewater is the liquid waste matter from commercial, industrial and domestic sources. While traditional management of wastewater treats all wastewater as one stream, management options can be broadened significantly if wastewater is separated into component streams, typically greywater, blackwater and industrial wastewater as follows:

- Greywater is wastewater from household bathrooms and laundries. It contains cleaning products such as soaps and detergents, which may also be high in phosphorous, but is not contaminated with human wastes or pathogens (unless babies' nappies are being washed).
- Blackwater is proportion of the wastewater that contains human wastes or food wastes, typically arising from toilets and kitchen sinks. It contains high levels of nutrients and bacteria/pathogens.
- Industrial wastewater can have widely varying properties depending on the type of industry. At Hummock Hill Island, the only likely industrial activities are related to car and boat servicing, where volumes of wastewater generation are low and the main contaminant in wastewater is hydrocarbons. Note that if carwash facilities were provided, these would be of the modern type where water/wastewater is fully re-circulated.

Blackwater and greywater flows are calculated in Table 3.10 on the following basis:

- For residential properties, sewage flows include all internal uses (177 L/p/d based on Table 3.7);
- Residential greywater flows are based on the internal uses excluding kitchen and toilet wastes (140 L/p/d based on Table 3.7);
- For non-residential properties, sewage flows include 100% of internal usage. Where separate internal and external water demands have not been identified, sewage flow represents 80% of the total water consumption; and

- Non-residential greywater flows include 90% of internal flows, or 80% of the total water demand where internal demands have not been specified (Cardno, 2007).

Table 3.10 – Blackwater and Greywater Volumes (Source: Cardno, 2007)

Category	Blackwater kL/d	Greywater kL/d	Total Sewage kL/d
Residential	156	591	747
Non-Residential	19	160	186

Industrial wastewater, i.e. wastewater from boat and car servicing is not included in these calculations as quantities are low. These wastewater streams will be treated on site prior to collection by a waste contractor.

3.4.1.4 Water Supply Strategy

The overall strategy for water supply to the proposed Hummock Hill Island Development is one of self sufficiency and independence from mainland supply. A number of options were evaluated for water supply as summarised in Section 4 (Alternatives chapter) and are also provided in detail in Appendix A7.1 (Cardno, 2007).

The preferred water supply system for the proposed development is an integrated system comprising of:

- Rainwater tanks for non-potable household uses (shower, laundry);
- Rainwater can be used for potable uses (drinking, kitchen) if UV or filtration units are installed at the tank; this will be optional for all households.
- Recycled water from treatment of wastewater is used for toilet flushing and all external uses;
- Recycled water is also used for irrigation of public open space and the golf course;
- Potable water (drinking and kitchen) and/or top up of rainwater tanks are provided from a small desalination plant. Desalination water will be circulated in a reticulation system throughout the proposed development; and
- Mandated water efficient devices are installed in all buildings.

A particular advantage of the integrated system is that it is only partly dependent on rainfall, and thus much less vulnerable to extended drought conditions than systems relying on capture of rainwater, either in dams or tanks. In the event of a prolonged drought, water restrictions may be required as rainwater tanks run dry, however, the desalination plant combined with water recycling would allow most uses of water to be maintained in particular potable water.

Water management is emphasised at a household level, such that households are responsible for balancing water use and supply. Desalination water will be priced in accordance with the cost of production, thus encouraging residents and business operators to rely more heavily on rainwater.

The three main components of the integrated system are discussed in more detail below.

Rainwater Tanks

The water supply strategy seeks to maximise supply from rainwater tanks as energy efficient and sustainable means of supplying water to the proposed development. However, 100% rainwater supply is considered impractical for the entire development. In order to achieve the required level of reliability at this location, tank sizes would be impractically large for normal size residential lots and townhouses, with 140 kL tanks required to meet reliability requirements. Much larger tanks would be required for commercial, apartment and hotel components of the proposed development.

Cardno (2007) has calculated that, for a standard residential house, a 45 kL rainwater tank will provide about 215 ML/day reliably. In wetter years, it would provide a much higher yield. A 22 kL tank would provide about 120 L/day at the same reliability level; this tank size is considered appropriate for a townhouse. Minimum tank sizes will be mandated for all residential properties (whether permanent or visitor accommodation) based on the above volumes and a consideration of roof size. Individuals may install larger or additional tanks at their discretion and will benefit from reduced water costs if reliance on alternative supplies is reduced. Tanks of this size are typically installed underground. Note that this is consistent with the current requirement of Miriam Vale Shire Council for a minimum 22 kL tank to be installed in each new residential property.

For commercial properties, hotels, apartments and similar high density accommodation, larger tanks in the order of 3-5 ML will be required and will be installed underground during building construction.

Final tank sizes for all components of the development will depend on lot size and roof area and will be subject to design rules to be imposed on all buildings in the development.

Rainwater tanks are not suitable for potable water unless fitted with a disinfection or filtration system. Installation of individual filters and/or UV units to rainwater tanks will be at the discretion of individuals. This, combined with larger tank sizes, will reduce reliance on the proposed potable water supply system, and hence, reduce costs associated with water consumption.

Desalination

It is proposed that the required 441 kl/d potable water requirement (at full capacity) will be derived from a small desalination plant. Desalination produces potable quality water from seawater (or brackish water). For a small scale application such as Hummock Hill Island, a Mechanical Vapour Compression (MVC) desalination process has been selected as most appropriate technique. This type of desalination plant uses the principles of a heat pump to evaporate and then condense water, separating salt water into freshwater and saline concentrate streams. The heat transfer and recovery system is very efficient for this scale of application, with energy consumption in the order of around 10 kWh per kilolitre of water produced.

MVC is the second most popular desalination technology used in Australia, behind reverse osmosis, and is particularly well suited to small scale applications. At the scale required for the Island, energy consumption is comparable to reverse osmosis.

Other advantages of MVC for this application are:

- Pre-treatment requirements are minimal and requirement for chemical addition is also minimal compared to most other water treatment technologies involving both desalination and conventional treatment;
- Operation is simple and low maintenance;
- Reliability is very high;
- Product water quality is very high;
- Production rate can be varied to suit demand;
- The plant is easy and quick to power up and down and can be shut down without any special requirements; and
- Corrosiveness of product water can be managed through blending small quantities of unprocessed feedwater or concentrate rather than addition of chemicals.

The desalination plant will be located in the industrial zone, near the entrance to the Island adjacent to the Village Centre Precinct as shown in Figure 3.6.

The overall MVC process proposed for desalination at Hummock Hill Island is as follows:

- Seawater will be extracted from Boyne Channel via a seawater intake pump located on the northern (Island side) pier of the bridge. The pump will be programmed to pump seawater during the upper half of the tidal cycle to ensure a consistent quality of raw water. A stainless steel submersible pump will be screened to prevent the ingress of debris and organisms into the pipeline. Flows into the pump will be quite low compared to currents in the Boyne Channel and are not expected to entrap marine organisms;
- Raw seawater will be pumped to a 1 ML settlement and hydraulic balance tank at the desalination plant site;
- From the balance tank, the water is pumped through a filter to remove suspended solids/particulates from the feedwater that would otherwise foul the pipe work and heat exchangers. The filter is self cleaning and a small volume of sludge is generated from cleaning. The sludge consists of particulate matter from the marine environment and will be disposed of at landfill (refer to Section 10). Filter backwash water will be returned to the balance tank;
- Filtered feed water is pumped through a de-aerator to remove oxygen and other gaseous components that may affect condensation;
- Filtered feedwater is pre-heated in heat exchangers using waste heat from the product and concentrate streams;
- Preheated feedwater is then pumped to an evaporator where it is heated to a temperature which allows evaporation of fresh water as water vapour (steam). Heat from the water vapour is then recovered by compressing the vapour; this causes it to condense and give up heat energy in a condensing heat exchanger. This heat is then reused to heat untreated feedwater to boiling point;

- Condensate, or distilled water, is cooled by reducing pressure; heat from the cooling process is captured for preheating of raw water;
- The "salt" component of the feedwater is left behind in the evaporation process and removed as concentrate; this is also hot when removed and is cooled through a heat exchanger so that heat can also be reused to preheat feedwater. Concentrate has exactly the same chemical composition as seawater except that each component is about twice as concentrated. No chemicals are added to the concentrate, and no chemical transformations take place during the MVC process;
- Condensate (product water) is fed into two batch testing tanks where automatic testing of the treated water can be undertaken to ensure quality;
- Once tested for quality, product water is pumped to a1 ML potable water storage. This storage will be covered and will be located at approximately 110 mAHD to allow gravity feed of reticulated water supply throughout the proposed development. Reservoir location is shown on Figure 3.4 and has been selected to minimise visual impact;
- As with any reticulated water supply, chlorination will be undertaken to control bacterial levels. Emerging technology allows manufacture of hypochlorite from the concentrate stream; this would avoid the need to transport and store hypochlorite (GHD 2003). This option will be investigated as part of the detail design phase; and
- Concentrated brine (850 KL/day) will be discharged to a series of evaporation ponds located adjacent to the desalination plant as shown on Figure 3.6. The concentrated solution water will be naturally evaporated leaving a residue of crude sea salt which requires intermittent removal. The required area of each evaporation pond would be approximately 6,000 m^2 or approximately 80m x 80m. By utilising the natural evaporation pond there is no requirement for discharge of concentrate back into the estuary or the ocean. Sea salt collected from the evaporation ponds may be disposed of at landfill, and will also be suitable for commercial processing if a suitable arrangement can be made with a commercial salt manufacturer. Evaporation ponds will be lined to prevent leaching of saline concentrate to groundwater or leakage to surface waters. The ponds will be designed to contain rainfall events up to the Q100 event (approx. 13 mm). If salinity levels in the ponds are equal to or less than seawater due to dilution by rainwater, the water will be released to Boyne Channel via a release point as shown on Figure 3.13.

The MVC process is summarised in Figure 3.13. Appendix A7.1 contains product information for MVC systems; note that this does not imply that the particular systems depicted in the product information will ultimately be selected for Hummock Hill Island, but is included for information.

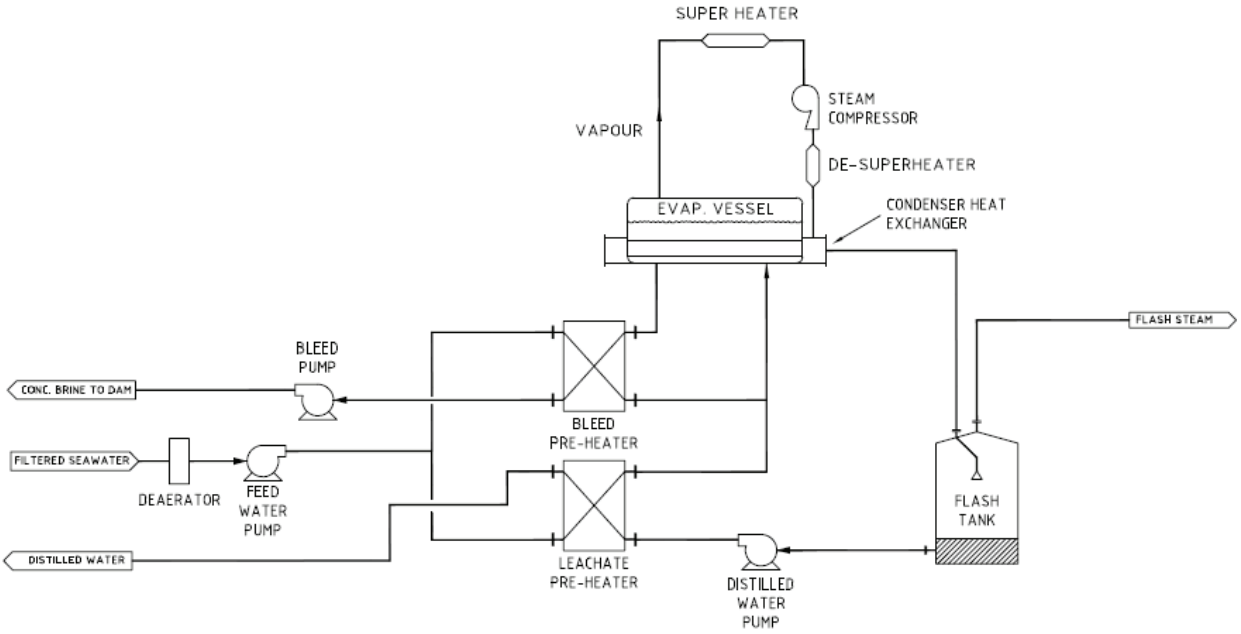


Figure 3.13 – Process Diagram for MVC Desalination Process (Source: MPI, 2007)

The proposed desalination plant will be classified as an Environmentally Relevant Activity (ERA) 16 as prescribed in Schedule 1 of the *Environmental Protection Regulation, 1998*. Application for a Development Approval (and associated Registration Certificate) will be lodged once detailed design is conducted. Matters to be resolved during detailed design include:

- Exact capacity of the MVC plant, storage tanks, pipework and other fittings;
- Detailed characterisation of feedwater;
- Potential for hypochlorite to be manufactured from concentrate; and
- Blending requirements to stabilise corrosiveness in the product water.

Recycled Water

The final stage in the integrated water management cycle for the proposed development is recycling of wastewater (grey water and black water) for use in:

- Toilet flushing;
- External uses such as car washing and garden watering;
- Irrigation of golf course and public open space, as a lower priority; and
- Fire fighting.

Class A+ water will be produced from greywater and blackwater using a mechanical treatment process combined with nutrient removal and filtration. This technology is already in use in the region and is discussed further in Section 3.4.1.5. Water quality from this process meets the requirements set out in the Queensland Water Recycling Guidelines and is shown in Table 3.11.

Estuarine water quality indicators from the Queensland Water Quality Guidelines are also included as there may occasion where recycled water is released to surface waters (refer Section 3.4.1.5) such as during long periods of rain or major storm events.

Table 3.11 – Recycled Water Quality Requirements

Parameter	ADWG Standard	Qld WQG (Estuarine)	Recycled Water Quality
BOD_5	< 20 mg/L	-	< 5 mg/L
Suspended Solids	< 5 mg/L	-	< 5 mg/L
Ammonia as N	< 0.5 mg/L	0.008 mg/L	< 0.5 mg/L
Nitrogen – Total N	< 50 mg/L	0.2 mg/L	< 4 mg/L
Phosphorus as P - Total	0.2 mg/L	0.02 mg/L	0.2 mg/L
pH	6.5 – 8.5	8-8.4	6.5 – 8.5
Total ClO_2 in Reclaimed Water Storage	1 mg/L	-	> 0.2, < 0.6 mg/L
E. Coli	<1000 per 100 mL	NA	<1 in a 500 mL sample
Faecal Coli Form	< 100 per 100 mL	-	< 1 in a 500 mL sample
Colour	< 15 TCU	-	< 2 TCU (Nitrogen)

The Class A+ recycled water will be delivered throughout the development via a separate reticulation system from a fully enclosed recycled water tank located adjacent to the potable water storage tank. Tank capacity is a nominal 1 ML (i.e. about 1 day's supply), with final capacity to be determined in detailed design stage.

Additional uncovered storages will be provided at the golf course and air strip for water in excess of residential/tourism/commercial demands. These will be unlined or compacted clay lined as infiltration of Class A+ water to groundwater beneath the golf course does not generate a contamination risk. This water will be used for irrigation of the golf course and nearby airstrip.

Fire fighting water will be drawn from the recycled water supply system as the quality is very good in terms of human health risks. The need for additional dedicated fire fighting storage and fire hydrants will be assessed during detailed design and input from local emergency services will be sought.

The Queensland Recycled Water Guidelines require a recycled water management plan to be prepared in accordance with processes and standards established in these guidelines. The process for developing a recycled water management plan is set out in the Guidelines as follows:

- Establish a suitable qualified and experienced risk assessment team, representative of the range of risks likely to be associated with the recycled water system;
- Fully describe the recycled water system, including all possible points of exposure for human and environmental receptors;
- Identify hazards and evaluate risk associated with each hazard;

- Determine appropriate controls, including process controls, quality control and other management measures. Where possible controls should be preventive and based on design mechanisms to minimise risk of human error or accident;
- Establish performance requirements for each control measure and determine appropriate monitoring, measurement and validation processes for each performance requirement;
- Identify corrective actions in the event that performance requirements are not met;
- Prepare management procedures;
- Establish documentation, record keeping, reporting, communications and other system requirements;
- Document in a plan and present plan to stakeholders; and
- Provide for continuous improvement of plan through regular audits and updates.

Operation of the water treatment plant will also constitute Environmentally Relevant Activity 15. This is discussed in more detail in Section 3.4.1.5.

3.4.1.5 Wastewater Treatment

Wastewater generated by the proposed Hummock Hill Island Development will be entirely domestic in nature. As such, it is not expected to contain high levels of potentially toxic constituents such as heavy metals and pesticides. It will however contain pathogens that are harmful to human health and nutrients that may be harmful to some ecological processes.

A package treatment technology has been selected for Hummock Hill Island based on high velocity sonic disintegrator (HVSD) technology that allows production of high quality recycled water as discussed in Section 3.4.1.4 and Appendix A7.1. Water quality produced by this system is shown in Table 3.11. This technology is already being used in the region, at Agnes Water.

Steps in the proposed treatment process are as follows:

- Blackwater and greywater (combined) is pumped via a sewerage system to an anaerobic storage tank at the treatment plant location. This tank is fully enclosed and odour is not released from the plant;
- Wastewater stream passes into a Cell Destruction Unit (CDU) where mechanical processes destroy pathogens by denaturing proteins at a cellular level;
- Grease and oil (e.g. from foods) are removed in an aeration tank;
- The treated water is passed through zeolite filters; and
- Magnesium oxide is added and a crystallisation process is used to remove ammonia and phosphate as “struvite” crystals. Struvite is an ammonium magnesium phosphate ($MgNH_4PO_4$) that occurs naturally in mineral deposits.

This choice of technology is particularly effective at removing pathogens (bacteria, viruses and so on) as it destroys the individual cells, unlike more conventional treatment processes that rely on

physical removal of pathogens from the treatment process. This means that, as well as producing high quality recycled water, sludge and filter residues are not contaminated with pathogens, making them safer for reuse as soil conditioners.

Struvite crystals precipitated from the process has an application as a high quality fertiliser. Zeolite can be regenerated or used as fertilizer based on the removed nutrient concentrations.

A centralised treatment system is the most viable and sustainable treatment option for the small scale of development proposed at Hummock Hill Island. Wastewater (greywater and blackwater) will be collected from households and commercial premises via a reticulated sewerage system. A pump station will be required to transfer wastewater from the northern end of the Island as this will not be able to be gravity fed to the water recycling plant. All premises in the proposed development will be connected to the reticulated sewerage system. Septic tanks will not be allowed as part of the proposed Hummock Hill Island Development.

The water recycling plant will be designed to minimise odours. In particular, inlet works and digesters with odour scrubbing facilities are fully enclosed, allowing effective capture and management of odorous compounds arising from untreated wastewater. The proposed location for the recycled water plant is shown on Figure 3.4 and provides for a 100m buffer from any residential properties or recreational areas.

The sewage treatment plant will be sized to cater for an ADWF of 1.0 ML/d with additional storage provided to handle up to 3 times ADWF as per guidelines. It is proposed that the plant will be constructed in two stages of 500 kL capacity each.

The proposed technology has been shown to be very reliable and low maintenance. The plant does not rely on residence time as part of the treatment process; the treatment process takes about 30 minutes. Inlet storage will mean that wastewater can be held temporarily if either of the duplicate plants is undergoing maintenance.

In the event of a breakdown, the wet weather storage can be used to store wastewater that cannot be treated at the duplicate plant. The duplicate plant will be able to “catch up” overnight when wastewater flows are lower. In the unlikely event that both plants are malfunctioning or one plant is unavailable for an extended period of time, tanker trucks will remove untreated sewage for treatment and disposal at mainland facilities operated by Calliope Shire Council or Gladstone City Council.

Back up power will be provided to the water recycling plants and pumping system using diesel generators. Generators will be tested as part of the regular maintenance program to ensure that they activate if required.

With these measures in place, overflow of untreated sewage from the sewerage system or treatment plants will be avoided.

The risk of production of “off specification” recycled water from the HVSD plants is very low as treatment is largely by physical or chemical processes which are much more reliable compared to

biological processes used in conventional wastewater treatment plants. The nature of the wastewater catchment is such that spikes of contaminants are very unlikely; spikes are usually associated with industrial inputs. Also, the recycled water is placed in storages rather then released to the environment, providing further containment in the event of any problems being detected by on-line monitoring systems.

The proposed HVSD recycled water treatment plant is quite tolerant to small quantities of household chemicals, paints, oil and similar, however householders will be educated not to dispose of these substances to sewer. Householders and visitors will received an information package on management of the sewerage system and appropriate disposal of household hazardous chemicals.

The proposed water recycling plant will constitute Environmentally Relevant Activity 15d or 15h. As such, it will require a Development Approval for Material Change of Use under the *Integrated Planning Act 1997*. Application for this Development Approval will require provision of operation and maintenance procedures for the water recycling plants and sewerage system. A similar water recycling system has already been approved and is in operation at Agnes Waters.

3.4.2 Water Cycle – Stormwater

The proposed stormwater management strategy for the proposed development will use Water Sensitive Urban Design (WSUD) for all aspects of stormwater control associated with the development. The overall objective of stormwater management will be to maintain existing water quality and nutrient loadings of existing natural systems on and around the Island (refer to Section 8 and 9).

Healthy Waterways, in their Technical Design Guidelines (2006), describe WSUD as an internationally recognised concept that offers an alternative to traditional development practices. WSUD is a holistic approach to the planning and design of urban development that aims to minimise negative impacts on the natural water cycle and protect the health of aquatic ecosystems. It promotes the integration of stormwater, water supply and sewage management at the development scale. Development principles for the proposed Hummock Hill Island Development are outlined in Table 3.12.

Table 3.12 – Design Objectives for Stormwater Controls (after Cardno, 2007)

Design Objective/Development Principles	Response
Protect existing natural features and ecological processes	Utilisation of stormwater treatment trains that maintain hydraulic flows and existing water quality within ephemeral watercourses in the Island, thus protecting sensitive receiving environments at watercourse discharge points
Maintain the natural hydrologic behaviour of catchments	Hydraulic characteristics of existing ephemeral watercourse catchments will remain unchanged
Protect water quality of surface and ground waters	Stormwater controls will maintain current ephemeral watercourse water quality objectives and adjacent estuarine water quality objectives
Minimise demand on the reticulated water supply system	Collected stormwater can be used as a back-up irrigation water supply minimising treated water demands

Design Objective/Development Principles	Response
Minimise sewage discharges to the natural environment	Treated sewage (Class A+) will be used for irrigation purposes and non-potable uses via third pipe reticulation
Integrate water into the landscape to enhance visual, social, cultural and ecological values	Stormwater treatments will be incorporated into the final masterplan of the proposed Hummock Hill Island Development. Treated stormwater will be discharged into existing ephemeral watercourses as required by the Special Lease.

3.4.2.1 Water Sensitive Urban Design

A stormwater management system has been designed for Hummock Hill Island that achieves the targets and development principles set for the proposed development, including protection of the natural environment, and provision of high quality urban infrastructure.

Hummock Hill Island has no permanent (perennial) fresh watercourses and few defined drainage lines. Catchments and subcatchments on the Island are quite small, generally less than 2 km^2 within the lease area. The most well defined drainage line flows between the two ranges of hills on the Island and has been dammed in the past, presumably to supply water to cattle grazing activities. Another small dam has been created south of "Boyne Hill", the smaller peak on the southern side of the Island. Stormwater on the western end of the Island infiltrates quickly into sandy soils while, to the east of the main range, drainage is either directed to the largest dam and then to a tidal inlet of Boyne Creek or to Sandfly Creek north-east of the airstrip. The development concept for Hummock Hill Island has been developed to avoid any changes to the hydrology or water quality of these areas.

Principles of Water Sensitive Urban Design (WSUD) have been applied to stormwater management for the Island. WSUD is now recognised as international best practice, providing a holistic approach to the planning and design of urban development that aims to minimise negative impacts on the natural water cycle and protect the health of aquatic ecosystems. It promotes the integration of stormwater, water supply and sewage management at the development scale.

Applying these principles to the Island has resulted in a stormwater management system that:

- Incorporates capture of rainwater from rooftops (via rainwater tanks);
- Maintains the hydrological characteristics of catchments/subcatchments;
- Removes those contaminants from stormwater that arise from urban development prior to release to surrounding environment; and
- Integrates water into the landscape to enhance visual, social, cultural and ecological values.

In the proposed development, stormwater originating from all rainfall events of up to the 100-year recurrence interval will be attenuated close to the source, and released in a controlled manner which will resemble the natural drainage rates and pathways existing before development. Attenuation close to source means that stormwater systems can be installed in stages as the development progresses.

Treatment devices, including bioretention basins and swales and permeable pavements, will ensure that pollution originating from the development will be intercepted and removed from runoff, in all storms of up to the three-month recurrence interval (in urban areas, the three-month flows account for approximately 90% of the mean annual runoff). A range of suitable devices was assessed (refer Appendix A7.2 – Stormwater Management). Table 3.13 outlines preferred stormwater control techniques selected as most appropriate for the proposed Hummock Hill Island Development, based on achievement of both quality and quantity targets.

Table 3.13 – Preferred Stormwater Control Techniques (Cardno, 2007)

Device	Description	Function
Bioretention Devices	Combine a grass or vegetated swale with an infiltration trench. Usually on flatter ground, but can be incorporated into steeper areas using terracing or stepped systems. May be located within a retention basin.	Remove high proportion of sediment and nutrients from stormwater Mimic natural infiltration Slow down flow.
Swales (grassed or vegetated)	Broad drains lined with grass or other vegetation, typically along the edges of roads or following contours.	Slow and direct flow but also remove sediment and nutrients in lower rainfall events. Aesthetically pleasing compared to concrete drains. Grass cover avoids erosion of drainage lines. Effective on relatively flat slopes or when following contours.
Porous Pavements	Pervious surfaces which allow stormwater to penetrate may be underlain by storage zones or allow natural infiltration. Used under paved areas, footpaths, cycleways and lightly trafficked roads.	Effective in capturing stormwater from areas such as public spaces, footpaths, cycle ways, thus avoiding concentrated flows from these features. Allow collected stormwater to be treated before direction to surface flow systems.
Rainwater tanks	Household level and for hotels and commercial buildings.	Captured roof water counters the effects of decreased stormwater infiltration due to impermeable surfaces which otherwise tends to increase stormwater flows in developed areas. Integrates with water supply system (refer Section 3.4.1.4). Have some effect in reducing nitrogen levels in runoff.
Ponds and wetlands	Constructed pond and wetland systems located within the golf course (golf course ponds will also contain recycled water for irrigation).	Attenuate quantity of stormwater flow. Polish stormwater quality, removing sediment and nutrients. Store irrigation water for use across the site. Provide for public amenity and wildlife habitat.

In order to address drainage requirements for the proposed development, it has been broken up into zones. This allows stormwater management to be matched to existing drainage patterns, and also for attenuation at source. Table 3.14 describes existing and proposed stormwater treatment for each drainage zone.

Table 3.14 – Proposed Drainage Zones Stormwater Management Options

Zone	Existing Drainage	Proposed development	Proposed Stormwater Treatment
Lagoon (Master Plan Precincts 1, 2 and 3) 98.3 ha	Flat to undulating sand ridges, sandy soil with high infiltration rate. Few defined drainage lines, no wetlands. Defined drainage line parallel to northern beach, drains to west but no defined outlet (would wash out in rain events).	Low to medium density houses and villas, tourist park, beachfront tourist hotel.	Central ornamental lake/lagoon system providing habitat and polishing of stormwater. Lagoon will be lined to prevent excessive infiltration. Bioretention swales along all roads drain to lagoon. Overflow channel from lagoon to north beach, using existing drainage line. Rooftop catchments partially compensate for decreased infiltration.
Bay (Master Plan precinct 3) 8.2 ha	Flat sandy soils. Existing drainage channel to south which drains to west, beach to north.	Beachfront holiday homes on either side if a minor road.	Lined bioretention swales with sandy loam filter on each side of road draining to existing channel. Minor works to existing channel to stabilise, using natural materials. Rooftop catchments partially compensate for decreased infiltration.
Town and Headland (Precincts 4 and 5 on Master Plan) 49.3 ha	Flat to gently sloping sandy soils with high infiltration rate. No defined drainage lines, no wetlands. Rises to steeper headland in West with rockier soils and lower infiltration rates. Minor drainage to west beach (west of headland). Existing (dry) drainage channel parallel to northern beach conveys some flows west, remainder discharges overland to northern pr western beach or via southern drainage path towards airstrip and ultimately Boyne Channel.	Commercial town centre, resort hotel, conference centre, motel, parks/ landscaped areas. Seaside cottages and beachfront holiday homes. Educational and sporting facilities. Large proportion of impermeable areas in town.	Permeable paving on roads and paths, underlain by filter media and impermeable membrane. Central bioretention basin system which forms part of landscaping and drains to beach/rocky area south of headland via controlled discharge. Southern part to be conveyed along natural contours past the airstrip to estuarine discharge point south of Island. Rooftop catchments partially compensate for decreased infiltration.

Zone	Existing Drainage	Proposed development	Proposed Stormwater Treatment
Hummock Hill (Master Plan Precinct 6) 31.19 ha	Many drainage lines on west face of slope draining directly to estuary/Boyne Channel. Fewer drainage lines on east face draining to airstrip and flat low-lying areas to north and east. Existing dam to south	Ridgetop houses, hillside terraces on east facing slope, no development on west facing slope. Main road along toe of east facing slope, also ridgetop road. Golf Course resort apartments at southern end.	Treatment swales along ridgetop road and main road (bottom of slope). Swales drain south to existing "main reservoir" (which will be repaired) to provide storage during storm events. Flows above Q100 drain east and west down slope. Rooftop catchments partially compensate for decreased infiltration.
Boyne Hill (Master Plan Precinct 7) 24.5 ha	Drainage down sides of hill then flows south to estuary.	Ring road following contours around ridge, apartments and hillside terraces following ring road.	Lined bioretention swale. Drainage directed to existing "main reservoir" (which will be repaired). Emergency (over)flow routes via existing drainage channels down slope. Rooftop catchments partially compensate for decreased infiltration.
Boyne East and West (Master Plan Precincts 8 and 9) 59.83 ha	North-eastern part drains north-east to low lying land, possible connection to minor estuary and open coastal waters in high rainfall events. North-western and south western parts drain to existing dams. These are the only clearly defined drainage features in this zone. Southern portion drains to estuary.	Golf course Golf course resort apartments and home sites. Hillside terraces and apartments.	Lined bioretention swales with underlying sandy loam filter. Flow routed to golf course lagoons. Lagoons may be lined – to be determined in detailed design depending on existing infiltration rates. Drainage from southern end of Precinct 9 to follow existing drainage lines on either side of the knoll. Rooftop catchments partially compensate for decreased infiltration. Emergency overflows from golf course lagoons to north-east; lined as necessary to protect conservation zone from infiltration.

3.4.2.2 Water Quality

Current existing water quality for waters within and surrounding Hummock Hill Island are discussed in detail in Section 8 and 9 respectively for freshwater and estuarine and marine waters. In summary:

- Turbidity levels within estuarine and coastal waters around the Island exceed the respective Queensland Water Quality Guidelines (2006) for the Central Coast Queensland Region by up to 18 times in coastal waters and 5 times in enclosed estuarine waters;
- Ammonia concentrations within estuarine and coastal waters exceed the respective Queensland Water Quality Guideline (2006) for the Central Coast Queensland Region by up to an order of magnitude;
- NOx (Nitrate and Nitrite) concentrations in both open and enclosed coastal waters exceed the respective Queensland Water Quality Guideline (2006) for Central Coast Queensland Region; and
- Phosphorous levels in estuarine and enclosed coastal waters around Hummock Hill Island exceed the respective Queensland Water Quality Guideline (2006) for Central Coast Queensland Region by 3 to 4 times.

It should be noted that these results do not necessarily indicate degraded aquatic ecosystems as there can be a wide range of nutrient and turbidity/suspended solid levels in healthy ecosystems particularly at the site specific level. Ecosystems may adapt to higher levels of nutrients and/or suspended solids particularly in estuarine systems. It should also be noted that estuarine and enclosed coastal waters are naturally nutrient rich environments and this contributes to the productivity of these ecosystems. Excessive nutrient or suspended solids levels can however harm aquatic ecosystems, for example by favouring growth of algae over other organisms, by smothering bottom dwelling (benthic) organisms and blocking light penetration.

Stormwater runoff is typically a key contributor to nutrient (nitrogen and phosphorous) and turbidity/suspended solids levels in receiving waters under natural and degraded conditions. This is not necessarily a problem, as estuarine waters in particular rely on nutrient inputs from land-based sources for productivity. However, poor quality stormwater can degrade water quality in receiving waters to the extent that ecosystem health is affected. Hence, one of the key principles of Water Sensitive Urban Design is to limit the contribution of stormwater runoff from developed areas to degradation of water quality in receiving estuarine and marine waters by seeking to maintain or slightly decrease nutrient and suspended solids loads in stormwater runoff.

Current stormwater design involves use of the industry standard modelling package, Model for Urban Stormwater Improvement Conceptualisation (MUSIC). MUSIC modelling was undertaken on the undeveloped and developed cases for stormwater runoff from Hummock Hill Island (refer to Appendix A7.2). Results for various catchments on the Island for the undeveloped case are as follows:

- 7.7 – 8.0 mg/L for suspended solids. Model results were all within the WQO for suspended solids in both open coastal and estuarine waters;

- 0.03 mg/L for total phosphorous. Model results for the undeveloped case exceed the water quality objective for phosphorous of 0.02 mg/L; and
- 0.7 mg/L for total nitrogen. Model results were all well in excess of the nitrogen water quality objectives for open coastal and estuarine waters.

While nutrient levels in stormwater for the undeveloped (existing) case exceed Water Quality Objectives, it must be remembered that the Water Quality Objectives apply to ambient water quality in the receiving water, not to quality of stormwater runoff. In the case of Hummock Hill Island, stormwater entering the much larger receiving water bodies is quickly mixed and diluted.

The MUSIC model was applied to stormwater runoff for the proposed Hummock Hill Island Development to compare the undeveloped existing case to the proposed developed case. For each of the seven stormwater management zones outlined in Section 3.4.2.1, a reduction in each of the key parameters was achieved, as follows:

- Total suspended solids in runoff was reduced by between 88% and 97%, with the average reduction being 93%;
- Total nitrogen in stormwater was reduced by between 3% and 37%. Nitrogen quantities from the Town and Headland zone increased by 2.6%; and
- Total phosphorous levels were reduced by between 16% and 37%.

Modelling also indicated that gross pollutants (litter) will be fully contained within proposed stormwater treatment systems for each of the zones. A summary of MUSIC modelling results for the entire development are presented in Table 3.15.

Table 3.15 – MUSIC Results for pre-development and post-development Conditions for the Island

Potential Pollutant	Undeveloped (existing) case	Developed case	Reduced by
Total Suspended solids	270,000 kg/yr	231,850 kg/yr	-38,150 kg/yr (-14.1%)
Total Phosphorous	249 kg/yr	240 kg/yr	-9 kg/yr (-3.6%)
Total Nitrogen	3,010 kg/yr	2,992 kg/yr	-18 kg/yr (0.6%)

As the area of the proposed development consists of around 19% of the total area of Hummock Hill Island, and significantly less of the total Island land area that drains to the waters surrounding Hummock Hill Island, little overall change in water quality from current existing conditions is expected. Overall annual nutrient loads for the whole of Hummock Hill Island were modelled with and without the proposed development. A reduction in 14% of suspended solids was predicted, arising entirely from the reduced suspended solids load from the developed area after development. Nutrients nitrogen and phosphorous decreased only slightly (0.6% and 3.6% respectively). This minimal reduction was done to minimise any potential changes to the existing nutrient dynamics of estuarine waters.

On this basis, stormwater flows from the proposed development will not result in degradation of water quality in receiving estuarine and marine waters or adjacent, environmentally sensitive, aquatic ecosystems and will not affect natural nutrient cycles in these waters. Water quality may improve slightly, particularly as a result of reduced suspended solids loads from the developed area.

3.4.2.3 Water Quantity

Rainfall runoff is an important component of estuarine environments, as it provides freshwater input, dissolved and particulate nutrients and a flushing effect. Urban development tends to increase stormwater runoff as vegetated soils are replaced with harder surfaces where infiltration is reduced or effectively prevented reducing infiltration to soils and groundwater and increasing surface runoff. As a consequence stormwater discharge is generally in urban environments is generally greater in quantity and reaches the discharge point faster.

A number of strategies have been incorporated into the proposed development to minimise ephemeral watercourse discharge changes including:

- The small footprint of development in the context of the whole Island (19% of the total land area);
- Porous pavements in some areas to reduce surface runoff generation;
- Bioretention devices that retain water and allow it to gradually seep into underlying soils and groundwater;
- Grassed or vegetated swales with infiltration trenches to reduce discharge times and volumes; and
- Maintenance of landscaped and vegetated areas throughout the proposed development that reduces stormwater discharge.

These measures will generally attenuate flows up to the three month event (i.e. a rainfall event of intensity that might be expected to occur once every three months). Beyond this, further retention of flows is required, both to maintain human safety in high rainfall events, and to minimise increases in flows to the surrounding coastal environment.

Peak flows for up to the Q100 rainfall event have been calculated before and after development for each of the stormwater zones identified in Table 3.14 and are presented in Table 3.16. Without attenuation, increases of between 28 and 36% of flows are predicted in the Q100 rainfall event for most of the zones, with the highest increase of 56% in the more densely developed Town precinct. Though this area is a small catchment and subsequent flows are correspondingly small.

Table 3.16 – Peak Q100 flows (m^3/s) pre and post development

Zone	Existing Case	Developed Case	% Change
Lagoon	39.79	51.85	+30
Bay	3.31	4.26	+28
Town	10.71	16.74	+56
Headland	9.23	12.50	+36
Hummock Hill	12.63	16.23	+29
Boyne	14.05	18.55	+32
Boyne W	10.17	13.43	+32
Boyne Hill	9.92	12.76	+29

In addition, detention basins will be installed in each drainage zone (refer to Figure 3.15) to slow down the rate of release of stormwater flows. In the Lagoon and Bay drainage zone (zones 1, 2 and 3), the lagoon feature will provide detention of stormwater flows from these areas. An additional detention basin will be installed for the town and headland zones (zones 4 and 5). This will be part of the landscaping of these zones and will probably consist of a chain of detention basins with an outlet to the existing ephemeral watercourse parallel to the northern beach.

The proposed lagoon will be lined with an impermeable layer due to the high infiltration rates (11 m/day) of sandy soils in this area. Performance of the lake has been modelled to ensure that (a) the lagoon's ornamental and habitat purpose can be maintained if water levels fluctuate and (b) water quality in the lagoon can be maintained. With lining, the lagoon is predicted to retain water at all times, and water quality is predicted to meet ANZECC/NHMRC (2000) Guidelines for primary contact recreation. However, high runoff events may result in increases of coliforms in the lagoon. Primary contact recreation will be prohibited in the lagoon to avoid any risk of contact with poor quality water. In addition, any boating activities that might harm the integrity of the impermeable liner will be prohibited.

The existing reservoir south of Hummock Hill (Zone 6) will be utilised as a retention basin for flows from this area and from Boyne Hill further south. The dam wall will be assessed and repaired as necessary to ensure it meets dam safety requirements.

The golf course lagoon systems will provide stormwater detention for zones 8 and 9 (Boyne East and West). Eventually discharging via existing ephemeral watercourses to Boyne Creek.

The golf course lagoons will be unlined, or have a compacted clay liner. Impermeable lining is not considered necessary as the soils in this area have naturally lower infiltration rates. Testing of infiltration rates and estimates of impacts on groundwater will be undertaken during the detailed design stage and a determination of the need for a liner on the golf course lagoons will be made, as well as a specification set for the permeability of this liner.

In storm events greater than the Q100, overflows of detention basins will occur. As these basins will be surrounded by residential development, dedicated overflow paths will be established. In the

southern sections of the proposed development (zones 6, 7, 8 and 9) two existing ephemeral watercourses will be utilised; running between Hummock Hill and Boyne Hill and a second to the east of Boyne Hill. Both have been dammed, and these dams will provide some detention before overflowing to Boyne Creek and Colosseum Inlet respectively. As these are the natural flow paths for storm flows, the natural drainage patterns have been retained.

The lagoon serving precincts 1, 2 and 3 will require a constructed overflow to the ephemeral watercourse south of the Bay Zone. This ephemeral watercourse will also receive stormwater flows from the Town Centre and part of the Headland Zone.

3.4.2.4 Stormwater Management during Construction

During the construction phase, removal of vegetation and exposure of soils can result in increased levels of sediment mobilisation by overland flows, compared to both pre-construction and post-construction scenarios. Earthworks and installation of linear infrastructure can also lead to temporary changes in topography and drainage.

A detailed erosion and sediment control plan will need to be developed for each phase of the proposed development. This will be part of the Operational Works development approval and will follow best practice standards as current at the time of the works. Current best practice standards in Queensland are taken to be the *Institute of Engineers Australia Erosion and Sediment Control Guidelines (1996)*. An extensively revised version of these guidelines is in preparation and is expected to be released late in 2007. This version incorporates a number of lessons learned since publication of the 1996 guidelines, as well as new technologies that have become available. It is expected that, over 16 years or so of development of Hummock Hill Island, there will be ongoing developments in erosion and sediment control practices and in the range of devices and materials available. Hence, it is inappropriate to prepare a detailed erosion and sediment control plan for the proposed development at this stage, but rather to make this a requirement for each phase of the works. In this way, lessons learned from earlier phases, as well as advances in techniques and technology can be incorporated into each successive stage.

The basic principles of erosion and sediment control are not likely to change and hence, any erosion and sediment control plan developed for Hummock Hill Island will comply with the following general principles:

- Exposure of soils to erosive forces (wind and rain) will be minimised through staged clearing of vegetation and progressive stabilisation and/or rehabilitation of disturbed surfaces;
- The time which soils are exposed to erosive forces will be minimised through careful planning of construction activities;
- Clearing of vegetation on individual land parcels will not be allowed until immediately before development of that parcel. This will avoid issues arising from the current common Australian practice of clearing vegetation from entire subdivisions at once, regardless of the time frames for house construction;
- Erosion control techniques will focus first on avoiding raindrop and wind impact on exposed soils such that the mobilisation of soils is minimised;

- Clean stormwater will be diverted around areas of exposed soil. Outlets from stormwater diversion drains/bunds will be stabilised to prevent scouring at the outlet;
- If flows are concentrated along a drainage line or pathway, this will be stabilised to prevent scouring;
- Runoff water from disturbed areas will be detained to maximise settlement of sediment before release off-site. The type of detention will be selected based on current best practice guidelines; and

Permanent stormwater control systems will only be installed prior to earthworks where these are not susceptible to damage from sediment laden runoff during construction. Otherwise, temporary drainage control will be incorporated into the erosion and sediment control plan.

3.4.3 Energy

3.4.3.1 Electrical Power

Total peak electrical energy demand for the development is expected to be 8,000 kilowatts. Growth in demand will be concurrent with development progress.

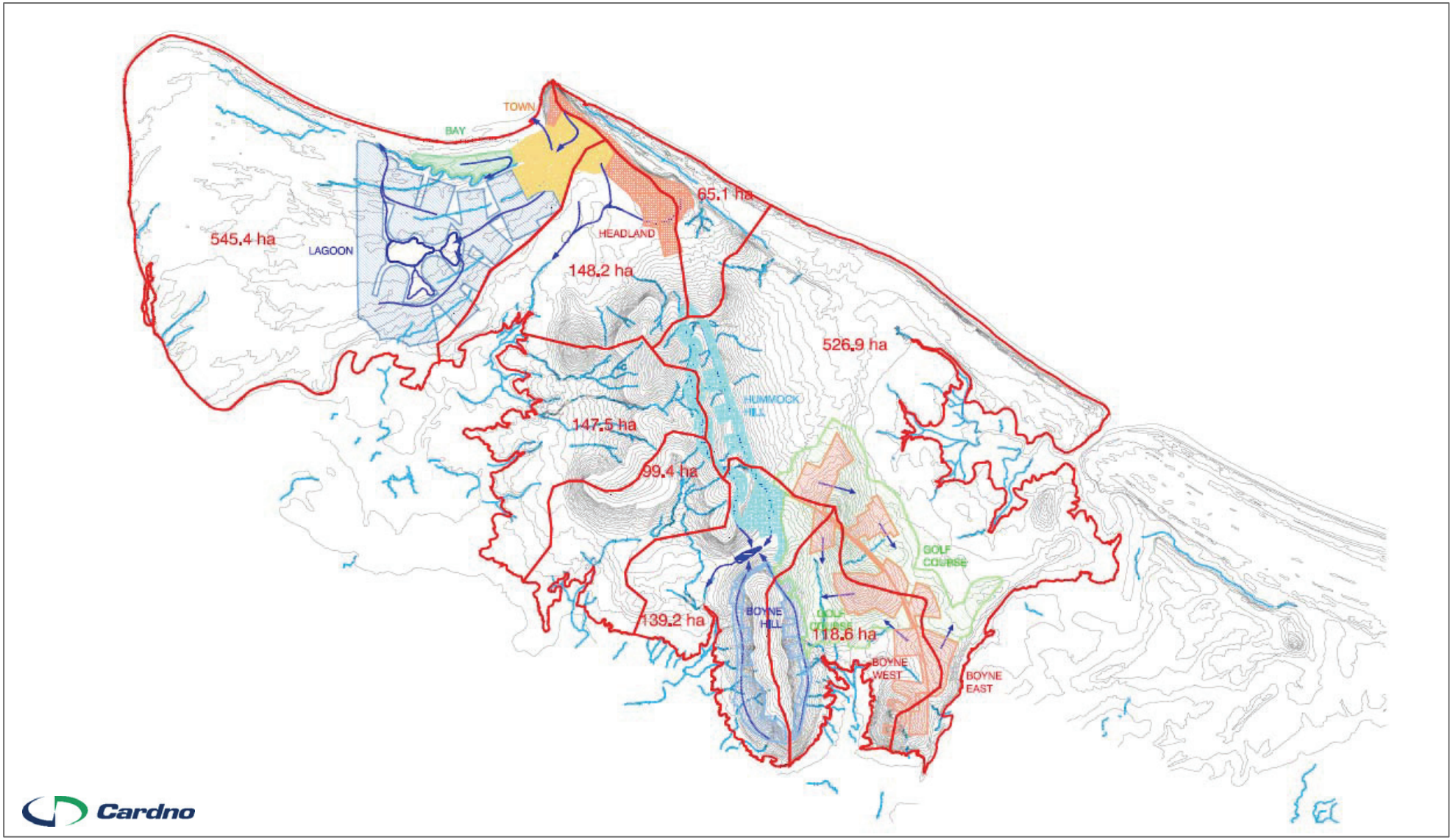
Alternative power sources investigated included:

- Mains grid connection from Ergon Energy's 22 KV network on the mainland;
- On-Island generation using a gas fired cogeneration plant or diesel engine generators;
- Solar/photovoltaic cell arrays; and
- Wind Turbines.

All alternatives investigated concluded that:

- a base load supply of electricity will be required from the mainland grid to ensure security of supply to the development; and
- the base load supply could be supplemented by the other sources including those listed above.

The provision of a secure supply of electricity to the Island is a condition of the Special Lease and the Queensland Government will only grant freehold title for the development after electricity has been provided to the Island. Ergon Energy have confirmed that power to the Island, is available from the existing network near Foreshores Estate, approximately 12 km from the Island. (Lincolne Scott July 2007).



LEGEND

- Inferred Drainage Lines
- Development Drainage Path
- Catchment Boundary
- 139.2 Catchment Area, Hectares (Total Island Area 1790 ha)

Figure 3.13 - Post Development Catchments and Flow Routes

This figure must be read in conjunction with the data disclaimers located at the front of this report . The data acquired for this project is known to be of low spatial resolution and as such no representation or warranties about its accuracy, reliability or suitability are given. Assumptions and conclusions made from this figure and the associated data must be made with full understanding of the data limitations. SKM accepts no liability or responsibility whatsoever for or in respect of any use of or reliance upon the figure and the associated data

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NOT TO SCALE

Hummock Hill

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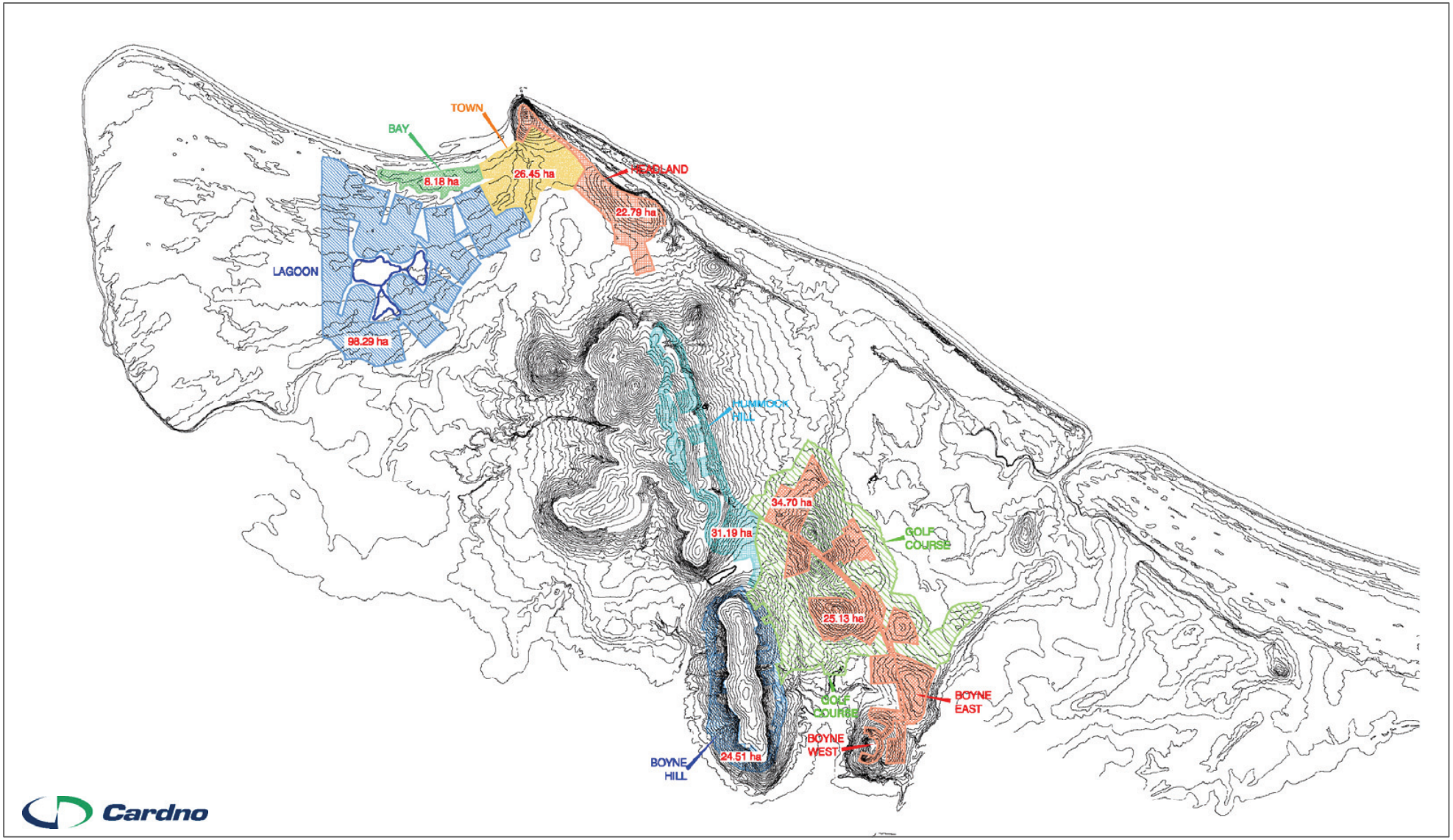

Figure 3.14 - Stormwater Drainage Zones

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Consequently the proponent proposes to connect the Island to the mainland grid to supply electricity for the initial stages of the development. During detailed design of the development infrastructure further investigations and feasibility studies will be undertaken to examine alternative electricity options for the full development. 12 km of overhead power lines will be constructed to take power to the bridge and then taken underground across the bridge to a substation adjacent to the Boyne Channel Village Centre. Both HV and LV reticulation around the development will be via underground cables.

From 1 March 2006 all new homes built in Queensland are required to install energy efficient hot water systems (solar, gas or electric heat pump) and use energy efficient lighting for at least 40% of internal floor space. All of the residences in the development will have solar hot water systems installed.

In addition to energy efficiency measures outlined in Section 3.4.3.3, there will be restrictions on use of electrical power where gas can be substituted such for cooking purposes. These are incorporated into the Plan of Development (see Appendix A2).

3.4.3.2 Gas

Gas will be brought to Hummock Hill Island from the major north-south regional gas line at the intersection of Bruce Highway and Turkey Beach Road. The pipeline will follow the existing road access to Hummock Hill Island.

Gas will be mandatory for cooking and heating. For hot water systems, gas boosters will be allowed to supplement solar hot water.

3.4.3.3 Energy Efficiency

At a State level, as reported by Energy Efficient Strategies for the Queensland Department of Public Works (2000), electricity is the most significant operational energy source for residential buildings in Queensland, accounting for 86% of all operational energy sources. Natural gas and wood are the next biggest energy sources accounting for 5 % each, while LPG accounts for 4%. All other fuels had either a small share or were insignificant.

In terms of end use, electrical appliances and equipment and water heating are responsible for 48% and 35% of operational energy consumption in residential buildings respectively (refer to Table 3.17). Space heating and cooking are the next biggest end uses accounting for 7% of operational energy consumption each, followed by only 3% for space cooling.

Electricity is the dominant source of greenhouse gas emissions in the Queensland residential sector, accounting for 98% of all residential operational emissions. In terms of end use share, electrical appliances and equipment dominate Queensland residential operational gas emissions in 1999, accounting for 55% of the state total. Water heating is the next most significant with 33% followed by cooking at 7%, space cooling 3% and space heating 2%, as outlined in Table 3.17.

Table 3.17 Operational Energy Share and Greenhouse Gas Emissions by End Use – Queensland Residential Sector

End Use	Operational Energy Share (%)	Operational Greenhouse Gas Emissions (%)
Electrical Appliances and equipment	48%	55%
Water Heating	35%	33%
Cooking	7%	7%
Space Heating	7%	3%
Space Cooking	3%	2%

Whilst electricity consumption is expected to experience the strongest growth on a state wide basis, power generation in the Gladstone area will remain at its current capacity. The proposed development will incorporate relevant energy efficiency strategies in its design to reduce the use of electricity and associated greenhouse gas emissions. Requirements for both the residential and commercial operational sectors are addressed below.

Residential operational emissions savings will be attained by incorporating:

- Use of energy efficient fuels in the residential sector - the development will incorporate fuel switching from electricity to gas to reduce greenhouse gas emissions;
- Hot water supply in the residential sector – the development will incorporate solar hot water heating with a gas booster to reduce reliance on electrical water heating, reducing downstream greenhouse gas emissions from electricity generation.
- Use of water-saving technologies to reduce hot water use – for example water-saving shower heads use less hot water, reducing energy demand for hot water heating;
- Space Conditioning in the Residential Sector - passive house design will minimise requirements for space heating and associated electrical demands;
- Space Conditioning in the Residential Sector - public awareness for programs especially focused on ways of avoiding the need for space cooling and energy efficient appliances;
- Use of energy efficient lighting – such as fluorescent bulbs and emerging low energy LED lighting; and
- Encouragement of the use of energy efficient appliances at the household level.

Commercial Operational Emissions Savings will be attained by incorporating:

- Energy efficient lighting systems:
- Lighting control systems – individual switching, timers, motion sensors and daylight sensors for:
- Individual rooms, external and common areas;
- Zones within buildings;
- Entire building control systems.

- Daylight integration through design, roof lights, light shelves and window placement;
- Improved maintenance of lighting systems; and
- Replacement of lower efficiency lighting for higher efficiency lighting.
- Ventilation and air-conditioning (HVAC) systems;
- Improved calibration and maintenance of HVAC systems to ensure peak operational performance;
- Improved thermal performance of building shells especially in the areas of window performance, shading and sealing; and
- Swimming pools may only have solar heating.

Incorporation of these strategies into the proposed development will reduce the total electrical demand, reducing the subsequent use of coal based electricity generation and the associated greenhouse gas emissions.

3.4.4 Traffic and Transportation

Within the proposed development, cycling and walking paths will be provided to encourage visitors and residents to utilise these transport modes when weather permits.

A bus station will be provided in the town centre and bus lay-bys will also be incorporated into design of the main access road so that a bus service can be provided in future. It is expected that once population reaches a critical mass, local and regional providers will consider bus connections either from the train station at Miriam Vale or from Gladstone. The bus station and bus lay bys will also allow for safe operation of a school bus route.

Some areas of the proposed development will be highly suitable for golf buggies. This form of transportation is proving effective in a number of private communities in Australia and would be appropriate at Hummock Hill Island, even though roads will be public. Road design at Hummock Hill Island will take this form of transportation into consideration to encourage residents and visitors to utilise it, provided it is acceptable to Miriam Vale Shire Council.

As is the case throughout urban and rural Australia, it is expected that cars will be the major form of transportation for residents and visitors to the Island.

3.4.4.1 Traffic Predictions

Predictive modelling of traffic volumes has been conducted to estimate the potential increase in traffic associated with the proposed Hummock Hill Island Development (refer to Appendix A7.4). Details of traffic predictions are provided in Section 6.1.

3.4.4.2 External Roads

The existing road network to Clarks Road is considered acceptable for the projected traffic volumes from Hummock Hill Island during development. Clarks Road will require upgrade to a Class 3 Rural Arterial Road (Refer to Section 6. Clarks Road is currently located in a 40 m wide road corridor

sufficient for the proposed road type and required WSUD stormwater controls. Table 3.18 outlines existing road classification and the proposed upgrade required for the projected population post development (refer to Figure 3.16). It is a condition of the SL that the proponent finances all upgrades to the access road, Clarks Road.

Table 3.18 – Existing and Proposed Road Upgrade

Road	Current Classification	Proposed Classification
Bruce Highway	National Highway	National Highway
Turkey Beach Road	Rural Arterial	Class 3 Rural Arterial
Turkey Beach Road	Rural Collector	Class 3 Rural Arterial
Foreshores Road	Rural Collector	Class 3 Rural Arterial
Clarks Road	No Classification	Class 3 Rural Arterial

3.4.4.3 Island Roads

The Island road network will be centred on the Trans-Island Boulevard, being the main sub-arterial or trunk road running from the bridge to the town centre. Road capacity will be 10-12,000 vehicles per day. This will be a limited access road and in particular, residential and commercial development will not front directly onto this road.

As shown in the Master Plan (Refer to Figure 3.3), a network of lesser roads will be developed. Collector streets will provide for traffic volumes of 3,000 vehicles per day and will provide access within each precinct of the proposed development. Accommodation units will generally not open directly onto collector streets. Accommodation units are generally arranged in pods around smaller access streets providing direct access to each house or unit development.

A final assessment of road capacity and design requirements will be made in the detailed design stage of the proposed development. Intersection treatments will be determined at this stage. Road design and intersection design will be in accordance with the most recent relevant guidelines for rural and subdivision road design. Current relevant guidelines are:

- Austroads Rural Road Design; and
- Queensland Streets design Guidelines for Subdivisional Street Works.

Reference to Section 6 should be made for further details on roads and traffic impacts.

3.4.4.4 Boyne Creek Bridge

The proposed Boyne Creek Bridge will be a Balanced Cantilever structure consisting of three spans of 40 m, 70 m, and 40 m. The bridge will be launched from engineered earthen abutments utilising the existing causeway alignment. The bridge superstructure will consist of a variable depth, single cell post-tensioned concrete box girder with vertical webs.

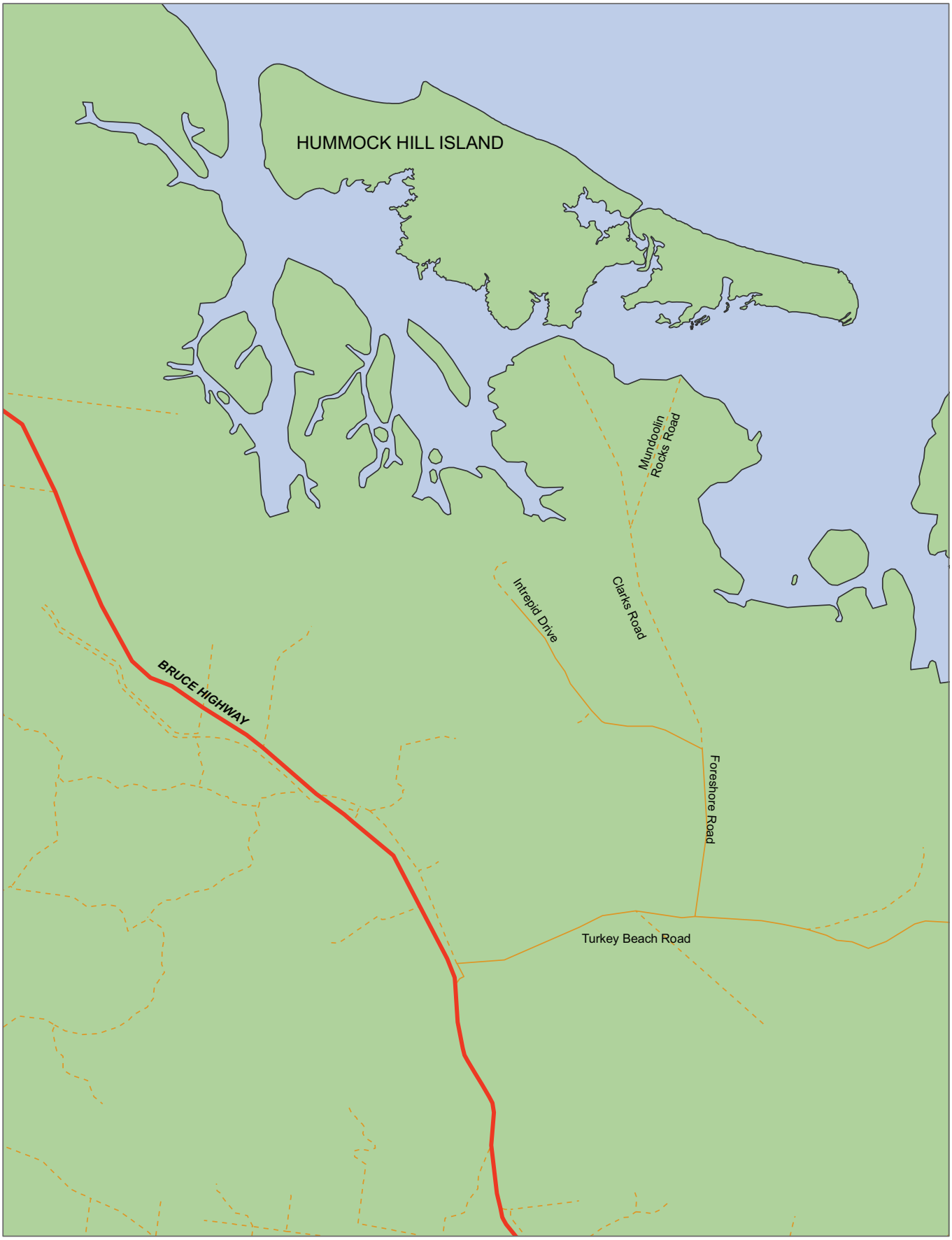

Figure 3.15 - Existing Road Network To Hummock Hill Island

LEGEND

- Highway
- Local Road
- Street

0 0.5 1 2 3 Km

N W E S

Hummock Hill

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This figure must be read in conjunction with the data disclaimers located at the front of this report . The data acquired for this project is known to be of low spatial resolution and as such no representation or warranties about its accuracy, reliability or suitability are given. Assumptions and conclusions made from this figure and the associated data must be made with full understanding of the data limitations. SKM accepts no liability or responsibility whatsoever for or in respect of any use of or reliance upon the figure and the associated data

Construction of the proposed bridge will require a temporary access jetty to be constructed for plant access from which bridge construction activities will be conducted. Initial construction works for founding bridge piers and constructing casements will be conducted from this jetty. The jetty will be a temporary structure consisting of H-beams and steel decking.

Once bridge piers are constructed the bridge will be constructed outwards in a balanced cantilever. The segments are cast using a moveable formwork traveller at each end of the cantilever. For a 70 m span the required girder depth is approximately 2,400 mm deep at mid-span and approximately 5,000 mm deep at the piers.

Deck drainage can be accommodated by a pipe, hung from the deck under the bridge. The pipe can be hidden from view by a pre-cast skirt from the concrete barrier the box girder is either supported on pot bearings at the piers and abutments or integrally connected to the piers. Deck expansion joints are located at the abutments to accommodate the braking, temperature, creep and shrinkage movement of the deck. The deck is supported by reinforced concrete piers. The piers are founded on pilecaps supported by the either bored or driven piles.

Figure 3.17 – Typical Balanced Cantilever Construction (Brunswick River, NSW))

3.4.4.5 Public Boat Ramps

Two public boat ramps will be built as part of the proposed development (refer to Figure 3.1). One boat ramp will be constructed on the eastern shore of Colosseum Inlet to provide all tide deepwater access to Colosseum Inlet. A second tidal boat ramp is proposed to be built on the northern bank of Boyne Creek adjacent to the western side of the proposed bridge (refer to Figure 3.5).

Proposed public boat ramp structures will be designed in accordance with the Australian Standard – *Guidelines for Design of Marinas (AS3962-2001)*. Reference will also be made to the relevant Queensland Transport standards for boat ramp design during detailed design. Typical cross section is provided in Figure 3.18.

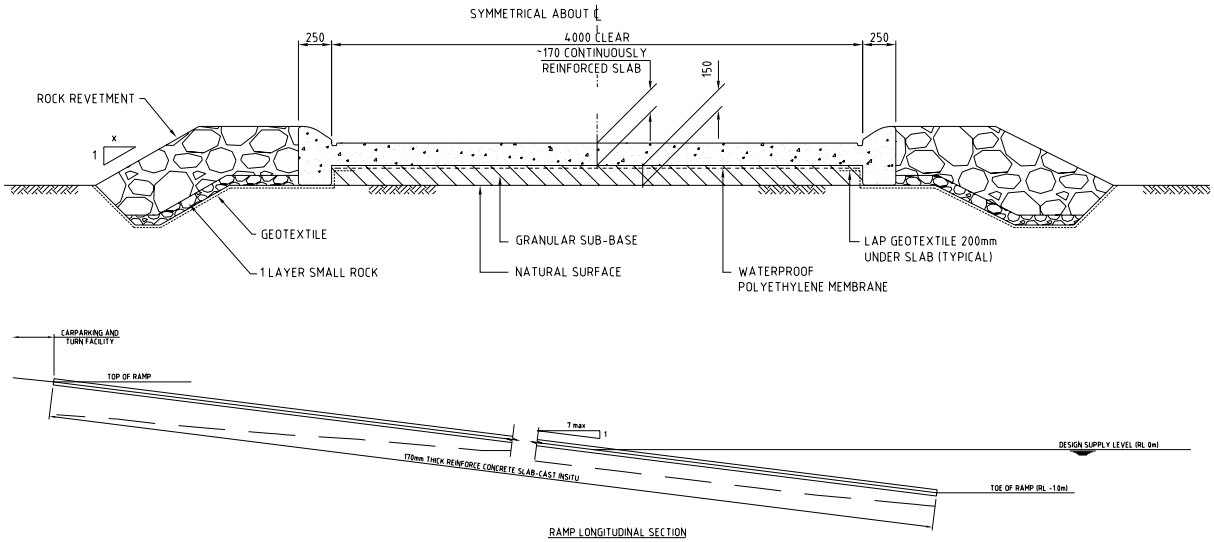


Figure 3.18 – Typical Cross Sections for Public Boat Ramps

The proposed public boat ramp in Boyne Creek will be located adjacent to and west of the access bridge northern abutment as shown in Figure 3.6 and will extend to the main channel of Boyne Creek, intercepting the current causeway that will be removed. The boat ramp will not provide all tide access to Boyne Creek, being limited to the duration of navigable water depth as dictated by the tide state. It is anticipated that water access will be achieved for approximately two thirds of the tidal cycle.

Parking and facilities will be located in the Village Centre precinct with an access road leading to the boat ramp. Due to the length of the ramp a turning circle will be incorporated approximately half way along the length of the ramp to reduce reversing distance. Further design requirements will be as per AS3962 – 2001 and Queensland transport requirements.

The proposed public boat ramp in Colosseum Inlet will again be designed in accordance with AS3962-2001 and Queensland Transport requirements however the ramp length will be shorter and will not require a turning facility along the length of the ramp. Appropriate parking facilities will be built at the end of the access road and above the HAT. Further details on proposed public boat ramps are presented in Section 6.

On completion of the proposed development public infrastructure, including boat ramps will be handed over to the Local Government Authority.

3.4.4.6 Airstrip

A small private airstrip will be constructed as part of the proposed development to the east of the main ridgeline and will utilise currently cleared ground of the former homestead airstrip. The proposed airstrip will be designed with reference to the Civil Aviation Advisory Publication No: 92-1(1). As such the airstrip will be an un-registered airstrip for use by planes with a maximum take off weight (MTOW) of less than 5,700 kg. Based on this limitation, planes utilising the airstrip will be limited to those outlined in Table 3.19.

Table 3.19 - Typical Planes with an MTOW less Than 5700 kg

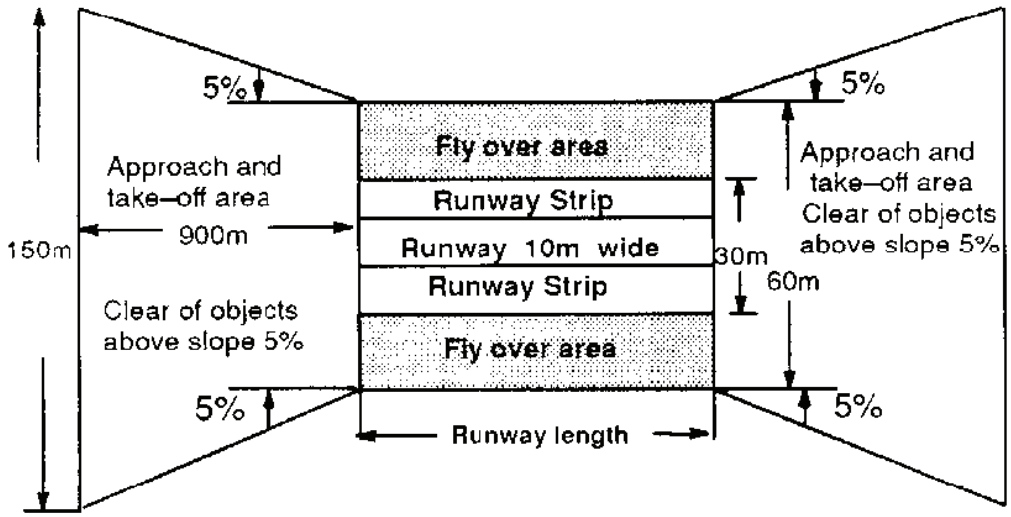
Aeroplane Type	Ref Code	Wing Span (m)	Length (m)	MTOW (kg)
DHC2 Beaver	1A	14.6	10.3	2490
Beechcraft:				
58 (Baroon)	1A	11.5	9.1	2449
100	1A	14.0	12.2	5352
Britten Norman Islander	1A	14.9	10.9	2850
Cessnna:				
172	1A	10.9	8.2	1066
206	1A	10.9	8.6	1639
310	1A	11.3	9.7	2359
404	1A	14.1	12.1	3810
Piper:				
PA 31 (Navajo)	1A	12.4	9.9	2950
PA34	1A	11.8	8.7	1814
Beechcraft 200	1B	16.6	13.3	5670
Cessna:				
208A (Caravan)	1B	15.9	11.5	3310
402C	1B	13.45	11.1	3107
441	1B	15.1	11.9	4468

Source: CASA Manual of Standards Part 139 - Aerodromes

The proposed runway design will be constructed with reference to Civil Aviation Advisory Publication No: 92-1(1) and designed to accommodate planes with an MTOW of 5,700 kg. As such the following recommended minimum physical characteristics will be:

- Runway Width = 15 m;
- Runway Length = approx 1000 m;
- Longitudinal slope along the runway = <2%;
- Transverse slope across the runway = 2.5%; and
- Approach and take off area = clear of objects above a 5% slope.

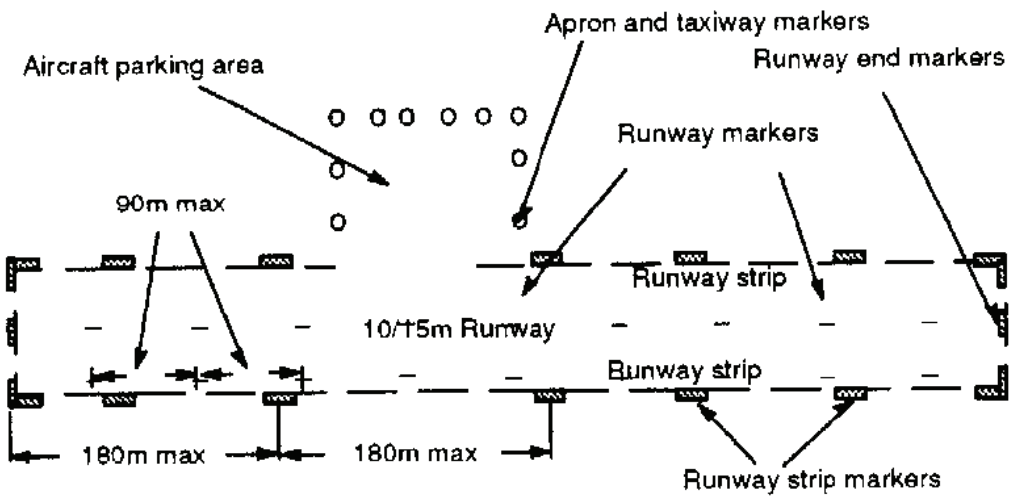
The runway will be designed as a grass airstrip with sufficient ground density to accommodate the designed MTOW. Detailed geotechnical assessment of the existing airstrip will be conducted prior to construction to assess the level of ground enhancement required for the runway. Figure 3.19 outlines the above physical characteristics proposed for the airstrip on the Island.



Source: CAAP92-1(1)

Figure 3.19 – Recommended Airstrip Physical Characteristics

As the airstrip will be a permanent feature of the proposed development airstrip markings will be installed of colour and specifications set out in AIP AGA and shown in Figure 3.20.



Source: CAAP92-1(1)

Figure 3.20 - Typical Runway Markings for an Airstrip

3.4.5 Summary of Built Infrastructure Requirements

In summary, the following built infrastructure will be required to service the proposed development:

- Turning land provision at Turkey Beach road approaching Bruce Highway;
- Intersection upgrade at Turkey Beach Road/Foreshores Road intersection;
- Surfacing of Foreshore Road to Clarks Road (about 3.4 km);
- Forming and surfacing of Clarks Road (about 8.6 km);
- Bridge across Boyne Creek;
- Internal road network of sub-arterial or trunk collector roads and smaller collector and access streets;
- Gas pipeline from Bruce Highway via existing road reserves (16.5 km);
- Internal gas reticulation throughout proposed development;
- Overhead mains power line from Turkey Beach Road to Hummock Hill Island(about 12 km);
- Underground power reticulation throughout proposed development;
- Mechanical Vapour Compression desalination plant producing up to 500 kL/day;
- Potable water supply reticulation network throughout the proposed development;
- An evaporation pond about 140m by 140m for disposal of brine from desalination;
- A wastewater treatment plant based on High Velocity Sonic Disintegrator (HVSD) technology treated about 1 ML/day of wastewater (in two 0.5 ML/day phases);
- Wastewater collection network transferring wastewater to the wastewater treatment plant;
- Non-potable water supply reticulation network transferring treated recycled water throughout the proposed development; and
- Stormwater management systems including vegetated/grassed swales, bioretention basins and detention basins.

3.5 Construction and Development

3.5.1 Financial Aspects

Anticipated construction costs for the proposed development are anticipated to be $635 Million (or $390 in NPV[1] terms) over the 16 year construction period. A breakdown of anticipated development costs are outlined in Table 3.20.

[1] In the absence of a project specific discount rate, the assessment assumed a 6.0 % real discount rate, following the 1997 Queensland Treasury Project Evaluation Guidelines (Queensland Treasure, 1997). All net present values are expressed as of the start of 2007.

Table 3.20 - Estimated Construction Costs for the Proposed Development

Cost Item		Cost ($)
Primary Infrastructure		
	Access Road	
	Boyne Creek Bridge	
	Cross Island Boulevard	
	SUB TOTAL	33,750,000
Internal Civil Works Infrastructure		
	Internal Roads	
	Drainage	
	Water and Wastewater Reticulation	
	Electricity	
	Gas	
	Telecommunications	
	Land Clearing	
	Landscaping	
	SUB TOTAL	69,980,000
Community Infrastructure		
	SUB TOTAL	29,950,000
Site Preparation for Commercial and Retail Development Land		
	SUB TOTAL	1,550,000
Statutory and Associated Costs		
	SUB TOTAL	12,320,000
Infrastructure Maintenance Costs		
	SUB TOTAL	13,600,000
Management costs and Professional Fees		
	SUB TOTAL	38,727,600
Expenditure to Date		
	SUB TOTAL	4,000,000
	TOTAL (Excluding interest)	203,877,600

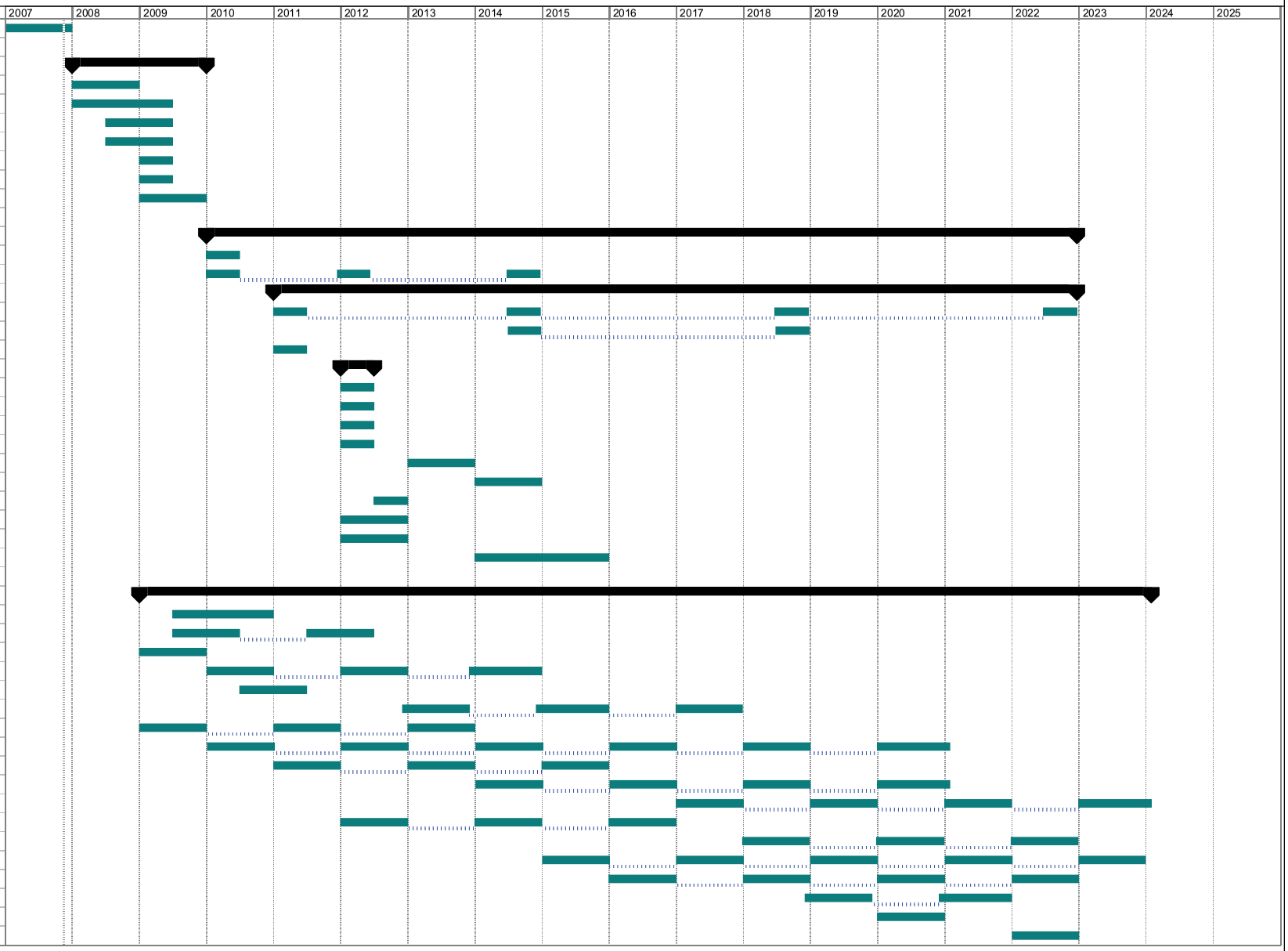
Detailed financial aspects related to this development are confidential and are provided under separate cover to the Coordinator-General.

3.5.2 Schedule

The proposed developed will be staged over a 16 year period as presented in Table 3.21.

Table 3.21 - Proposed Hummock Hill Island Development Project Schedule

ID	Task Name
1	Developmental Approvals
2	
3	**Infrastructure**
4	Access Road to the Island
5	Bridge over Boyne Creek
6	Water Supply to the Island
7	Waste Water Treatment Plant
8	Power Supply
9	Solid Waste Transfer Station
10	Trans Island Boulevard and Services
11	
12	**Social Infrastructure**
13	Colluseum Boat Ramp
14	Beachside Picnic Parks
15	**Education Precicnt**
16	Retail and Commercial Centre
17	Infants and Primary School
18	Centre for Higher Education
19	**Community Services**
20	Fire Station
21	Police Station
22	Ambulance Station
23	Medical Centre
24	Boyne Channel Marine Centre and Boat Ramp
25	Boyne Channel Home Offices
26	Airstrip
27	Tourist Park
28	School Recreational Camping Ground
29	Golf Course
30	
31	**Resort and Residential Development**
32	Headland Resort Hotel
33	Headland Resort Apartments
34	Headland Holiday Homes
35	Beach Front Holiday Homes
36	Beach Front Apartments
37	Seaside Cottages
38	Ridgetop Houses
39	Hill Side Terraces
40	Lagoon Villas
41	Riparian Eco Houses
42	Bushland Residential
43	Resort Town Apartments
44	Resort Village Townhouses
45	Golf Course Resort Homesites
46	Golf Course Resort Apartments
47	Boyne Channel Apartments
48	Beachfront Tourist Hotel
49	Conference Centre and Motel



Project: Construction Schedule.mpp
Date: Mon 12/11/07

Task | Milestone | Rolled Up Task | Rolled Up Progress | External Tasks | Group By Summary
Progress | Summary | Rolled Up Milestone | Split | Project Summary | Deadline

3.5.3 Construction Activities -Infrastructure and Services

Construction activities associated with installation of infrastructure and services are provided in Table 3.22. Co-location of linear infrastructure will minimise environmental impacts associated with construction activities, and in particular earthworks.

Table 3.22 – Construction Activities

Component	Time frame	Construction Activities
Upgrade of external (mainland) road network including Foreshores Road and Clarks Road	Phase 1 – Years 1-3	Confirm design parameters, including design standard and service requirements with Miriam Vale Shire Council/Department of Main Roads. Conduct survey and geotechnical investigations. Prepare detailed design. Obtain permit to clear assessable vegetation (Vegetation Management Act). Prepare Erosion and Sediment Control plan and install devices as per identified schedule. Prepare CEMP. Prepare Cultural Heritage Management Plan (CHMP) (also covering external power and gas supply). Clear vegetation as required within road reserve. Vegetation to be retained for use in rehabilitation. Grade road reserve as per detailed design. Install culverts and drainage systems. Install road base, bitumen surface, shoulder treatments (shoulder treatments to minimise risk of sheet erosion). Reinstate remaining areas within road reserve with native vegetation compatible with road safety requirements.
Bridge over Boyne Creek	Phase 1 – Years 1-3	Confirm design parameters, including design standard and service requirements with Miriam Vale Shire Council. Conduct survey and geotechnical investigations (including acid sulfate soil identification). Prepare detailed design. Obtain Operational Works permit for works in a tidal zone, to destroy marine plants and to clear assessable vegetation. Prepare Erosion and Sediment Control plan and install devices as per identified schedule. Prepare Acid Sulfate Soil management plan and construct treatment areas. Prepare CEMP. Remove mangroves from construction area. Excavate for bridge foundations as per design, treating acid sulfate soil as per management plan. Install bridge foundations and construct roadway. Reinstate disturbed areas and monitor for mangrove regeneration.

Component	Time frame	Construction Activities
Internal road network - Trans-Island boulevard and associated services Minor road network (collector and access streets)	Phase 1 – Years 1-3 As required to service development modules during phases 2 and 3	Confirm design parameters, including design standard and service requirements with Miriam Vale Shire Council. Conduct survey and geotechnical investigations. Prepare detailed design. Obtain permit to clear assessable vegetation (Vegetation Management Act). Prepare Erosion and Sediment Control plan and install devices as per identified schedule. Prepare CEMP. Clear vegetation as required within identified road alignment. Vegetation to be retained for use in rehabilitation. Grade road reserve as per detailed design. Install culverts and drainage systems. Install road base, bitumen surface, shoulder treatments (shoulder treatments to minimise risk of sheet erosion). Reinstate remaining disturbed areas within road alignment with native vegetation compatible with road safety requirements.
Power Supply – external, above ground power lines, 12 km	Phase 1 – Years 1-3 (in conjunction with upgrade of Foreshores Road and Clarks Road)	Confirm design parameters including exact alignment of power lines. Vegetation clearing to be undertaken in conjunction with clearing required for road upgrades. Prepare CEMP. Install poles and transmission line. Install transformers and other equipment at connection point. Make connection.
Gas supply – external, 16.5 km	Phase 1 – Years 1-3 (in conjunction with upgrade of Foreshores Road and Clarks Road)	Confirm design parameters including exact alignment. Vegetation clearing to be undertaken in conjunction with clearing required for road upgrades. Prepare CEMP. Identify and install erosion and sediment control measures Clear topsoil and set aside. Excavate trench and install pipe. Backfill trench. Dispose of excess spoil at regional landfill or beneficial reuse (if available). Replace topsoil. Stabilise surface as per road design requirements.

Component	Time frame	Construction Activities
Power supply – internal (underground) Water and wastewater reticulation Gas reticulation	As required to service development modules during phases 1, 2 and 3 Coordinated with road installation wherever co-located	Confirm design parameters, including design standard and service requirements with Miriam Vale Shire Council and relevant power and gas authorities. Conduct survey and geotechnical investigations. Prepare detailed designs. Obtain permit to clear assessable vegetation (Vegetation Management Act). Prepare CEMP. Prepare Erosion and Sediment Control plan and install devices as per identified schedule. Clear vegetation as required within specified alignment. Vegetation to be retained for use in rehabilitation. Clear topsoil and set aside for reuse. Excavate trenches and install power/gas/water as per design. Back fill trenches. Dispose of excess spoil to regional landfill or beneficial reuse if available. Replace topsoil and reinstate in accordance with design (compatible with road design requirements)
Water and wastewater treatment plants, evaporation pond (18,500 m^2)	First units in years 1-3 (phase 1). Subsequent units as required to meet population growth	Confirm location and design parameters. Conduct survey and geotechnical investigations. Prepare detailed design. Obtain permit to destroy assessable vegetation (if required). Prepare Erosion and Sediment Control plan and install devices as per identified schedule. Clear vegetation and strip topsoil – stockpile for later use in landscaping. Conduct any excavations and remove subsoil for use at regional landfill or other beneficial reuse as available. Install plant as per design. Install evaporation pond as per design. Use topsoil and cleared vegetation for landscaping around plant location and evaporation pond.
Boat Ramp – Colosseum Inlet Boat Ramp – Boyne Channel Associated boat/trailer parking	Colosseum Inlet public Boat Ramp in Year 3 Boyne Creek public Boat Ramp and parking in Year 6	Confirm design parameters, including design standard and service requirements with Miriam Vale Shire Council and Queensland Transport. Conduct survey and geotechnical investigations (including acid sulfate soil identification). Prepare detailed design. Obtain permit to destroy marine plants and assessable vegetation. Prepare Erosion and Sediment Control plan and install devices as per identified schedule. Prepare Acid Sulfate Soil management plan and construct treatment areas. Remove mangroves from construction area.

Component	Time frame	Construction Activities
		Excavate for boat ramp foundations as per design, treating acid sulfate soil as per management plan. Install boat ramp and queuing pontoons. Clear vegetation and conduct earthworks for car park. Construct car park. Reinstate disturbed areas and monitor for mangrove regeneration.
Golf Course	Years 8-9	Prepare detailed design, including identification of vegetation clearing requirements and wildlife corridors. Identify appropriate grass species compatible with climate and irrigation of treated wastewater. Apply for permit to clear assessable vegetation (Vegetation Management Act). Prepare Erosion and Sediment Control Plan and install devices as per schedule. Conduct earthworks and install permanent drainage systems and lagoon systems. Place topsoil/top dressing and sow fairways and greens with selected grass species. Plant remaining areas with selected native species. Maintain temporary erosion and sediment control devices until 80% grass cover is achieved and permanent stormwater and drainage systems are in place.

All construction activities will be undertaken in accordance with a Construction Environmental Management Plan (CEMP). Requirements of the CEMP are provided in Section 20.

3.5.4 Construction Activities – Site Preparation and Building Development

Tourist, residential, commercial and retail premises will be constructed over about 18 years, commencing once the bridge and main access roads are in place. For each component of the proposed development, construction will consist of:

- Confirm design requirements, survey and geotechnical investigations;
- Prepare detailed design for earthworks, buildings and other structures;
- Identify extent of vegetation clearing required;
- Identify erosion and sediment control requirements and any other site-specific environmental management requirements and prepare site specific environmental control plans;
- Obtain permits as required, including clearing of assessable vegetation and building certification;
- Install erosion and sediment control devices and/or permanent stormwater and drainage systems;
- Clear vegetation and conduct earthworks (progressively where possible);
- Install services including water, wastewater, power, gas, roads, driveways and pathways;

- Construct buildings;
- Connect to power, water and wastewater systems; and
- Reinstate disturbed areas (progressively where possible).

Equipment used in site preparation and building construction will vary depending on the type of building being constructed, but may include earthmoving equipment, lifting equipment and power tools.

3.5.4.1 Golf Course Construction

The proposed Wild Golf Course is located at the southern end of the development site and will act as a buffer between the residential lots and the undisturbed bush land, providing a smooth transition from low density residential lots to sensitive and endangered Regional ecosystems. The lightly wooded terrain within the proposed Wild Golf Course is generally gently undulating and therefore the course contours will follow natural ground and require minimal excavation and filling. Fairways and greens have been set back from residential areas with generous buffer areas for safety. The course comprises two loops of nine holes returning to a centrally located clubhouse. Practice facilities including a driving range and practice putting greens are located adjacent to the club house (Refer to Figure 3.7).

A course maintenance facility is located adjacent to the driving range, well away from the residential areas. The maintenance building will contain the machinery store and workshop, materials stores, offices and staff facilities. The building will be approximately 30 x 20 metres x 5.5 metres high, steel framed on concrete slab and Colourbond roof and wall cladding. Chemicals will be stored in a bunded area within the building. A hard stand area will be provided around the building for vehicle parking and wash down. Double skin, above ground fuel storage tanks will also be located on the hard stand area. The hard stand area will be bunded and drained to interceptor traps (to EPA requirements) before being pumped to sewer. The maintenance area will be screened from the course and residential areas by the natural landform and by planted native vegetation.

The golf course will be designed and built to international standards, incorporating principles established in the Australian Golf Union's (AGU) Environmental Strategy for Australian golf courses. The design of the course has not yet been completed and contract negotiations are currently underway with a number of Australia’s leading golf course architects to design and supervise construction of the course.

A leading golf course management company will be appointed to provide a high standard of operation and maintenance of the course with the view to elevating the stature and image of the development and reinforcing the recognition of the project in the Australian market.

The programming and scheduling of construction works will take into account local weather patterns, including the 'wet' season. The course is to be staked in the field prior to any preparatory works or any clearing taking place. The site will be cleared of any noxious weeds, prior to commencement of construction and will be kept tidy at all times during construction operations. Some clearing of vegetation will be required, but will be kept to the minimum required to construct

the course. All existing trees, shrubs and grasses on the site of the golf course, except that indicated as being removed as part of the development plans, are to be protected during the period of construction.

The general terrain is gently undulating and the course layout is designed to fit with the natural slopes of the land. The design aims to minimise the amount of earthworks. Where earthworks are required a localised cut and fill balance approach will be adopted to minimise the movement of earth around the site. Environmental protection measures including cut-off drains, berms, silt terraces, sediment retention ponds and bunding will be implemented to minimise sediments from entering existing watercourses. To minimise erosion a detailed construction plan will limit the areas of land to be cleared at any time. Earthworks, drainage, irrigation, sand capping and turfing will follow a logical progression so that construction site will be stabilised before moving to open up new areas.

Where possible materials will be sourced on site, however, it is likely that some materials such as sand will need to be imported from the mainland for sand capping of fairways and for tee and green seedbed medium, and for bunkers, along with suitable gravel for course drainage layers.

Construction will utilise a small fleet of scrapers, bull dozers and rippers, loaders and excavators, with skilled operators experienced at working in sensitive environments. Where construction is near particularly sensitive vegetation areas, the smallest machinery practical will be used. Machinery noise will be limited to that allowed by Environmental Guidelines.

The site will be progressively cleaned up and care taken to ensure weeds are not spread to sensitive vegetation areas.

Drainage

Well planned and designed drainage will ensure all weather playing conditions. Drainage will include a combination of surface and sub-surface drains. Fairways, greens and tees will require formal herringbone sub-surface drainage. Fairways and green surrounds will be contoured to minimise runoff into sensitive vegetation areas.

Grasses

The selection of grasses will take into account the location, topography and climate In playing areas, grasses will be selected that are best adapted to the local environmental conditions to provide the necessary characteristics of playability, yet permit the use of environmentally sustainable maintenance techniques. Grass types requiring minimum irrigation will be selected. Grassing of the course will be completed progressively in order to avoid erosion. Turf sod will be used on steeper slopes such as bunker faces, edges of tees and greens as required, with the more gently sloping greens and fairways either seeded or vegetatively propagated by use of stolons.

The roughs that make up a significant area of the golf course will be maintained in the natural uncleared condition, without irrigation.

Golf Course Operation

Golf course maintenance will be in accordance with the *Guidelines for Improving the Eco-Efficiency of Golf Courses in Queensland* produced by The Australian Golf Course Superintendents Association (AGSCA) and Qld EPA.

Irrigation water use will be minimised as will the use of pesticides and fertilizers. Day to day operations will include eradication of noxious weeds and removal of unwanted plant growth to allow and encourage the natural re-establishment of plant species native to the Island.

Fertiliser and Chemical Application

Only fertilisers registered for use on turf will be used at any time during construction and on-going maintenance. Best management practice will be used, with all fertiliser applications determined by regular soil analysis. Fertilisers based on organic compounds supplemented by slow release fertilisers low in phosphorus will be used. Care will be taken to minimise the application of fertilisers and nutrients to areas of indigenous planting.

An Integrated Pest Management (IPM) system of control utilising a range of techniques will be adopted to manage particular pest problems. Pesticide rotation will be practiced to minimise the potential problem of pest resistance. Best management practices will be adopted and care taken with pesticides and chemicals including their appropriate storage, safe use and disposal, all to be carried out in accordance with the manufacturers recommendations and statutory regulations including conformance with applicable Australian Standards. Pesticide operators will be required to be familiar with the toxicity and hazard rating of pesticides with Material Safety Data Sheets (MSDS) kept in the maintenance shed for all the chemicals used.

Irrigation System

The correct design and management of the irrigation system for fairways and greens will protect the soil profile and water table and control the spread of non indigenous turf grasses. Directional sprinklers and dual irrigation lines on all fairways will be used to ensure uniform distribution and avoid over watered areas. Valve-in-head sprinklers will provide optimum control. All sprinklers and control valves will be shall be pressure regulated to prevent sprinkler operating pressure variations.

The system will be operated by a central computer in conjunction with field and in-ground decoders. Irrigation schedules will be controlled by on-site weather stations. Provision will be made for soil moisture and nutrient monitoring sensors around the course that will monitor root zone moisture and nutrient movement through the soil profile. The sensors will be connected to central computer to assist the system operator to make decisions regarding watering frequency and fertiliser application periods. Wind sensors may be installed to control watering during periods of undesirable wind speed and direction. Data from the weather station will be used to automatically adjust the preset daily watering times to match the daily evapotranspiration rates for the site. Off-peak night time irrigation will lower pumping costs and apply water at optimum times to combat wind and evaporation effects.

Irrigation pumping stations will be equipped with variable speed pumps designed to meet peak season demands. The pumping stations will require 415 volt 3-phase supply.

Irrigation water for the golf course will be from both stormwater and recycled treated greywater from the STP. Greywater will be treated to A+ standard with phosphorous levels averaging 0.5 mg/L and not exceeding 1.0mg/L. The treated effluent will be piped to storage dams around the course. The course will require an average irrigation requirement in the order of 100 to 125 ML per year with peak demands in summer of approximately 1.25 to 1.5 ML per day. Storage dams will be lined and collectively have an storable capacity of 20 ML, equivalent to two weeks peak demand storage.

Warning signs will be provided around the course to inform that recycled waste water is being used for irrigation.

3.5.5 Construction Resources and Materials

Construction materials are proposed to be derived from existing sources located within the local area, such as local aggregate quarries, existing manufacturers and business. Typical construction materials to be sourced for the project will include, but not be limited to:

- Concrete;
- Bricks;
- Timber;
- Steel;
- Aggregate;
- Glass; and
- Plastic.

Sourcing of materials for various stages of the proposed project will be at the discretion of the principal contractor awarded each stage of the project. Raw materials for the project will be obtained from local sources and businesses wherever possible.

3.5.6 Construction Workforce

It is estimated that construction will generate an average of 260 direct and indirect jobs per year, and a peak employment of 460 persons. At a State level, the project is estimated to directly and indirectly generate almost 4,700 person years of employment in construction, with an average of 300 jobs per year, and a peak employment of 550 persons.

Construction would create employment opportunities that include skilled and unskilled positions in engineering design, construction supervision and trades, earthmoving, equipment operation, building and landscaping. At a regional level the proposed development would provide new opportunities in the building trades for those seeking to leave agricultural activities, particularly in the younger age groups.

The phased nature of the development would provide the local labour market considerable time to adjust to the opportunities created and to build required skills through established systems (e.g. the apprentice and vocational education systems). Whether the jobs are secured by local residents or

by labour from other regions would in part depend on how capable the region is in building the needed skills. Section 17.2.4 provides details on the economic benefits of construction employment opportunities for both the region and the State.

3.5.7 Construction Environmental Management

Construction environmental management measures are required to minimise those environmental impacts of construction activities that cannot be avoided through adoption of sustainable design principles as set out in Section 3.2.

Construction activities will be undertaken by a range of contractors under the overall supervision of the Proponent. The proponent will set objectives, targets and performance measures for construction activities which will be imposed on all contractors through contract documents such as the Construction Environmental Management Plan (CEMP).

Preliminary objectives of the targets are set out in Section 20. These will be reviewed again prior to commencement of works, and throughout works, to ensure that they remain appropriate and reflective of best practice environmental management.

Contractors will then be required to submit environmental management plans specific to activities being undertaken, prior to commencement of works for approval. As a minimum, contractor's environmental management plans will be required to contain:

- Identification of environmental aspects and impacts of the proposed activities and an assessment of environmental risk associated with the activities;
- Specific Environmental Control Plans to address all significant risks, and to achieve the objectives and targets established by the Proponent. Environmental Control Plans will include:
  - A statement of relevant legislative requirements, including approval and permit requirements;
  - A statement of policies, codes and standards applicable to the activity;
  - Management actions designed to ensure that objectives and targets are achieved;
  - Responsibility and time frames for all management actions;
  - Monitoring actions designed to detect non-compliance with objectives and targets, and responsibility and frequency of monitoring; and
  - Corrective actions in the event that monitoring indicates that performance is not meeting targets;
- Procedures for dealing with incidents and complaints;
- A procedure for identifying and implementing required corrective actions;
- Compliance checking/auditing and review of environmental management measures and performance;
- Roles and responsibilities in relation to environmental management requirements; and

- Training and awareness activities to ensure that those with roles and responsibilities in relation to environmental management are appropriately trained and qualified to discharge those responsibilities.

The Proponent will compliance check/audit environmental performance of contractors. Failure to perform to the required standards may result in penalties or termination of contract.

Relevant legislation, policies, standards and codes are also identified; these will need to be reviewed and updated prior to and during construction. Refer to Section 2 for a list of pertinent legislation, policies, standards and codes.

Contractors with ISO14001 certified environmental management systems will be preferred tenderers for all packages of work associated with the proposed development.

3.5.8 Construction Waste

Construction waste management will be based on the requirements of the *Environmental Protection (Waste Management) Policy 2000* (EPP Waste) that outlines the waste hierarchy which moves from the most preferred — waste avoidance, to reuse, recycling, and energy recovery, through to waste disposal, the least preferred. Construction waste management will also incorporate concepts of construction site waste management from other jurisdictions within Australia and overseas to make use of further construction waste management strategies such as the UK Building Research Establishment (BRE) SMARTWaste program for construction and demolition waste.

Anticipated construction wastes are detailed in Section 11 of the EIS and will include:

- Fill and soil (not contaminated);
- Fill and soil (contaminated);
- Timber and vegetation;
- Scrap metal;
- Cable and wire;
- Concrete, bricks, tile and rubble;
- Plasterboard;
- Packaging wastes, plastic, glass and timber;
- Domestic and general waste;
- Organic and food waste;
- Wastewater;
- Diesel and other fuels;
- Paints and other chemicals; and
- Asbestos cement.

Any construction waste that cannot be recycled or reused and requires disposal, will be transported to the Calliope Shire Council's Benaraby Landfill. A waste acceptance agreement will be sought from the Landfill Manager prior to dispatch of waste from the Island. Records of approval will be kept on file as part of the recording requirement of the Waste Management Plan.

Construction waste management will be the responsibility of the Principal Contractor at the time of the particular construction activity. The Principal Contractor will undertake waste management in accordance with the Construction Waste Management Plan detailed in Appendix A7.3 of this report. On-site construction waste management will include dedicated construction waste collection points and bins. Waste storage bins shall be colour coded and/or labelled for separation of wastes into categories. Australian Standard *AS4123.7 – 2006 Mobile waste containers Part 7: Colours, markings and designation requirements* specifies the appropriate bin and/or label colour for the associated waste streams. Construction personnel will be provided with instructions of waste management during site induction as a requirement of the Construction Waste Management Plan.

Construction waste material will be transported to the nearest recycling facility within Miriam vale Shire or Calliope Shire. Material that cannot be re-used or recycled will be collected by a licensed waste contractor and transported to the Benaraby landfill within Calliope Shire. Details of proposed construction waste management are provided in Section 11, and Appendix A7.3.

Air emissions during construction activities are outlined in Section 9 of the EIS. The main air quality impacts during construction activities will arise from dust generation during earthworks and vehicle movement over unsealed surfaces. Further dust generation will occur during phased construction activities when tourists and residents will be inhabiting the Island. Dust management strategies are outlined in Section 10 of the EIS.

Air emissions from heavy plant will be greatest during initial construction of infrastructure. No permanent inhabitants will be in place on the Island during major earthworks activities. Air emissions from heavy plant are not expected to have a significant impact on local or regional air quality, given the relatively low usage expected (and therefore low quantity of emissions) and the generally good daytime dispersion conditions experienced at this coastal location due to consistent south easterly prevailing winds. All construction vehicles will be required to comply with relevant Australian standards and State regulations for vehicle emissions.

Liquid wastes derived from construction activities will be minimal. Construction of stormwater control lagoons in the western section of the proposed development are likely to require de-watering of groundwater during construction. Collected groundwater will be transferred to sediment control ponds to reduce suspended sediments prior to being discharged back into infiltration trenches or used for site dust suppression/fill moisture control. Liquid waste management, where applicable, during construction activities will be the responsibility of the construction contractor. Liquid waste disposal will be conducted in accordance with the Construction Waste Management Plan as outlined in Section 11 and Appendix A7.3.

3.6 Operation and Maintenance

3.6.1 Waste Generation and Management

Domestic and general waste will be the largest waste stream generated during operation of the development. Remaining wastes streams generated include recyclable wastes such as paper, cardboard, plastics, glass, metals and organic waste.

Anticipated operational wastes are detailed in Section 11 of the EIS and will include:

- Domestic and general waste;
- Organic and food waste;
- Green waste;
- Treated wastewater;
- Metals;
- Plastics;
- Glass;
- Paper and cardboard;
- Hazardous and other chemicals;
- Electrical and electronic equipment (E-waste); and
- Waste by-products from the tertiary wastewater treatment plant.

Management of operational wastes will be based on the waste management hierarchy outlined in Section 10 of the EIS and above. Management of operational waste will be based on the waste management hierarchy of:

- Waste Avoidance/reduction during construction activities;
- Waste Reuse of materials on and off site;
- Waste recycling of materials on and off site; and
- Waste disposal as the last resort.

Domestic waste management and collection responsibilities will be transferred to Miriam Vale Shire Council following completion of initial stages as part of the gradual hand-over of project responsibilities. Commercial waste management and disposal will be the responsibility of the waste generator, who will engage a licensed recycling/waste contractor to dispose of waste material off-Island.

Solid waste generated during operation of the proposed development will be stored in colour coded bins as specified in Australian Standard *AS4123.7 – 2006 Mobile waste containers Part 7: Colours, markings and designation requirements*. Liquid waste generated during operation of the project will be contained in a suitably designed receptacle constructed to the relevant Australian Standard or building code.

Sludge from feedwater filters will arise solely from particulate matter entrained in the feedwater pump and be material naturally present in the waters of Boyne Channel. Assuming suspended solids content of feedwater to be 20 mg/L, and allowing for 50% of suspended solids to be removed in filtering, about 7-8 kg/day of sludge would be generated from the feedwater filtration when the MVC plant was operating at full capacity. Disposal to landfill is proposed as a fallback management method for this waste stream. However, as the sludge is essentially natural material occurring in the marine environment, and likely to be high in nutrient and organic matter, other beneficial uses may be identified for the sludge, for example use as a soil conditioner in the golf course. This will be subject to further testing and in particular, to being able to manage salt levels in the sludge.

Around 850 cubic meters a day (850 KL/day) of brine concentrate will be produced when the plant is operating at full capacity. As chemicals are not added, removed or chemically altered in the MVC process, the constituents of the concentrate are identical to that of the feedwater (i.e. seawater from Boyne Channel) but at about twice the concentration. Concentrated brine will be discharged to a series of evaporation ponds on a batch cycle. As each pond is filled, concentrated brine is pumped to the next pond in the sequence for evaporation. These ponds will occasionally require salt to be removed; this may be able to be utilised in commercial salt manufacturing processes active in the region, or can be disposed of at a landfill. Concentrated brine will not be discharged to estuarine or marine waters around the Island.

3.6.2 Financial Aspects

Financial feasibility aspects related to this development are confidential and are provided under separate cover to the Coordinator-General.

Annual operating costs for management of infrastructure will be covered by normal LGA rates. Costs for maintaining the undisturbed natural areas of the Island remaining outside the proposed development are proposed to be covered by a Special Area Levy charged to all businesses and residences and included in Council charges and rates. Costs for drinking water are expected to be higher than typically experienced in urban areas but offset by the ability to supplement with rainwater and recycled water, such that, with good water management at the household level, households may pay significantly less for water supply than comparable properties in urban centres. Costs for electricity and gas will be comparable with those experienced in urban centres in Central Queensland.

3.6.3 Infrastructure and Services

A build, transfer, operate system is proposed for infrastructure and services required for the proposed Hummock Hill Island Development. Infrastructure and services required for the proposed development as described in Section 3.4 will be installed by the developer at the developer's cost. This will include both internal and external infrastructure. The Proponent will transfer the completed public infrastructure to the LGA. Public infrastructure will include:

- All internal roads, paths, cycleways;
- Access Bridge across Boyne Creek;
- Boat ramps, car/trailer parking and access roads;

- All water and wastewater reticulation systems;
- All water and wastewater treatment systems;
- All stormwater management systems;
- Waste transfer stations and residential collection systems; and
- All parkland and public open space.

This transfer is consistent with the sorts of infrastructure and services that typically fall within Local Government jurisdiction in Queensland.

The proponent proposes to enter into an operation and maintenance agreement with the LGA to maintain and operate the infrastructure for a period of years to be agreed and until such operation and maintenance costs can be covered by income from rates applied to the developed land. The agreement will allow the proponent to recover a proportion of the operation and maintenance costs from rates collected by LGA during the period of this agreement. The proponent will provide a training program for LGA staff before transfer of operation and maintenance responsibilities to the LGA.

Installation of electrical power and gas will be by relevant authorities at the developer's cost. Operation will then be undertaken by the relevant authority. Costs of operation and maintenance will be through supply tariffs. This same arrangement is used for all developments of this type in Queensland.

3.6.4 Airstrip

Operation of the proposed airstrip will be as a private operation for small/light single turbo-prop aircraft only as discussed in Section 3.4.5. Night time use will not be provided for. Use of the airstrip will be for private planes, scenic joy flights, or small charter flights (less than 10 persons) bringing visitors to the Island.

Aviation fuel will be stored at the airstrip. Underground tanks will probably be used to reduce risk of collision. The airstrip operator will be required to hold a Development Approval to store fuels under the *Integrated Planning Act 1997/Environmental Protection Act 1994*. Details of design and management of fuel storage will be addressed in the application for this permit.

The fuel storage will comply with:

- Australian Standard 1940 (Storage and Handling of Flammable and Combustible Liquids); and
- CP 4 Design installation and Operation of Underground Petroleum Storage Systems

3.6.5 Golf Course

Golf course maintenance will be in accordance with the *Guidelines for Improving the Eco-Efficiency of Golf Courses in Queensland* (2001) produced by The Australian Golf Course Superintendents Association (AGSCA) and Qld EPA.

These guidelines provide methods and management principles that minimise the use of irrigation water, pesticides and fertilizers minimising impacts to adjacent ecosystems. Day to day operations will include eradication of noxious weeds and removal of unwanted plant growth to allow and encourage the natural re-establishment of plant species native to the Island. A detailed Turf Management Plan will be developed by the course designer based on the AGSCA Guidelines that will guide the day to day management of the course and facilities.

3.6.5.1 Fertiliser Application Management

Best management practice will be used, with all fertiliser applications determined by regular soil analysis as required by the AGSCA Guidelines. Care will be taken to minimise the application of fertilisers and nutrients to areas of indigenous planting.

The development of a Golf Course/Turf Management Plan in line with the AGCSA (2001) will incorporate management principles such as:

- The use of in ground sensors and regular soils analysis to assess soil moisture and nutrients to manage recycled water application rates;
- Management of fertiliser use, limiting fertiliser applications, use of slow release natural organic fertilisers, application of fertiliser during forecast dry weather only; and
- Management of the course as a "wild" course retaining and utilising native vegetation to the maximum extent, minimising the area of managed turf and limiting recycled water application to that available.
- Design of the course to include bioretention basins to "process" stormwater residual nutrient loads prior to release to existing drainage lines and ephemeral watercourses;

Incorporation of the above management principles together with developing practices on similar courses within the GBRWHA will control potential nutrient inputs at the source and provide in-stream treatment/mitigation measures to ensure that receiving water WQO are achieved and potential impacts to identified EVs minimised.

3.6.5.2 Chemical Application Management

Best management practices will be adopted and care taken with pesticides and chemicals including their appropriate storage, safe use and disposal, all to be carried out in accordance with the manufacturers recommendations and statutory regulations including conformance with applicable Australian Standards. Pesticide operators will be required to be familiar with the toxicity and hazard rating of pesticides with Material Safety Data Sheets (MSDS) kept in the maintenance shed for all the chemicals used.

Management of pesticide application within the proposed development and particularly associated with golf course maintenance will be through the development of an Integrated Pest Management Plans (IPMP) as recommended by the *Improving the Eco-efficiency of Golf Courses in Queensland (AGCSA, 2001)*. Components of the IPMP can include:

- Understanding course conditions and characteristics;
- Surveying pest species on the course;
- Defining pest management intervention thresholds;
- Development of a monitoring and record keeping program; and
- Development and implementation of pest control strategies.

The pest management hierarchy under the IPMP includes non-chemical cultural methods as a preference followed by non-cultural methods utilising pesticides or biological control agents as a second tier management strategy. Cultural management strategies that control weeds without chemical use include:

- Selection of disease resistant turf species;
- Selection of low water requirement turf species;
- Turf management through:
  - Soil aeration;
  - Thatch control;
  - Irrigation management;
  - Increased mowing heights;
  - Minimal and appropriate use of organic fertiliser supplements;
- Development of a pest monitoring plan; and
- Removal of low density pests/weeds by hand;

Non-cultural methods will be triggered at a certain pest threshold and will use pesticides or biological controls. Pesticides will be used based on the following principles:

- Review of the location where the chemical will be used and proximity of any drainage, bioretention/stormwater structures and ephemeral watercourses;
- Selection of the lowest toxicity chemical that will be effective for the intended purpose (preferably compounds that biodegrade rapidly to non-toxic products);
- Consideration of soil and thatch conditions within the area to be used;
- Review of weather conditions (no application if rain is forecast for 48 hrs);
- An application hierarchy of:
  - Direct (to leaf) application;
  - Spot spraying;
  - Treatment of the diseased area only;
  - Controlled broader spraying. and

- Conduct a monitoring program of site groundwater and receiving waters for pesticides and incorporate results into a quarterly summary report.

Use of such hierarchy and management options will minimise the use of chemicals within the proposed development and minimise potential impacts to ephemeral watercourse and groundwater EVs, downstream waters such as dams, estuaries and the coast (refer to Section 8.3.1).

3.6.5.3 Irrigation System

The correct design and management of the irrigation system for fairways and greens will protect the soil profile and water table (particularly in groundwater discharge zones, refer to Section 5) and control the spread of non indigenous turf grasses. Directional sprinklers and dual irrigation lines on all fairways will be used to ensure uniform distribution and avoid over watered areas. Valve-in-head sprinklers will provide optimum control. All sprinklers and control valves will be pressure regulated to prevent sprinkler operating pressure variations.

The irrigation system will be operated by a central computer in conjunction with field and in-ground decoders and sensors. Irrigation schedules will be controlled by an on-site weather station. Provision will be made for soil moisture and nutrient monitoring sensors around the course that will monitor root zone moisture and nutrient movement through the soil profile. The sensors will be connected to central computer to assist the system operator to make decisions regarding watering frequency and fertiliser application periods. Wind sensors may be installed to control watering during periods of undesirable wind speed and direction. Data from the weather station will be used to automatically adjust the preset daily watering times to match the daily evapotranspiration rates for the site. Off-peak night time irrigation will lower pumping costs and apply water at optimum times to combat wind and evaporation effects.

Irrigation pumping stations will be equipped with variable speed pumps designed to meet peak season demands. The pumping stations will require 415 volt 3-phase supply.

Irrigation water for the golf course will be from both stormwater and recycled, treated sewage from the STP (refer to Section 3.4.1). Sewage will be treated to A+ standard with phosphorous levels averaging 0.5 mg/L and not exceeding 1.0mg/L. The treated effluent will be piped to storage dams around the course and located away from residential areas. The course will require an average irrigation requirement in the order of 100 to 125 ML per year with peak demands in summer of approximately 1.25 to 1.5 ML per day. Storage dams will be lined and collectively have a storage capacity of 20 ML, equivalent to two weeks peak demand storage.

Warning signs will be provided around the course to inform that recycled waste water is being used for irrigation.

3.6.6 Controls for Private Sector Activities

The Plan of Development will become part of the Miriam Vale Shire Council Planning Scheme and will continue to apply after completion of initial construction period and will guide any future development.

Changes to the Plan of Development will only occur through regulated process such as those established under the existing *Integrated Planning Act 1997*.

3.6.7 Management of Conservation Features

Special Lease SL 19/52155 requires that at the time of freeholding of the proposed development land, the proponent must surrender the remaining land within the lease area back to the Crown. The lease makes no mention of the future/final status of the land to be surrendered. The proponent proposes that the undeveloped land surrendered to the Crown be designated as a 'Conservation Zone" within the Draft Plan of Development (Refer to Appendix A2).

The proposal is to establish a parks and gardens maintenance office on the Island. The Maintenance Office will be responsible for:

- Establishment and maintenance of urban parks and gardens;
- Establishment and maintenance of fire breaks and fire management;
- Control of noxious weeds;
- Construction and maintenance of perimeter fences;
- Provision and maintenance of pedestrian beach access infrastructure;
- Cleaning of beaches;
- Management of re-vegetation programs;
- Testing of water quality at ephemeral watercourse discharge points and on-site water storages;
- Liaison with Qld NPWS; and
- Control of feral animals.

The proponent will be responsible for the recruitment and training of staff for the parks and gardens maintenance office. At the appropriate time the parks and gardens maintenance office and staff will be wholly transferred to the LGA. The costs of establishing and operating the Office will to be initially funded by the proponent. However, a local area charge will be included in LGA rates on all properties on the Island to cover the costs of managing the natural, undisturbed areas of the Island.

Perimeters of the development areas will be fenced with 3 strand wire sheep fences to minimise vehicle access to the undisturbed areas of the Island.

3.7 Ecological Sustainable Development

The Hummock Hill Island Master Planned tourist and residential community is designed from the ground up on Ecologically Sustainable Development (ESD) principles. Triple bottom line factors of economic, social and environmental issues have been considered and incorporated into the master planned community from the design stage.

The *National Strategy for Ecologically Sustainable Development* (NSESD) issued by the Department of Environment and Heritage (DEH, 1992) defines ESD as *"……using, conserving and enhancing the community's resources so that ecological processes, on which life depends, are maintained and quality of life for both present and future generations is increased."*[2] DEW clarify this notion stating that ESD requires "*changes in the nature of production and consumption so that they can better satisfy human needs while using fewer raw materials and producing less waste.*"

The Core Objectives outlined in the NSESD (1992) are defined by DEW as:

- to enhance individual and community well-being and welfare by following a path of economic development that safeguards the welfare of future generations;
- to provide for equity within and between generations; and
- to protect biological diversity and maintain essential ecological processes and life-support systems.

The guiding principles outlined in the NSESD (1992) are stated by DEW as:

- 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.

DEW note that the above "*guiding principles and core objectives need to be considered as a package. No objective or principle should predominate over the others. A balanced approach is required that takes into account all these objectives and principles to pursue the goal of ESD.*"

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[2] An Overview of the National Strategy for Ecological Sustainable Development, Department of the Environment and Water Resources. http://www.environment.gov.au/esd/national/nsesd/overview/index.html (accessed October 2007)

Part 2 of the NSESD (1992) provides a number of specific objectives for a range of sectoral issues (such as Fisheries Ecosystem Management) followed by a series of action that Governments will achieve. As the NSESD (1992) is aimed at the Government policy level, application of specific objectives stated within the NSESD at the project level is not considered appropriate. However, ESD principles provided by DEW in the *Australian Local Sustainability Initiative* (EA, 2002) are considered more applicable at the project level whilst being cognisant of the overall ESD objectives outlined the NSESD (1992).

The following Sections outline how the proposed Hummock Hill Island Development will achieve the key objectives of ESD as outlined in the *Australian Local Sustainability Initiative, An Achievement Recognition Matrix* (Environment Australia, 2002).

3.7.1 ESD Objectives and Project Achievement

Our Commitment	NSESD Guiding Principles
Objective 1 - Greater community wellbeing and concern for key social issues	
▪ The master planned community will be based on sensitive social design, incorporating a range of essential social services such as medical centres, community services and recreational opportunities for a range of ages (refer to Section 3 and Section 16); ▪ The development will provide a range of tourist accommodation options to enable access for a wide range of social demographic, ranging from affordable camp grounds through to holiday homes to a hotel resort (refer to Section 3). The tourism component of the proposed development has considered both the current and future requirements for the region as outlined in the Queensland Tourism Strategy – A 10-year vision for sustainable tourism (Qld Government, 2006) which incorporates the triple bottom line perspective of economic, social and environmental goals (refer to Section 4); ▪ The development will provide affordable housing options and a range of housing types which are intended to be affordable by workers on the Island. The additional supply of residential land may also decrease overall pressure on housing supply in the longer term, which may help keep property prices and rental costs in nearby areas at more affordable prices. ▪ Master planning will consider objectives and Policy Actions of the Wide Bay Burnett Regional Plan 2007 – 2026 and Central Queensland Regional Growth Management Framework, 2002. In general, the proposed development can demonstrate compliance with the outcomes sought by the Wide Bay Burnett Regional Plan with exception of the preferred settlement pattern. However, the development only proposes to provide for the convenience shopping needs and some entertainment needs of the Island's visitors and residents as part of the development. The proposed development does not detract from the established or desired regional centres network. While Hummock Hill Island is situated outside the Central Queensland Region, it is within a reasonable commutable distance of Gladstone City, which offers higher order goods and services than the towns in Miriam Vale Shire. As such, it is anticipated that the new population on Hummock Hill Island would expand the Gladstone City's catchment area and contribute to the economic and social prosperity of this centre (refer to Section 2). ▪ A program of community consultation was undertaken to provide opportunities, encourage and facilitate active community involvement in the EIS process and provide ongoing information about the Hummock Hill Island Development. The consultation	*Decision making processes should effectively integrate both long and short-term economic, environmental, social and equity considerations.* *Decisions and actions should provide for broad community involvement on issues which affect them.*

Our Commitment	NSESD Guiding Principles
program has provided opportunities for 'affected' and 'interested' persons to contribute to the process, assisted the EIS project team to understand and respond to community issues where necessary and captured feedback and incorporated it into the draft EIS (refer to Section 16).	
Objective 2 –Local economic development and employment growth	
▪ The Project is expected to generate direct and indirect employment opportunities during both the construction and operation phases of the Project. Development will utilize local labour and resources, stimulating local economy. The creation of new jobs by the proposed development over a 16 year period would present substantial opportunities for the local labour market. The phased nature of the development would provide the local labour market considerable time to adjust to the opportunities created and to build required skills through established systems (e.g. the apprentice and vocational education systems). Whether the jobs are secured by local residents or by labour from other regions would in part depend on how capable the region is in building the needed skills (refer to Section 17). ▪ The Project is expected to allow for employment and skills training opportunities during construction, and facilitate a range of business and employment opportunities following construction within the Village/Town Centres and resort facilities. It is likely that employment options available as a result of the project during both construction and operation would increase job opportunities, employment diversity and training opportunities in the area. This is likely to lead to a gradual increase in median incomes, and potentially help to retain younger people (15-24 years) in the area (refer to Section 16). ▪ Skill shortages may be addressed through apprenticeships and training programmes. In the 2006 and 2007 budgets, the State and Federal governments3 respectively announced several packages to address skills shortages through apprenticeships and training (refer to Section 16).	*Decision making processes should effectively integrate both long and short-term economic, environmental, social and equity consideration.* *The need to develop a strong, growing and diversified economy which can enhance the capacity for environmental protection should be recognised.*
Objective 3 – Sustainable use and management of land and water resources	
▪ An integrated water supply strategy has been developed, with the preferred water supply system comprising of. ▪ Rainwater tanks for non-potable household uses; ▪ Rainwater can be used for potable uses if UV or filtration units are installed at the tank; ▪ Recycled water from treatment of wastewater is used for toilet flushing and all external uses; ▪ Recycled water is also used for irrigation of public open space and the golf course; ▪ Potable water and/or top up of rainwater tanks is provided from a small desalination plant. Desalination water will be circulated in a reticulation system throughout the proposed development; and ▪ Mandated water efficient devices are installed in all buildings.	*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.*

[3] State Government: 2006-2007 Regional Budget Statement: Wide Bay Burnett, p. 4; Federal Government: 2007-2008 Budget: Realising Our Potential, p.12.

Our Commitment	NSESD Guiding Principles
Objective 4 – Protecting biological diversity	

▪ Design has been carried out with consideration to essential ecological systems, in particular: clearing within supratidal salt flats and mangroves will be minimised to the minimum width required to accommodate the road design and storm water controls. Clearing will be conducted in accordance with recommendations within the *Wetland Management Profile – Salt marsh Wetlands issued by the Queensland Wetlands Programme*.
▪ Water sensitive urban design (WSUD) principles will be used for all permanent control measures to mitigate litter, sediment, nutrient, hydrocarbon and chemical releases to adjacent estuarine and marine environments. Construction of WSUD features will utilise ephemeral watercourses that discharge to Boyne Creek, Colosseum Inlet and the marine environment (refer to section 15).
▪ The current Qld DPIF size and bag limits are considered to be sustainable and are designed to maintain recreational fishing populations will be maintained (refer to section 15).
▪ Impacts on terrestrial flora and fauna communities and identified World Heritage Values of the Great Barrier Reef will be minimised through a range of mitigation measures, including:
  ▪ Location of proposed buildings and associated infrastructure outside of endangered RE's to the maximum extent possible;
  ▪ Exclusion of development from the habitat known to support significant fauna species such vine forests supporting the black breasted button quail (*Turnix melanogaster*) and the Green Turtle (*Chelonia mydas*);
  ▪ Minimal disturbance to marine/tidal habitats, known to be of World Heritage and State significance;
  ▪ Incorporation of vegetated and riparian corridors within the master plan design to allow the free dispersal of fauna;
  ▪ Incorporation of formal fauna crossing points at potential road-strike points;
  ▪ Incorporation of fauna crossings in designed ephemeral watercourse crossings to allow the movement of fauna along riparian corridors;
  ▪ Maximisation of tree retention at the lot level i.e. 50% retention of vegetation on low and medium density residential lots (refer to section 14);
  ▪ Incorporation of Water Sensitive Urban Design treatments into stormwater management will manage and treat discharges that maintain existing water quality in estuarine and marine waters minimising impacts to the habitat of EPBC listed species such as seagrass meadows used by dugong (*Dugon dugong*).
▪ A compensatory habitat strategy will be developed, which is designed to: secure advanced regrowth (near remnant) vegetation within and outside the Shire, secure 'threshold' and 'of concern' REs of equivalent conservation status to those to be cleared for the project, strategic purchase of key land parcels which have been identified as key linkages or habitats for EVR taxa at the local, sub-regional or regional scale and revegetation and rehabilitation of existing cleared areas of land within the study area, with a view to re-instating pre-clearing vegetation types (refer to section 14).
	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.

Objective 5 – More efficient use of energy and greater use of renewable energy resources	
▪ Alternative power sources have been investigated as part of the EIS including: mains grid connection, on-Island generation using a gas fired cogeneration plant or diesel engine generators, solar/photovoltaic cell arrays and wind turbines. It is proposed to	*Decision making processes should effectively integrate both long and short-term economic, environmental, social and equity*

Our Commitment	NSESD Guiding Principles
use a combination of these energy generation methods. ▪ During the detailed design phase, investigations into energy efficiency measures and incorporation of appropriate strategies to maximise energy efficiency and limit greenhouse gas emissions will be undertaken. ▪ Buildings will be designed to 5 star standards for energy conservation, and will incorporate additional energy saving technologies that become available during the 16 year development period. ▪ Construction waste management will incorporate the Commonwealth Government 'Wastewise Construction Program, Waste Reduction Guidelines to minimise waste generation and maximise waste recycling. ▪ Minimisation of the developments contribution to global climate change will be an ongoing goal of the proposed development with downstream contributions to minimising subsequent impacts to the Great barrier Reef World heritage Area.	*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.*
Objective 6 – More effective land use planning, environmental protection and pollution control	

▪ Masterplanning will be in accordance with the proposed Plan of Development for Hummock Hill Island. It provides specific direction on how development should occur, based on the extensive investigations undertaken for this EIS, to achieve environmental protection and a sustainable and vibrant community. The overall objectives of the Plan of Development are:
  ▪ Areas of conservation significance are retained and the human population can enjoy living in close proximity to, and harmony with the natural ecosystems.
  ▪ Social environment will be based on a vibrant, dynamic and diverse community that has a strong environmental awareness and is committed to sustainable living and self development. Individuals and households will come to Hummock Hill Island seeking quality of life in its fullest sense and fulfilling educational and outdoor recreational experiences.
  ▪ Built environment will be appropriate to the scale of the development and the natural environmental setting. Infrastructure systems will be based on latest advances in sustainable living, but will be suitable for management and basic maintenance by the householders.
▪ The need for the development is demonstrated through the provision of a range and diversity of residential and tourism opportunities that will cater for the predicted growth in tourism and residential demand within the region (refer to section 4).
▪ Environmental values, particularly significant coastal resources are protected to the extent that impacts to significant environmental values are avoided and where not possible, the impacts are minimised and management arrangements are identified (refer to section 4).
	Decision making processes should effectively integrate both long and short-term economic, environmental, social and equity considerations.
	The need to develop a strong, growing and diversified economy which can enhance the capacity for environmental protection should be recognised.

Our Commitment	NSESD Guiding Principles
Objective 7 – Reducing consumption minimizing waste and properly managing hazardous wastes	
▪ The waste management hierarchy will be employed on site, focussing on avoidance, then reuse and recycling and disposal as a last option. A centralised waste collection area will be established on the Island to facilitate the implementation of the waste management hierarchy (refer to section 11). ▪ Class A+ water will be produced from greywater and blackwater using a mechanical treatment process combined with nutrient removal and filtration. This recycled water will be used for third pipe reticulation: toilet flushing, external uses such as car washing and garden watering, irrigation of golf course and public open space and fire fighting, minimising demand and on water resources in the region. ▪ Where practicable construction will include the use of modular components, purchase of materials cut to standard sizes or pre-fabricated materials to reduce the need for off-cuts. Material choices for building construction shall include a proportion of renewable or recyclable components, although use of renewable and recyclable components shall not compromise the construction of the buildings in accordance with the relevant development codes and the Building Code of Australia (refer to section 11). ▪ Chemicals, fuels, oils and any other substances that, if spilled, would cause pollution or contamination of the land or water, will be stored appropriately to minimise the risk of environmental impact. Chemical storage will comply with Australian Standards and Material Safety Data Sheets (MSDS) requirements (refer to section 11).	*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.*
Objective 8 – Reduced Greenhouse gas emissions and improving air quality	
▪ Alternative power sources were investigated as part of the EIS including: mains grid connection, on-Island generation using a gas fired cogeneration plant or diesel engine generators, solar/photovoltaic cell arrays and wind turbines. It is proposed to use a combination of these energy generation methods to supply energy to the proposed development and minimise reliance on non-renewable sources of energy. ▪ During the detailed design phase, investigations into energy efficiency measures and incorporation of appropriate strategies to maximise energy efficiency and limit greenhouse gas emissions will be undertaken. These actions will reduce impacts of the development on WHV of the Great Barrier Reef from greenhouse gas emissions. Construction and operation phase energy minimisation strategies will implemented and are detailed in Section 3.4.3 of this chapter. ▪ Dust generation will be minimised through staged development, reducing the area of exposed land and volumes of material moved around the site at any time, and through the incorporation of appropriate dust management measures (such as water spraying). A dust management plan will be prepared and implemented by the construction contractor. ▪ Impacts of air emissions associated with the development will be minimised through adequate buffers between the residential areas and the wastewater treatment plant and waste transfer station. Further investigation into the risk of odour nuisance and emissions controls would be undertaken during the detailed design.	*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.*

SECTION 4
PROJECT JUSTIFICATION

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4. Project Justification and Alternatives

Much has been said about the pressures that will come to bear as population in Queensland continues to grow. In central Queensland population growth is quite strong and comparable to the State annual average growth. The economic drivers contributing to growth in Gladstone and surrounding local government areas includes increased industrial activity in the Gladstone/Calliope State Development Area, increased activity in mining of coal and other commodities from the Bowen Basin inland from the area and intrastate migration.

These growth pressures, together with existing natural resource issues in Queensland have highlighted the need for future development to be smart and sustainable so that growth can occur within the limits set by resource availability and without compromising the natural features that attract both tourists and residents to Queensland.

As our society matures, people are seeking high quality lifestyles where a good balance between work and leisure can be achieved. A sense of fulfilment with life is seen to come from variety of challenges and opportunities, physical, social and learning experiences. The value of belonging in a community (social environment) is being rediscovered as is the sense of satisfaction that comes from being in touch with the natural environment and in control of the built environment.

Our population is aging and older people are in better health than ever with increasing life spans. These people have a lot to offer a community and are also seeking to stay active, participate in the community and pursue a range of personal goals.

As a society we are at a turning point for development, not only recognising the various components that contribute to a healthy, fulfilling lifestyle, but having the means to achieve this. Smart and sustainable developments will support the range of lifestyle advantages that are offered in Central Queensland, including a pleasant climate, access to marine, coastal and terrestrial areas of great natural beauty and a solid economic base.

4.1 Project Justification

4.1.1 Regional Tourism Context

As a tourism centre, the Central Queensland and Wide Bay Region is relatively undeveloped, with opportunities available for sustainable tourist developments that can provide facilities for international, national and regional visitors. Data from the Australian Bureau of Statistics (ABS) and Tourism Queensland shows that Central Queensland received 1.1 million visitors in 2006. The Gladstone region (including Gladstone, Calliope and Miriam Vale SLAs) received 356,300 visitors over the same period representing 32% of the Central Queensland visitation.

Visitors to the Gladstone region consisted primarily of intrastate (within Queensland) visitors (68 %) followed by interstate visitors (19 %) and international visitors (14 %) as shown in Figure 4.1. These figures suggest that the primary target market for the proposed region will be regional Queenslanders from the Bowen Basin mining growth areas who seek a quality holiday/short break

destination with a range of affordability options, such as that proposed by the development (refer to Section 3).

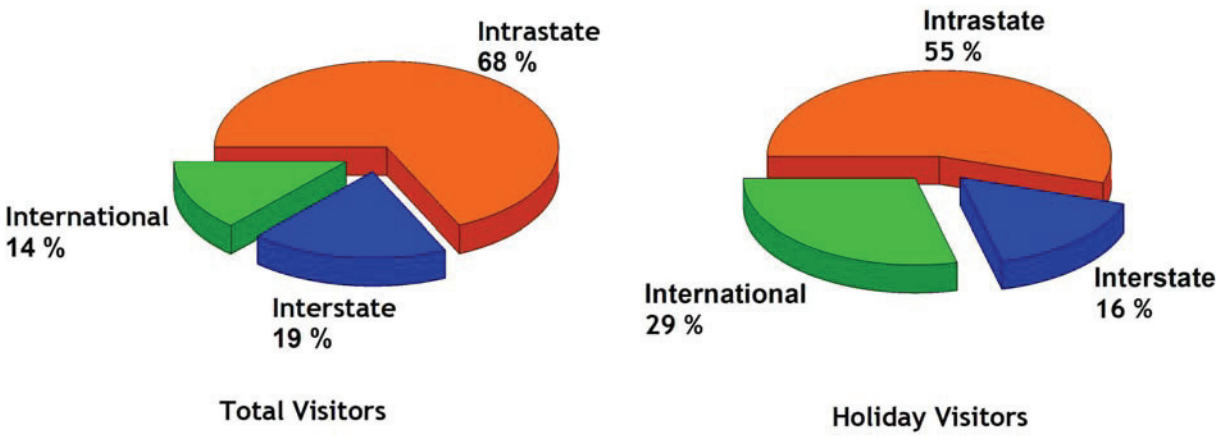


Figure 4.1 – Visitor Sources for Central Queensland (Source: Tourism Qld, 2006)

Standard Visitor Surveys conducted by Tourism Queensland for the Gladstone region (Calliope, Gladstone and Miriam Vale Shire) found that the top three most appealing aspects of the region were:

- Beaches/water/river – 30 % of respondents;
- Scenery/natural environment/wildlife – 15 % of respondents; and
- Climate – 13 % of respondents.

Hummock Hill Island provides a unique opportunity to utilise all three of these features sought after by tourists. The Island has two beaches on the northern side of the Island that are easily accessible from the proposed development and is also surrounded by deep water tidal estuaries that will have access via the two proposed boat ramps, one having all-tide access.

The proposed development will retain much of the vegetation outside the former pastoral lease area and will also retain much of the vegetation at the individual Lot level, retaining the natural scenery values of the Island for tourists and residents alike (refer to Section 5 and 14). The proposed development will be designed to have minimal visual impact from the surrounding waterways (refer to Section 5), again retaining the scenery values of the Island.

An integrated tourist and residential development on Hummock Hill Island will provide a range of accommodation options ranging from affordable camping to resort hotels built in harmony with the surrounding natural environment and based on ecologically sustainable development principles. As such, the proposed development is ideally placed in the regional market with good access to the regional transport hub of Gladstone City and accommodates the requirements of the regional market.

The Queensland Tourism Strategy: A 10-year vision for sustainable tourism (2006) has been endorsed by the Queensland Government as the plan to develop the tourism market in Queensland. This document provides four key goals over the next 10 Years, these being:

- Goal 1 - increase visitor expenditure by $1.43 billion above forecasts to $21.6 billion;
- Goal 2 - Increase Queensland's market share from overnight visitors to 29.1%;
- Goal 3 - Increase tourism's economic contribution to Gross State Product (GSP) by $900 million above forecasts to 12.5 billion; and
- Goal 4 - Create an additional 11,000 tourism jobs above forecasts.

To achieve this Tourism Queensland and the State Government have set a series of targets for the next 10 years, aligned with each goal outlined above. These are:

- Target 1 – Increase visitor expenditure and share of the total Australian market. Targets for visitor expenditure and share are outlined in Table 4.1.

Table 4.1 – Visitor Expenditure Forecasts and Targets for Queensland ($ billion)

	Actual 2005	Forecast		Target	
		2010/11	2015/16	2010/11	2015/16
Qld Visitor Expenditure	$14.83	$17.11	$20.24	$17.5	$21.67
Fitzroy[1] Visitor Expenditure (7%)	$1.04	$1.20	$1.42	$1.23	$1.52
Total Qld Overnight Share	27.28%	27.23%	27.13%	27.85%	29.05%

Source: Tourism Queensland (2006) Queensland Tourism Strategy

- Target 2 – Increase visitor expenditure in all Queensland destinations. The Gladstone Regional Tourist Organisation (RTO) is included with the Capricorn RTO in the Fitzroy region for this target that is outlined in Table 4.7 and is an increase of $1.06 billion above 2005 expenditure.

Table 4.2 - Visitor Expenditure target for the Fitzroy ABS Region ($ billion)

	Actual 2005	Forecast 2015/16	Target 2015/16
Fitzroy Visitor Expenditure	$0.59	$0.81	$0.87
% Total Queensland Expenditure	4.0%	4.0%	4.0%

Source: Tourism Queensland (2006) Queensland Tourism Strategy

Based on the Fitzroy region receiving 4% of Queensland visitor expenditure, the 2015/16 target for Fitzroy is $0.87 billion. It is noted that 2006 data indicated that the Fitzroy region received 7% of the total Queensland expenditure that would equate to a 2016 target of $1.52 billion (Tourism Qld, 2006).

By 2016 around $42 million in tourism expenditure will result from the proposed Hummock Hill Island development (refer to Section 17), this equates to around 5% of the proposed 2016 visitor

[1] Tourism areas are based on Statistical divisions

expenditure target for the Fitzroy region and greater for the Gladstone region, making a significant contribution towards achieving the Queensland Tourism targets.

- Target 3 – Increase the value of tourism to Queensland. This target is to increase tourism's contribution to Queensland GSP as outlined in Table 4.3. Based on the Fitzroy maintaining a 4% share of the Queensland total tourism GSP the 2015/16 target is an increase of $160 million over the next 10 years.

Table 4.3 – Increase in GSP ($ billion) and GSP of Tourism to Queensland

	Actual 2005	Forecast		Target	
		2010/11	2015/16	2010/11	2015/16
Qld Tourism GSP	$8.4	$9.8	$11.6	$10.1	$12.5
Fitzroy Tourism (@ 4%)	$0.34	$0.39	$0.46	$0.40	$0.50

Source: Tourism Queensland (2006) Queensland Tourism Strategy

Tourism expenditure from the proposed development as stated above is estimated as $42 million by 2016 and $80 million by 2024 following completion of the project. By 2016 tourism expenditure from the Hummock Hill Island development is anticipated to contribute 0.5% of the Queensland Tourism GSP and 12% of the Fitzroy tourism Gross Regional Product, again a significant contribution to the Queensland Tourism targets for 2016.

- Target 4 – Create an additional 11,000 tourism jobs above forecasts for Queensland. Within the Fitzroy RTO region this target equates to a target of an additional 1,640 tourism related jobs as outlined in Table 4.4.

Table 4.4 – Increase in Tourism Employment in Queensland and Fitzroy RTO

	Actual 2005	Forecast		Target	
		2010/11	2015/16	2010/11	2015/16
Qld Tourism Employment	136,000	149,000	166,000	153,000	177,000
Fitzroy Tourism Employment	5,440	5,960	6,640	6,120	7,080

Source: Tourism Queensland (2006) Queensland Tourism Strategy

At the Fitzroy region level the proposed Hummock Hill Island development is anticipated to generate around 350 jobs directly related to tourism by 2016 (refer to Section 17), 5% of the Tourism Queensland 10 year target for the Fitzroy region outlined in Table 4.4. Indirect job creation within the Fitzroy region will be greater by 2016 with over 400 jobs created regionally.

The development will contribute significantly to tourism within the central Queensland region providing flow-on effects to the regional economy. It will also attract a wide ranging market of potential visitors with little impact on existing tourist infrastructure.

Domestic tourism is estimated to generate $379 million to the Central Queensland region, 3.6% the gross regional product and 6.3 % (or 4,700 full-time jobs) of all employment in the region. This rates 6th behind the Gold Coast, Brisbane, Sunshine Coast, tropical North Queensland and the Whitsundays.

Estimated tourism expenditure from the Hummock Hill Island project over the 16 year development period is shown in Figure 4.2. The site is projected to accommodate on average approximately 1,600 tourists per night once fully developed. Their local expenditure while staying is projected to grow as the development of tourism accommodation units progresses and reach $80 million per year by 2024.

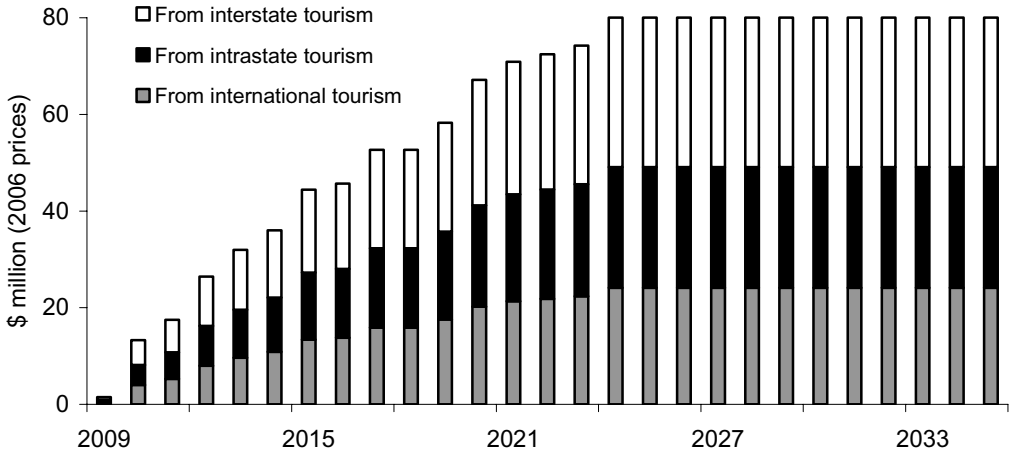


Figure 4.2 – Estimated Tourism Expenditure Over the Development Period

Estimated benefits for the regional economy for the period to 2035 are that tourism expenditure would make a direct contribution to regional value of $810 million ($290 million in NPV terms). The total direct and indirect (or multiplier) contribution to regional value – added is estimated as $1.06 million ($380 million in NPV terms). Net direct and indirect benefits to the region are $54 million (in NPV terms) and to the State $87 million (in NPV terms).

To achieve the 10 year targets outlined above, Tourism Queensland (2006) has conducted a Strength, Weakness, Opportunities and Threats (SWOT) analysis of the current Queensland tourism market. The tourism component proposed development is consistent with many of the identified aspects of the SWOT analysis such as:

- The proposed development provides a significant contribution to the projected growth of Queensland's and the regional tourism market;
- Being located within a 45 minute drive of Gladstone, an area of significant population and infrastructure growth;
- Providing a consistency of product and service quality to the regional tourism sector strengthening an identified weakness in the Queensland market;
- Represents a significant investment within the region of new serviced accommodation, new products, services and niche experiences strengthening an identified weakness in the current market;

- Provides tourism infrastructure during the identified period of growth over the next 10 years and beyond;
- Provides a range of products that services the various needs of the changing family demographic;
- Utilises and allows incorporation of new technology within the proposed tourism related developments such as sustainable building, power and water supply;
- Incorporates principles of environmental sustainability with the aim of developing infrastructure in harmony with the surrounding environment;
- Minimises adverse impacts to the adjacent environment by incorporating sustainable principles such as an independent water supply via desalination, water sensitive urban design that minimises stormwater contamination, utilisation of recycled water via third pipe reticulation, providing vegetation offsets and utilising lighting technology that minimises light spill over to adjacent habitats; and
- Meeting the higher expectations of product and service quality expected by current tourists.

As such, Central Queensland will benefit both economically and socially from sustainable and integrated tourism developments that increase accessibility to the regions coastline and natural scenery, an attraction that is in demand. Recent data indicates growth in the domestic tourism market and increasing demand for quality and affordable accommodation for the region with access to beaches and waterways. This coupled with increasing population pressure and increasing economic activity in the Bowen Basin and the Gladstone State Development Area will place strain on existing tourist infrastructure and associated centres. Development of Hummock Hill Island as an integrated and sustainable development will provide much needed capacity to service the anticipated tourist growth within the region.

Creation of an integrated and cost effective tourist development based on ESD principles requires the proposed scale of development. Considerable expenditure is required to install infrastructure such as upgrades to the existing Clarks Road, installation of a bridge and associated sustainable power and water reticulation. Installation of access and environmentally sustainable infrastructure would not be justified by a smaller scale development or alternatively would make the proposed market too exclusive for a dominantly intrastate tourism market.

The proposed scale is also necessary to provide critical mass for the proposed commercial centre and community infrastructure such as education and emergency services necessary to provide a sustainable and viable community. A smaller tourist community would not ensure viability for the proposed commercial precinct

4.1.2 Location Suitability

Currently Tannum Sands, 1770 and Agnes Waters accommodate tourism opportunities with beachside access. Tannum Sands acts more as an outer suburb of Gladstone, being predominantly occupied by workers. 1770 and Agnes Waters contain a high retired population demographic and is located some distance from regional transport nodes.

Between these two locations lie Wild Cattle Island National Park, Eurimbula National Park and Bustard Head National Park, the former being a sand based island and the latter being based on a rocky peninsula. Beaches located north of 1770 have limited accessibility and would not provide the opportunity for mixed tourism and residential use that a location such as Hummock Hill Island nearer Gladstone provides. Turkey Beach does have existing opportunities for expansion in the residential sector, however beach based tourism opportunities are limited due to a lack of suitable quality beaches.

Hummock Hill Island is ideally located close to regional transport nodes such as Gladstone (less than 45 minutes) and the Bruce Highway (less than 15 minutes) that can act as access points for tourists, particularly the self drive market that is typical of intrastate tourists as discussed above. The situation of Hummock Hill Island is advantageous over very limited alternative local sites for the following reasons;

- In a natural setting that, whilst attractive, is not unique within the region or the Great Barrier Reef World Heritage Area, making it suitable for an ecologically sensitive, master planned tourist and residential development;
- Access to good quality beaches and safe enclosed waters, the two most desirable assets of any tourism based development communicated in tourism Queensland surveys;
- Topography of the Island allows maximal use of ecologically sensitive design principles that minimize energy consumption and maximizes natural ventilation and screening opportunities;
- The proposed development area is located on a special lease that implies the intent to develop the land;
- The position of the development allows utilisation of existing transport corridors for access and power infrastructure, namely Clarks Road; and
- Compliance with the majority of Policy Actions within Section 3.1 and 3.2 of the Wide Bay Burnett Regional Plan (2007) and Section 3.1.1 of the Central Queensland Regional growth Management Framework (2002).

4.1.3 Development Need in the Local Context

The Gladstone region and Bowen Basin mining centres are rapidly expanding due to increased industrial and mining output driven by current resources demands. Gladstone has been identified by the State Government as an area for future industrial expansion with the Gladstone State Development Area, located to the north west of Gladstone City. Current projects completed, under construction or in planning stages are outlined in Table 4.5 below.

Table 4.5 – Current and Future Industrial Projects in the Gladstone Region

Project name	Capital Expenditure ($ million)	Construction Employment	Operational Employment
Projects Approved			
Air Liquide	$12	20 (peak)	3
Projects Committed			
Orica Australia – Yarwun Expansion	$137	300 (peak)	22
Goondicum Industrial Minerals Project	$50	50	60
Orica Australia – Yarwun Expansion	$38		
Central Queensland Ports Authority	$800	650	80
Rio Tinto – Yarwun Alumina Refinery	$2.1 billion	2,200	250
Origin Energy – Walloon Coal Seam Gas	$260	-	-
Alinta Ltd – Qld Gas Pipeline upgrade	$112	-	-
Projects Under Study			
Central Queensland Gas Pipeline	$200	300	8
CQPA – Fisherrmans Landing Expansion	$161	-	-
CQPA - Wiggins Island Coal Terminal	$1 Billion	800	125
Gladstone Pacific Nickel	US$2.8 billion	2600	450
Arrow Energy - Coal Seam Gas	$1.5 – 2	-	-
Arrukun Project – Refinery + Mine	$3 billion	2,300	500
Transpacific Industries – Waste Management	$20	70	-
Ergon Energy – Infrastructure Upgrades	$64	-	-
LNG International + Arrow Energy – LNG facility	$400	100	12
Santos – LNG facility	$7 billion	3000	200
Powerlink Qld – Infrastructure Upgrades	$95 (max)	-	-

Current industrial expansion has resulted in significant population growth (2.2 – 3.4% per annum) greater than the Queensland average (1.7% per annum). The future population for the area[2] is anticipated to be 80,495 by 2026 (OESR & PIFU, 2007). To cater for this future population growth large tracts of land to the south west of Gladstone have been acquired for residential development by various parties. Further residential expansion to the south west is limited by steep hills and land availability. Coastal land south of Tannum Sands is currently under development to accommodate some of the future urban expansion. Based on the future population growth of an additional

[2] Gladstone City, Calliope and Miriam Vale LGA (future Gladstone Regional LGA)

30,000 residents for the region by 2026, around 9,000 additional residential allotments will be required based on an average 2.7 persons per household (Cox, 2007).

The residential housing component of Hummock Hill Island would accommodate around 5% of the future population growth and allotment demand, providing a range of housing type and affordability in a desirable coastal location within a sustainable context that helps to reduce ecological footprint. The Island is ideally situated, with Gladstone (65 km), Tannum Sands (40 km) and Miriam Vale (30 km) being the nearest regional centres providing shopping, postal and banking facilities.

The proposed development would represent an additional sub-regional node to the area providing services to the adjacent local community such as Turkey Beach and Foreshores Estate without the need to travel long distances to the nearest adjacent centres mentioned above. Community services as mentioned in Section 16.2 will be incorporated into the commercial centre of the development.

Recreational facilities are currently limited within the area of the proposed development. Boat ramps that provide access for private recreational boats are available at Turkey Beach, Foreshores Estate, midway along Wild Cattle Creek (currently being upgraded as part of a development in Tannum Sands) and Boyne Island. No sporting facilities are located within the area, the nearest recreational facilities being ovals at Bororen and Tannum Sands. Camping sites are currently available in the Bustard Head National Park and unofficial camping is conducted on the northern and southern tips of Hummock Hill Island and in Sandfly Creek.

Increasing population growth within the area (3.8 % per year) will create an increasing demand for recreational facilities. Hummock Hill Island is well placed to provide for many of these opportunities. The proposed development will increase access to recreational facilities such as sporting ovals, water access, golf course facilities, tennis, squash and fitness activities. These facilities will provide the local community with increasing opportunities for participation in activities not currently available within the area without travelling considerable distance.

4.1.4 Demographic Profile

Hummock Hill Island Development is ideally situated to attract a range of demographic clientele to settle within the master planned community. The coastal location and sustainable lifestyle attracts a wide range of people from retirees and sea-changers to workers commuting to employment centres in the Gladstone region and mines in the Bowen Basin.

Census data from 2006 returns a median age of 43 for Miriam Vale SLA compared to Calliope and Gladstone with median ages of 36 and 32 respectively. This distribution is possibly reflective of the sea change phenomenon with a high proportion of retirees settling in coastal communities such as Agnes Water and 1770. The age distribution in Calliope and Gladstone displays a significantly smaller proportion of the 45 to 64 age group as may be observed in Table 4.6.

Table 4.6 – Age Structure of Miriam Vale, Calliope and Gladstone SLA

Age group	Miriam Vale	Calliope	Gladstone	Queensland
0-14 years	20.5	24.9	24.1	20.7
15-24 years	7.5	11.6	14.5	13.8
25-44 years	24.4	28.7	30.4	28.2
45-64 years	36.5	26.1	23.2	25.0
65+ years	11.1	8.7	7.8	12.4

Source: ABS Census, 2006

The proposed Hummock Hill Island Development is also ideally situated to cater for full range of demographic sectors represented in Miriam Vale Shire with their greater percentage in the 45 to 64 age range and Calliope and Gladstone with their greater percentage of the population in the 25 to 44 year age range. The range of housing proposed for the Island will cater for each of these demographics in both affordability range and lifestyle choices.

Gladstone continues to expand as an industrial base and the State Development Area is intended to attract further industry to the region as outlined in Table 4.5. This expansion of industrial capability within the region will continue to drive further workforce demands, a workforce that requires quality accommodation and lifestyle choices. As a consequence of continuing demand there will be further influx from interstate and intrastate populations as the current workforce ages and moves into the next demographic profile. The Hummock Hill Island Development provides a sustainable lifestyle choice within easy commuting distance to current and future employment centres in the Gladstone region.

Further development and expansion of mining centres within the Bowen Basin region will also further increase the demand for a holiday destination for the intrastate tourist sector. The Island is situated within an easy 2 – 3 hour drive from many of these regional centres and will provide an attractive holiday destination for both short weekend break and longer options

4.1.5 Population and Estimated Growth Trends

The 2006 census data indicates the Miriam Vale Statistical Local Area (SLA) recorded a population of 5,126, an increase of 6.3% from 2001 census data. The Calliope SLA (incorporating Tannum Sands) recorded a population of 15,054, an increase of 19.2% from 2001 census data. The Gladstone SLA recorded a population of 28,946 in 2006, an increase of 7.3% from 2001 census data. A summary of this census data is presented in Figure 4.3 together with projected population changes.

The LGA's population is expected to more than double by 2026 to over 10,000 people, with an average annual growth rate of 3.4% between 2001 and 2026 (PIFU, 2006). Calliope and Gladstone are also expected to grow to approximately 26,000 and 44,000 respectively by 2026, providing annual average growth rates of 2.3% and 2.2% respectively[3]. These growth rates are higher than the projected Queensland average of 1.7% per annum over the same period. This growth is expected to

[3] Medium growth projection (PIFU, 2006)

be fuelled by the economic growth in the mining, manufacturing and tourism industries of the region and also due to the 'sea change' phenomenon. This latter trend is characterised by increasing numbers of people moving to regional coastal areas which is perceived to provide more relaxed and comfortable lifestyle options. Five yearly predicted populations are presented in Figure 4.3 below.

Both the Wide Bay-Burnett Regional Plan and Central Queensland RGMF identify the importance of the coastal fringe as an important population growth area within the region. This is primarily attributed to the pleasant and unique lifestyle that is attractive to all age groups. The area also benefits from local employment, commercial and social opportunities of Gladstone and more recently the Bowen basin. In particular, employment demands being driven by further industrial expansion within the Gladstone State Development Area (GSDA) and increased mining activity within the Bowen Basin are likely to drive continued strong growth.

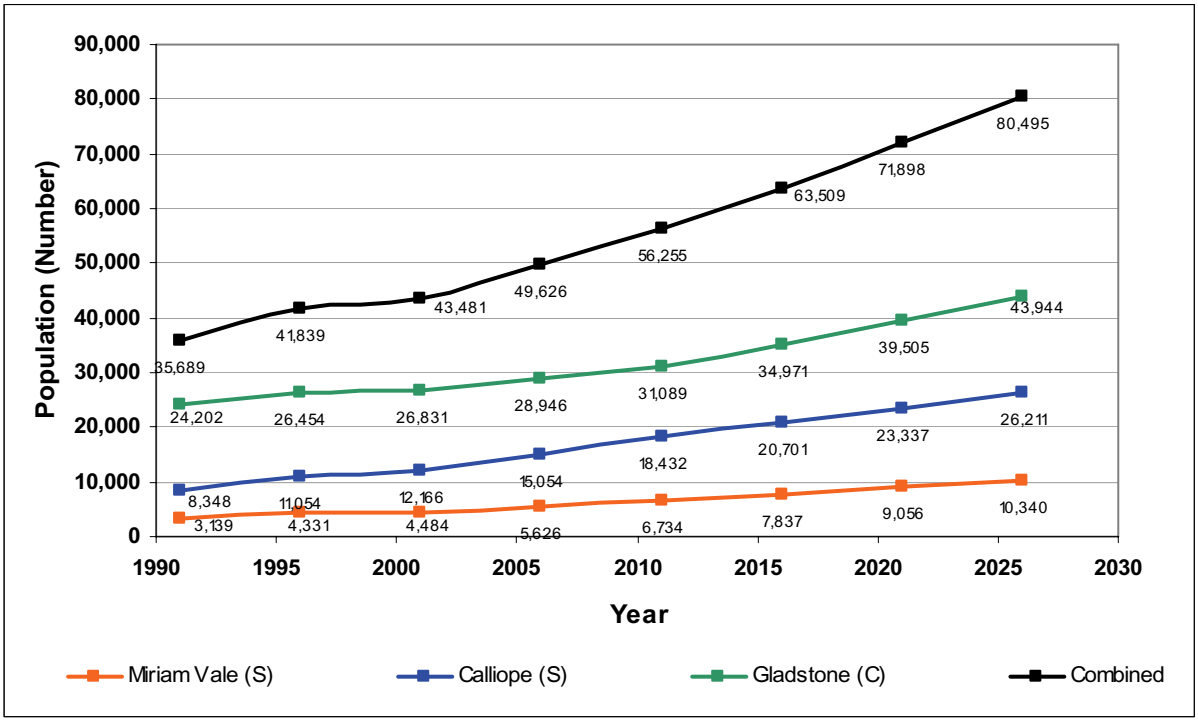


Figure 4.3 – Recorded and Projected Population Growth to 2026 for Miriam Vale, Calliope, Gladstone and Combined (Source: ABS & LGAP)

The final Hummock Hill Island Development population is expected to be in the order of 4,019 people, to be achieved at the end of the 16 year development period. The anticipated final population is planned to be 1,597 permanent residents with 2,271 tourists (at full occupancy). The anticipated schedule for population growth is shown Figure 4.4.

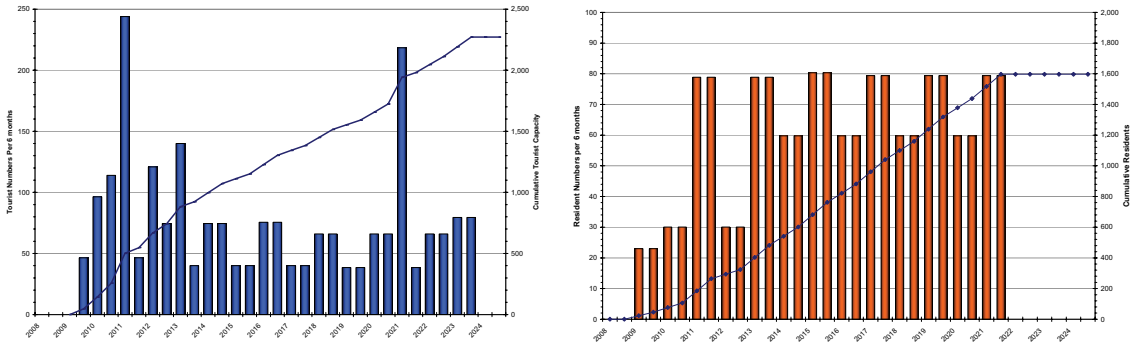


Figure 4.4 – Tourist and Residential Yearly and Cumulative Growth during Development

The development population is expected to be a mix of permanent and holiday residents and tourists roughly broken down as follows:

- All of the hotel, motel and campground accommodation will be for short term visits (not likely to exceed 7-10 nights);
- 50-60% of the residential properties (homes, apartments, townhouses) will be holiday homes/apartments and used by their owners for holidays or rented to holidaymakers on a nightly and weekly basis;
- 10-20% of the properties will be purchased by persons who will take up employment or business opportunities in servicing the tourism market or by investors who will rent the properties to people employed in the tourism industries on the island; and
- The remaining 20-30% of the properties is expected to be sold to persons who will take up permanent residence on the island. These may include retirees and workers commuting to Gladstone, Boyne Island or other employment nodes in the region.

Based on the projected tourist and population growth for the region the Hummock Hill Island development is strategically located to accommodate a 33% of the projected Miriam Vale Shire population growth and 5% of the Gladstone region population growth in a desirable coastal location utilising sustainable principles that minimise potential impacts to the adjacent environment.

4.1.6 Building Investment

The proposed Hummock Hill Island Development represents a significant economic opportunity for the Central Queensland region, in terms of dollars spent in the region as well as temporary and permanent employment opportunities.

It is estimated that more than 3,300 person years of direct employment would be generated in construction of the proposed development, with an average of 190 jobs per year from 2007 to 2024, and a peak employment of 350 persons. Once indirect effects are taken into account, construction is estimated to generate almost 4,700 person years of employment, with an average of 260 jobs per year, and a peak employment of 460 persons.

At a State level, the project is estimated to directly and indirectly generate almost 5,400 person years of employment in construction, with an average of 300 jobs per year, and a peak employment of 550 persons (Focus Economics, 2007).

Employment opportunities will include skilled and unskilled positions in engineering design, construction supervision and trades, earthmoving, equipment operation, building and landscaping. Average salary/wage for construction employees is in the order of $75,000 pa and increasing as demand continues to be strong for qualified trades.

Estimated expenditure for the 16 year project development program, including provision of infrastructure to Hummock Hill Island and preparation and servicing of land is $190 Million. Itemized costs are shown in Table 2.

Estimated costs of building construction are estimated to be in the order of $700 million as shown in Table 4.7. This expenditure is likely to occur over about 20 years from 2009.

Table 4.7 – Project Development Costs

The project will provide significant stimulation to the local, regional and State economies as most of the materials required for construction, can be locally sourced such as:

- Sand and aggregates – existing local sources;
- Cement, steel, bitumen, pipes, structural steelwork, – Gladstone;
- Pipes, valves and fittings –Gladstone and Rockhampton;
- Building materials- Gladstone;
- Treatment Plant components- Brisbane/Sydney;
- Fuel – Gladstone; and
- Building materials including bricks, wood, fittings and furnishings – Gladstone.

Once fully operational, around 400 full-time equivalent jobs are likely to be directly generated by the proposed development in areas such as:

- Maintenance workers and operators for infrastructure and services;
- Hospitality and recreation;
- Retail and commercial activities;
- Educational activities; and
- Cleaners, gardeners.

Economic activity associated with construction and operation will also result in flow on effects in the local, regional and State economies, with increased economic activity and employment.

4.1.6.1 Labour Force

"New employment creating initiatives are required, based on the twin strategies of encouraging growth by growing existing business as well as the traditionally more glamorous new business attraction strategies" are recognized by the WBBRP as an important requirement for the region, with it's current high demand/low spend population. Employment opportunities for youth that will support current demand by local industry are also required.

Staged development of Hummock Hill Island over the next 16 years will supply long term sustainable employment opportunities in a number of sectors including construction, skilled trades and tourism based industry. This will provide valuable opportunities to the local population and also attract outside sources of skills with a trickle down effect on the local economy.

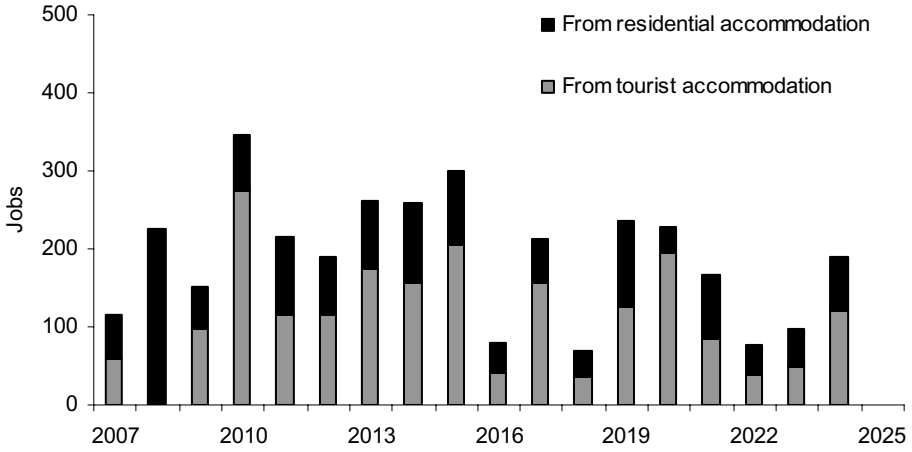
It is estimated that almost 3,300 person years of direct employment would be generated during construction, with an average of 190 jobs per year from 2007 to 2024 and a peak employment of 350 persons. Once indirect effects are taken into account, construction is estimated to generate almost 4,700 person years of employment, with an average of 260 jobs per year, and a peak employment of 460 persons (Focus Economics, 2007).

At a State level, the project is estimated to directly and indirectly generate almost 5,400 person years of employment in construction, with an average of 300 jobs per year, and a peak construction employment of 550 persons (Focus Economics, 2007). Construction benefits over the lifetime of the project are outlined in Figure 4.5

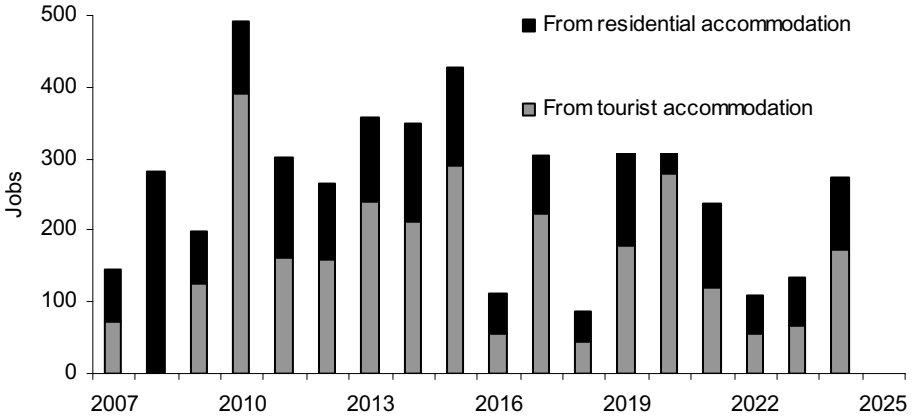
Substantial employment opportunities would also arise from the tourism activity generated by the project. It is estimated that over the period 2007 to 2035, more than 11,000 person years would be created directly, and a total of approximately 14,500 person years of employment would be created directly and indirectly. The number of jobs created is expected to rise steadily to the peak level in 2024, of the order of 700 persons. At a state level, the tourism expenditure is estimated to directly and indirectly generate up to 850 jobs per annum by 2024, or more than 17,000 person years of employment to 2035.

The creation of new jobs by the proposed development over a 16 year period would present substantial opportunities for the local labour market. With the population of Gladstone Regional LGA estimated to grow from 49,626 persons in 2006 to 80,495 persons by 2026, the project has the potential to provide an important source of employment for the large number of future, local residents that will enter the labour force providing a range of opportunities to a new generation workforce.

Direct impact on employment



Direct and indirect impact on employment (Type I multiplier)



Note: Direct and indirect effects are based on the average direct and Type I multipliers for the Wide Bay-Burnett and Fitzroy regions, for the residential building construction and other construction industries. The distribution of expenditure in a year on physical infrastructure, social infrastructure and land development between tourism and residential accommodation is based on the split of total building work between tourism and residential accommodation in the same year.
Source: Focus Economics, 2007.

Figure 4.5 – Regional employment from building and construction

Source: Focus Economics, 2007 – Refer to Section 17

4.1.6.2 Economic Indicators

Results of the regional level cost-benefit analysis are summarised at Figure 4.6. It is estimated that the net benefits from the project for the region are approximately $55 million (in NPV terms, at a real discount rate of 6%). That is, the project benefits are estimated to outweigh the project costs by $55 million. A significant share of these net benefits are likely to be secured in the local area given the business and employment opportunities offered by the development during the staged construction and operation.

Sensitivity analysis has been undertaken at higher real discount rates of 8% and 10%. The finding of positive net benefits remains at these higher discount rates (although only marginally so at the 10% discount rate).

	NPV in $ million (in 2006 prices), at a real discount rate of		
	6%	8%	10%
Benefits	550	430	345
Construction - tourism related	99	85	74
Construction - residential related	70	62	55
Tourism expenditure	380	283	215
Costs	495	418	358
Construction - tourism related	233	201	175
Construction - residential related	161	142	126
Other investment - tourism related	99	74	56
Additional preventative measures (environmental)	1	1	1
Benefits less costs	54	13	-13

Figure 4.6 – Regional benefit-cost analysis

Source: Focus Economics, 2007 – refer to Section 17

4.1.6.3 Educational Need and Relevance

With a final permanent population 1,600 people it is anticipated that there will be a need for a primary education facility. Currently Bororeen and Tannum Sands have primary school facilities that service the Turkey Beach and Foreshores area. With continued growth of Tannum Sands, primary education spaces are likely to be limited without further expansion. Bororeen is currently operating at 50% capacity and is capable of providing for initial primary education demand from Hummock Hill Island and the proposed expansion of Turkey Beach that does not have education facilities proposed incorporated into expansion plans.

Once constructed, Hummock Hill Island will be able to cater for a viable primary education facility drawing on the local population and also from the expanding adjacent population centres such as Turkey Beach and Foreshores.

It is also proposed to provide a tertiary education/research centre in collaboration with a Queensland University to utilise the opportunities available to study and provide feedback into the master planned community based on ESD principles. The research centre will enable continued application of ESD principles and the latest sustainable building design technology throughout the life of the proposed development.

It is considered essential that such new technology is incorporated into future growth of the project to its ultimate design capacity. The rate of technological change in sustainable energy and supply systems has been and is currently rapid, such as recent advances in new and more efficient photovoltaic cell systems. It will be essential to incorporate new and innovative technology into later phases of the project to further minimize ecological footprints, greenhouse gas emissions and increase sustainability.

4.1.7 Community Services

A range of community services is planned within the Hummock Hill Island Development that provides access "to essential services in an attractive environment which supports their daily needs and underpins their quality of life and functioning as viable working communities." Within three years of the development commencement, a medical centre and emergency services infrastructure will be built within the commercial centre for the development. These services will enable both permanent residents, adjacent populations in Turkey Beach and Foreshores Estate and tourist access to essential medical facilities and health care. Further opportunities exist within the commercial precinct for additional essential services to be established based on demand within the local and regional community.

The project will generate a consistent stream of employment opportunities through the 16 year development period in essential trades, creating an estimated 3,300 person years of direct employment during construction, with an average of 190 employees per year from 2007 to 2024 and a peak employment of 350 persons.

Substantial employment opportunities would also arise from the tourism activity generated by the project. It is estimated that post completion peak employment will be in the order of 700 persons. The proximity to Gladstone and Boyne Island will also provide employment opportunities for local and regional residents alike in existing and future industry and services. Further employment generation details are provided in Section 4.1.6.1

Water based transport links between Hummock Hill Island and Gladstone, such as high speed ferry services, are not considered feasible or a financially viable proposition, either currently or on completion of the project due to the shallow nature of the Colosseum Inlet entrance bar. No current high speed commuter ferry services currently exist within the Port Curtis Area and it is unlikely such a service will be required from a primarily tourist based development where commuting to employment centres (that have no current ferry landing facilities) would not be anticipated.

4.2 Project Alternatives

4.2.1 Location

Hummock Hill Island has unique attributes that are not otherwise available in Central Queensland. The location is integral to the proposed development, and indeed the proposed development has been conceived specifically for this location.

Hummock Hill Island is available to the proponent through a lease with the Queensland Government and no other such opportunities are currently available to the proponent within such close proximity to the transport hub of Gladstone.

While it would be possible to provide an equivalent number of residential and tourism accommodation units elsewhere in the Central Queensland region, and potentially within 45 minutes drive of Gladstone, the particular attributes of Hummock Hill Island make it favourable over any other location in easy reach of Gladstone. In particular:

- The coastal location provides a micro climate that is more comfortable for tourists and residentss, and reduces the need for artificial cooling minimising energy consumption and associated greenhouse gas production;
- The beach and surrounds are attractive and provide outdoor recreational opportunities that cannot be recreated anywhere else on the Central Queensland coast; and
- The land for the proposed development is available and has long been identified by the Queensland Government for this type of development under a special lease.

4.2.2 Alternative Master Plans and Land Use

As discussed in Section 1, the Island has a long history of use with a Pastoral Lease first issued on the Island in 1878 and running till 1991 when the Pastoral Lease was converted to a Special Lease for Lot 3 on FD841442. Conditions of the Special Lease included, construction of a bridge across Boyne Creek linking the Island to the mainland (Condition C374), progressive development of the leased land (Condition C380) and conduct all works in accordance with the approved plans (condition C378).

A number of development configurations have been developed since the establishment of the Special Lease over Lot 3 on FD841442. These are discussed in the following sections.

4.2.2.1 Proposed Development 1993

An original proposal for the "*provision of a major residential and recreational facility*" was proposed in 1993 by Hummock Hill Island Pty Ltd (a wholly owned subsidiary of Raymag Securities Ltd) and included:

- A 100 room hotel;
- 300 Park residential houses;
- 3,290 Residential allotments;
- 820 Condominiums;
- A caravan, relocatable home, holiday cabin and camping site with a 250 caravan capacity;
- Community facilities such as schools and emergency services;
- 2 Golf courses, bowling greens and tennis complexes;
- Water supply reservoirs;
- Sewerage treatment plants; and
- Water management processes including drainage to replenish aquifers.

Figure 4.7 - Proposed Development Circa 1993

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Hummock Hill

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Figure 4.8 - Proposed Development Circa 1999

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The proposed development from this era was given approval by Miriam Vale Shire council though development did not commence and the approval lapsed. Figure 4.7 presents a plan of the proposed development form this period.

4.2.2.2 Proposed Development 1999

A proposed development for "*a combination of tourist and residential facilities with supporting community infrastructure and commercial services*" was proposed by East Wing Corporation Pty Ltd in 1999 and was granted Significant Project status under the SDPWO Act. It was proposed to stage the development and included:

- A three phased residential tourist development housing about 9,000 people;
- A Centre for higher learning based on space related technology and incorporating a technology park complex; and
- A commercial space launch vehicle facility for launching low earth satellites.

Figure 4.8 presents the master plan for the above proposed 1999 development.

4.2.2.3 Proposed Development 2001 - 2006

A number of master plan developments were proposed by East Wing Corporation Pty Ltd between 2002 and 2005. These various concept plans and Master Plans were adjusted to conform with the constraints imposed by the environment as they were revealed. Figure 4.9 to Figure 4.12presents the various configurations proposed during this period.

4.2.2.4 Proposed Development 2007

The current master plan responds to the terrain and natural environmental values of the Island and is in accordance with current Queensland Government policy requirements governing development in areas of higher environmental sensitivity that includes:

- Avoidance of endangered regional ecosystems;
- Avoidance of development in the coastal zone (coastal management district) except where absolutely necessary for the bridge and two boat ramps;
- Avoidance of acid sulfate soils, again except where absolutely necessary for construction of the bridge and two boat ramps; and
- Avoidance of development in habitat of the one vulnerable species identified on the Island, the Black Breasted Button Quail.

Consideration of alternative footprints within this context has not been undertaken as the master plan has been adjusted to minimise disturbance to the natural environment within the constraints of the site.

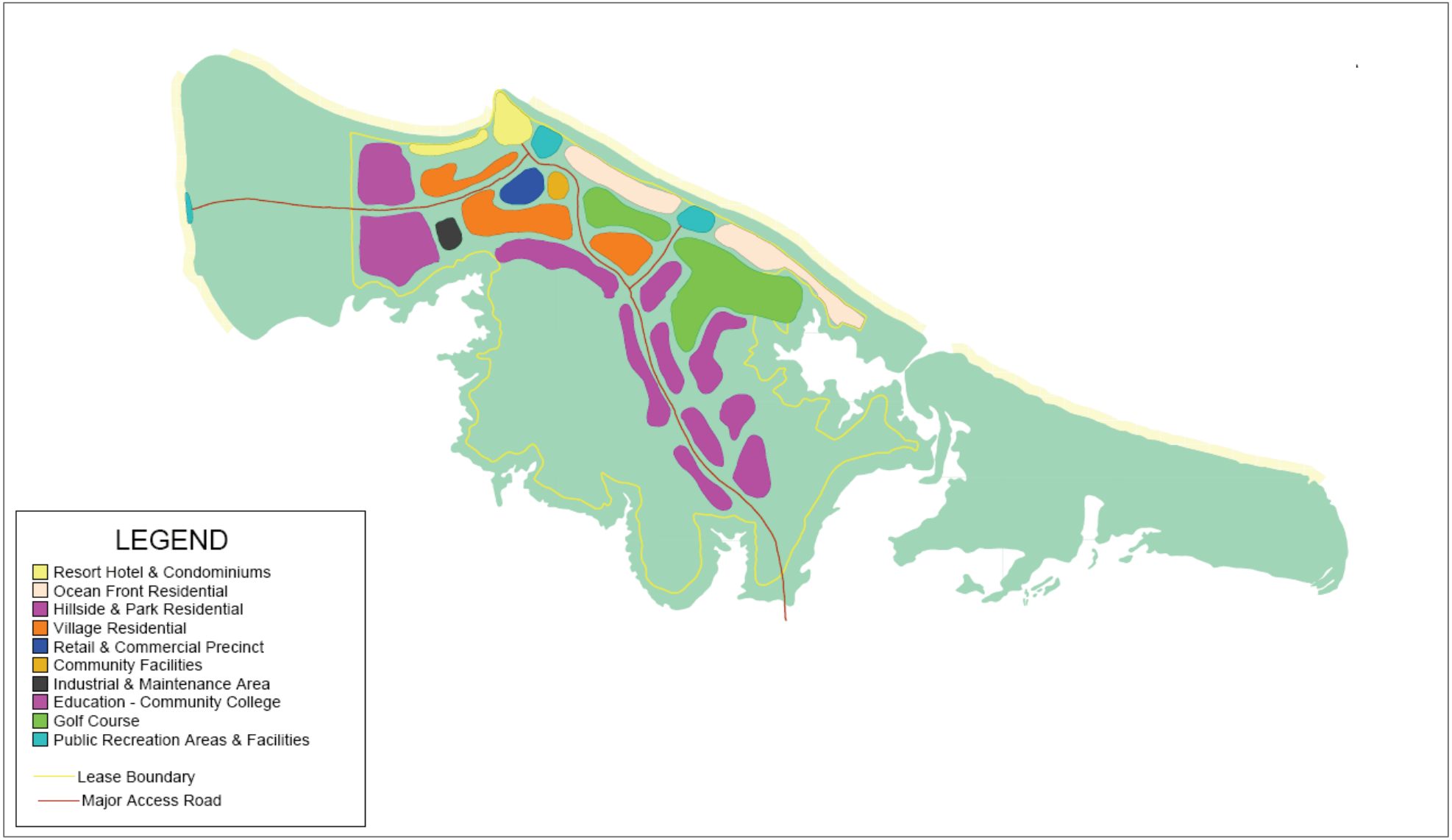

Figure 4.9 - Proposed Development - Concept Plan, A 2004

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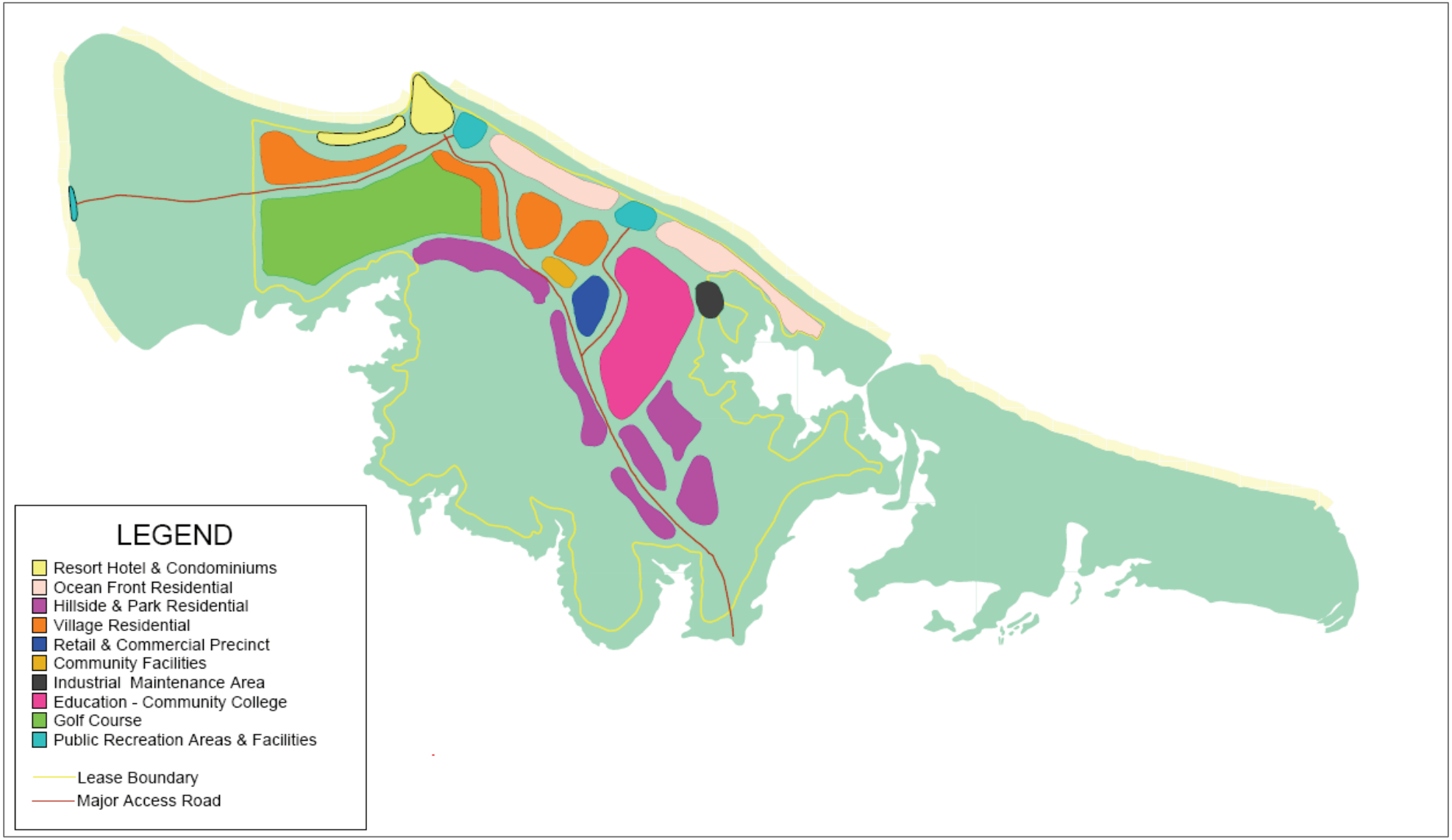

Figure 4.10 - Proposed Development - Concept Plan, B 2004

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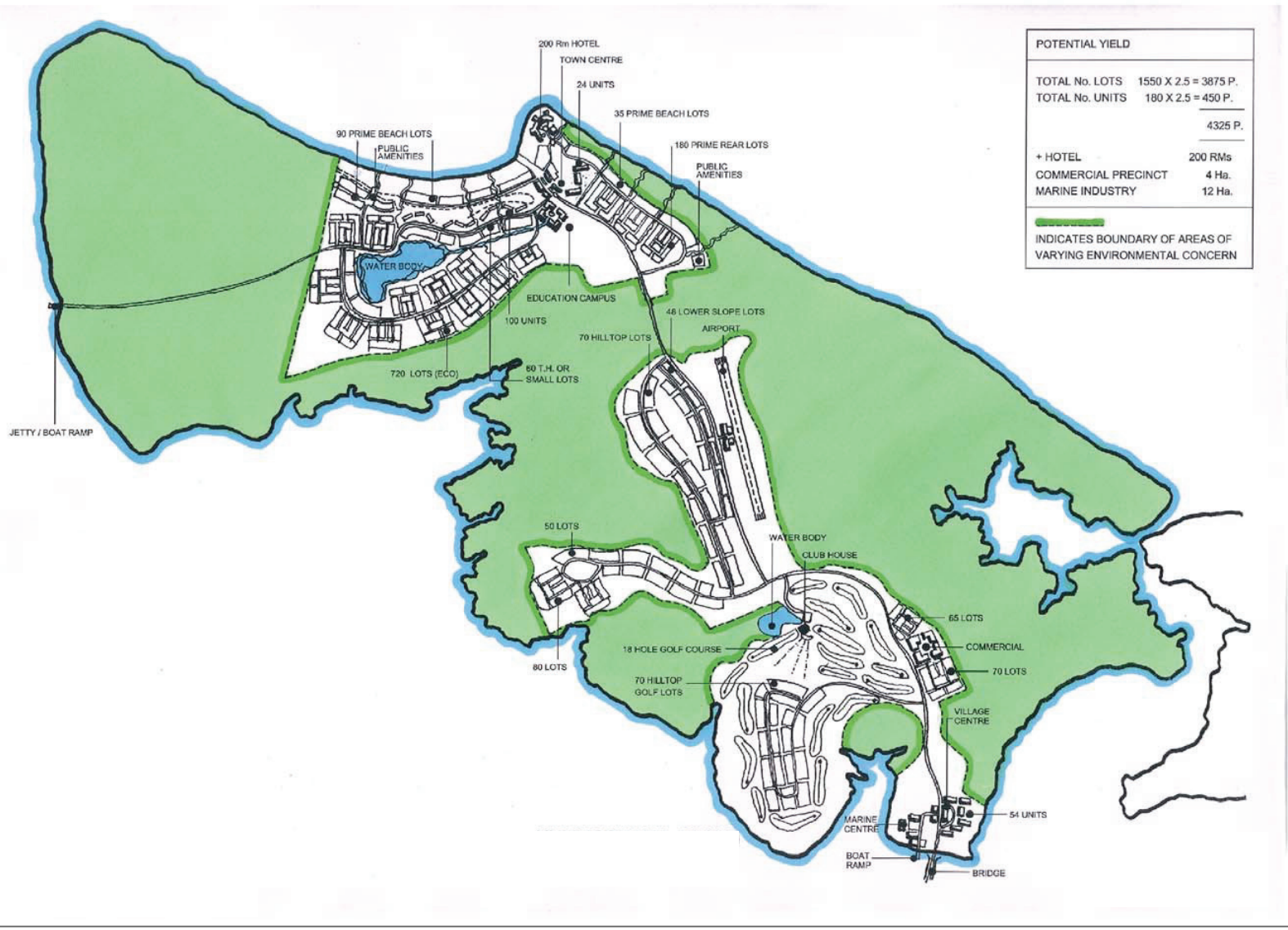

Figure 4.11 - Proposed Development - Master Plan C, 2005

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Figure 4.12 - Proposed Development - Master Plan H, 2005

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Land uses for the proposed development have been selected based on the need to meet demand for residential development, tourism opportunities and recreational opportunities in the region. Again, the proposed land use has been carefully developed to meet regional needs, and hence a wide range of alternatives was not considered. Specific details of the current proposed Master Plan are included in Section 3.1.

4.2.3 Access

Access is available to the Island via gazetted roads. Alternative road access was not considered as this would have required new road easements to be identified and gazetted. Shorter road access routes would require traversing the upper estuary of Colosseum inlet.

Access via ferry from Gladstone was discounted due to:

- Access being restricted in times of bad weather;
- The north side of the Island is too exposed for a safe landing port (without significant engineered protective structures) and there are navigational difficulties traversing sand bars at the mouth of Colosseum Inlet; and
- Travel times would generally be longer than by road.

4.2.4 Water Supply

4.2.4.1 Relevant Targets and Principles

As discussed in Section 3, a range of performance targets and principles have been established for the proposed development. Targets and principles directly relevant to water supply are repeated in Table 4.8 below.

Table 4.8 – Water Supply Targets and Principles

Performance Targets	Development Principles
A reliable water supply is provided Quality of water is appropriate for designated uses Natural hydrological cycles are not undermined Environmental quality is not degraded Water management infrastructure meets best practice urban design standards.	Groundwater is not used for water supply Water harvesting and consumption is strictly controlled Wastewater is treated and reused. Limited reliance on water resources from the mainland; Provision of a safe potable water supply that meets Australian Drinking Water Quality Guidelines; Site based water management is maximised including collection from roof catchments and reuse of wastewater; A reliable water supply is available for fire fighting

4.2.4.2 Options Considered – Water Supply Strategy

Water demands for a development of this type are quite variable in terms of quality and opportunities exist to maximise efficiency of water cycle management by matching available supplies to different types of uses. Quality and quantity requirements are set out in Section 3.4.2.

A range of options for water supply were identified:

- Mains water supply, involving installation of a water supply main connecting existing municipal water supplies to Hummock Hill Island;
- Desalination, involving installation and operation of a reverse osmosis desalination plant (thermal desalination was not considered because of high energy costs compared to reverse osmosis);
- Salt water, use of untreated water from the sea;
- Recycled water, being water treated to Class A or Class A+ in a wastewater treatment plant;
- Recycled water treated to better than Class A+ suitable for 100% potable reuse;
- Grey water, being water generated at a household level from showers, baths, hand basins and washing machines;
- Stormwater, being stormwater collected from overland flows (for example in a dam); and
- Rainwater, being water collected from rooftop catchments and stored in tanks at the household level.

Suitable uses for each of these sources are shown in Table 4.9.

Table 4.9 – Water Uses and Source Options

Water Type	Suitable Uses	Source Options							
		Mains Water	Desalination	Recycled (Water (potable)	Recycled Water (A or A+)	Greywater	Stormwater	Rainwater tank	Sea Water (untreated)
Potable	Drinking, cooking	✓	✓	✓				✓(1)	
	Washing hands, cleaning teeth, shower, dishwashing	✓	✓	✓				✓	
High Contact	Toilet flushing	✓	✓	✓	✓		✓	✓	✓
	Clothes washing	✓	✓	✓	✓			✓	
	Car washing	✓	✓	✓	✓			✓	
	Marine and vehicle servicing	✓	✓	✓	✓			✓	
Irrigation	Garden irrigation	✓	✓	✓	✓	✓	✓	✓	
	Irrigation of public areas, golf courses, etc	✓	✓	✓	✓	✓	✓	✓	
	Supply Considerations								
	Quality	☺	☺	☺	☺	😐	😐	😐	☹
	Reliability	☺	☺	☺	☺	😐	☹	😐	☺
	Site suitability	😐	☺	😐	☺	😐	😐	😐	NA
	Community Acceptance	☺	😐	☹	😐	😐	😐	😐	☹
	Implementation	Centralised	Centralised	Centralised	Centralised or Local	Household or Local	Centralised or Local	Household	Centralised (toilets only)
	Treatment Requirements	Possible re-chlorination	High energy requirement for treatment.	Very high level of treatment required.	High level of treatment required to meet guidelines	Treatment required to maintain acceptable standard	High level of treatment required	Disinfection and filtration required for potable uses	Toilets only, special fittings required to handle corrosion issues

(1) With treatment (sterilisation)

☺ = high, 😐 = Moderate, ☹ = Low

The suitability of each source for water supply was analysed in detail by Cardno (2007) (refer to Appendix A7.1). At least one of mains water, desalinated water, recycled potable water or tank water (treated) is required to meet quality requirements for potable and high quality uses. Of these:

- Mains water is available from Calliope Shire Council and can be piped to HHI at reasonable cost. Adequate supplies are available to meet 100% of demand from the proposed development;
- Desalinated water can be produced from a small scale desalination plant sited on the Island. Plants can be sized to ensure that 100% of water demands can be met through desalination;
- Potable recycled water can be produced from wastewater using specialised wastewater treatment units. However even with 100% recycling of wastewater, not enough water can be produced to meet demands, due to losses from the system due to outside use, evaporation and so on. Also, drinking of potable recycled water is not acceptable to all members of the community; and
- Rainwater tank, with a suitable disinfection unit fitted to the tank, can meet quality requirements for all required uses. However, analysis of rainfall patterns indicates that the required tank size for reliable household yield, even allowing for some recycling of wastewater, is in excess of 145 KL per household. This size is prohibitively large for this type of development.

On this basis, it is clear that the only water supply options that can, alone, meet 100% of the demand for the proposed development are desalination or mainland water supply. It is also clear that any water supply solution for the island must include either of these two options, or rainwater tanks (as supplementary supply mechanisms).

While both mainland supply and desalination are capable of providing 100% of water needs for the proposed development, project targets and development principles call for reuse and recycling of wastewater to be maximised, and also call for minimisation of reliance on mainland supplies. Further investigations were therefore carried out by Cardno (2007) on various integrated water supply options to identify suitable options to meet both quality and quantity requirements while also maximising reuse and minimising dependence on mainland water supplies.

Six configurations for water supply were investigated:

- Option 1 – Recycled Water Reticulation with Reticulated Potable Supply - providing reticulated recycled water to every property throughout the development. Recycled water derived from sewage treatment would be utilised for external uses and toilet flushing. It would also be used for irrigation of the golf course, sports field and airstrip. The remaining water would be provided through a potable supply (desalination or a pipeline from the mainland);

- Option 2 – Recycled Water Reticulation and Rainwater Tanks - recycled water supplemented by rainwater tanks. Rainwater tanks would be fitted with disinfection units to allow safe potable supply;
- Option 3 – Recycled Water Reticulation with Rainwater Tanks and Potable Backup – as for option 2 but with a separate potable water supply available for drinking and for top-up of the rainwater tank, if necessary. Potable back up could come from desalination or mainland supply;
- Option 4 – Greywater, Recycled Water & Reticulated Supply - Greywater is used for garden irrigation, recycled water for toilet flushing and potable supply (mainland or desalination) for all other uses;
- Option 5 – Greywater. Stormwater & Reticulated Supply – similar to option 4 but with use of stormwater rather than rainwater tank. This option would not involve recycling of blackwater, and hence a separate blackwater treatment system would be required. Treated wastewater from this would need to be disposed of to land (irrigation) as discharge to the marine environment is unacceptable in this location, and generally not preferred by Queensland Government for new installations; and
- Option 6 – Stormwater Harvesting & Reticulated Supply. As for Option 5 but with greywater and blackwater being treated by a separate treatment system and not available for recycling. As for option 5, treated wastewater would have to be disposed of through irrigation.

Each of the 6 options can meet the quality requirements for the proposed development, i.e. potable quality water is available for highly sensitive uses. A water balance was undertaken for each of the 6 options to determine whether each could meet the quantity requirements. Of the 6 options:

- Options 1, 3 and 4 can all meet the demand in all years as the amount of potable water (desalination or mainland supply) can be balanced to take into account dryer years;
- Option 2 does not achieve reliable supply of water in all years, i.e. would fail to meet adequate supply requirements in dry years; and
- Options 5 and 6 can meet reliability requirements in terms of quantity but result in generation of several hundred megalitres of treated wastewater per year requiring disposal via irrigation (over and above irrigation requirements of the proposed development).

Cost estimates were prepared for each of options 1, 3 and 4 and are presented in Table 4.10. Table 4.10 also shows the extent to which each of these options reduces overall dependence on potable water supply, compared to conventional urban developments. Option 3 shows a reduction in potable water supply requirements of almost two thirds.

Table 4.10 – Estimated Cost of Alternative Water Supply Options

Option	Description	Potable substitution	Est Capital Cost ($000s)
Option 1	3rd pipe reticulation plus potable	57%	$33,013
Option 3	3rd pipe reticulation, rainwater tanks, plus potable	65%	$35,680
Option 4	Greywater, 3rd pipe reticulation plus potable	57%	$43,213

Option 3 was selected as the preferred option (refer to Appendix A7.1) on the basis that:

- Capital costs are comparable to Option 1 and lower than Option 4;
- It achieves the highest degree of potable substitution; and
- It complies with Miriam Vale Shire Council requirements that all new households and accommodation units have rainwater tanks installed.
-

4.2.4.3 Options Considered - Potable Water Supply

The final matter to be resolved in selection of the preferred water supply strategy is the source of potable water. Having determined that rainwater tanks alone cannot supply reliable enough yield for potable water, two other sources have been identified:

- Desalination; and
- Mainland supply from Calliope Shire Council.

For the mainland supply option a new pipeline between the Tannum Sands reservoir and HHI would be required. Two alternative pipeline routes were identified, one following existing roads and the other taking the shortest route which would include crossing Colosseum Inlet. Capital and operating cost estimates for all three were prepared and are shown in Table 4.11. Operating costs are presented as Net Present Value annual costs over 25 years. While energy consumption is a consideration for all three options, it has not been considered separately as it is implicit in the operating costs.

Table 4.11 – Estimated Cost of Potable Water Supply Options

Option	Description	Estimated Capital Cost ($000s)	NPV ($000s)
Option A	Tannum Sands Reservoir via southern route	$9,750	$ 9,891
Option B	Tannum Sands Reservoir via Colosseum Inlet	$5,150	$ 7,693
Option C	Desalination	$8,500	$11,485

Option B, being mainland supply from Tannum Sands reservoir via Colosseum inlet is demonstrated to be the most cost effective option for potable water supply. However the proposed pipeline route traverses estuarine wetlands and would also be required to cross Colosseum Inlet which is a deep,

relatively fast flowing body of water. Environmental and construction considerations mean that this option has been discounted in favour of Option C, desalination which compares favourably with Option A.

Mechanical Vapour Compression (MVC) technology has been suggested for desalination water supply at this stage. MVC technology is suitable for small scale applications such as at HHI and is cost effective and energy efficient at this scale. It is also straightforward to operate, with low maintenance requirements.

A more detailed investigation into preferred desalination technology will be undertaken in the detailed design stage to ensure that the most appropriate type of desalination plant is selected. In particular, energy efficiency of a range of plants will be investigated and the most energy efficient plant selected. Regardless of the technology selected, a brine concentrate stream will be produced, hence all technologies will have a similar environmental footprint in this regard.

4.2.4.4 Wastewater Treatment

Selection of an integrated water supply system means that wastewater treatment options must be able to reliably produce high quality recycled water suitable for most household uses. This is consistent with project performance targets and development principles set out in Section 3. Relevant targets and principles for wastewater treatment are reproduced in Table 4.12.

Table 4.12 – Wastewater Treatment Targets and Principles

Performance Targets	Development Principles
Quality of water is appropriate for designated uses Environmental quality is not degraded	Discharge of treated wastewater occurs only in high rainfall events (>3 x ADWF) Wastewater is treated and reused. A reliable water supply is available for fire fighting

A comprehensive review of available technologies has not been undertaken at this stage of the project. The proposed high velocity sonic disintegrator technology meets all of the requirements for the project and is already in use in similar applications nearby, at Agnes Water. Further, this technology does not have any environmental disadvantages, i.e. it does not produce any difficult-to-dispose wastes or consume excessive energy or chemical resources.

A comprehensive review of alternative technologies will be undertaken in the detailed design phase, primarily to ensure that any recent developments in wastewater recycling have been overlooked.

4.2.4.5 Power Supply

Consulting Engineers Lincolne Scott P/L and MPI P/L were commissioned to undertake studies into the supply of electrical power to the development. Alternative power sources investigated included combinations of:

- Mains grid connection from Ergon Energy's 22KV network on the mainland;
- On-Island generation using a gas fired cogeneration plant or diesel engine generators;

- Large scale wind turbines; and
- Solar/photovoltaic cell arrays.

All investigated alternatives concluded that:

- A baseload supply of electricity will be required from the mainland grid to ensure security of supply to the development;
- Extension of the grid to service Hummock Hill Island is cost effective compared to other sources of electrical power identified; and
- The baseload supply could be supplemented by the other sources including those listed above.

A gas fired, cogeneration plant could be developed on the Island to provide reticulated chilled water, hot water and electricity to the high density housing and commercial buildings, as well as chilled water and electricity to adjacent residential lots. The chilled and hot water could be reticulated in pre-insulated direct buried pipe work and the electricity fed back into the Island electricity grid. The overall annual electrical energy consumption, as well as the electrical maximum demand, for the Island, could be significantly reduced if a cogeneration plant were installed. Greenhouse gas emissions (from coal fired power generation) would be significantly reduced if cogeneration replaced supply from the mainland grid. This option will be further investigated during detailed design of the town centre buildings and facilities.

Wind power is becoming increasingly popular worldwide, in both giant utility-scale installations and small-scale turbines intended to power a single home. Recent analyses show that wind power is considerably more environmentally friendly than, for example, electricity produced by coal-fired power stations. It uses fewer non-renewable resources, causes less local or regional air pollution and makes virtually no contribution to the enhanced greenhouse effect. Advances in wind power science and technology are reducing the cost of wind power to a point at which it is becoming competitive with many other energy sources, but still far greater that the cost of supply from the grid. To provide an effective electrical supply and make significant reduction in the islands greenhouse gas emissions a number of large scale wind turbines, standing up to 100 m high with 30 m blades would need to be installed. The proponent considers that large scale wind generators would be visible from sensitive receptors around the Island and would have significant and unacceptable aesthetic and visual impacts.

Solar power generation through photovoltaic cells is currently not an effective, efficient or economic solution for supply of electricity on the Island. However from 1 March 2006 all new homes built in Queensland are required to install energy efficient hot water systems (solar, gas or electric heat pump) and use energy efficient lighting for at least 40 percent of internal floor space. All residences in the proposed development will be required to install solar hot water systems reducing electrical power demands.

4.2.5 No Project Option

The no project option would result in Hummock Hill Island remaining in an unused state. Benefits of the project would be foregone, including:

- net regional benefits from the project of approximately $54 million (in NPV terms);
- net State benefits from the project of approximately $87 million (in NPV terms);
- An estimated 3,300 person years of direct employment from the project, with an average of 190 jobs per year, and a peak employment of 350 persons;
- An estimated 5,400 person years of direct and indirect employment in construction at the State level, with an average of 300 jobs per year, and a peak employment of 550 persons;
- $42 million in tourism expenditure that equates to around 5% of the proposed 2016 visitor expenditure target for the Fitzroy of the Queensland Tourism goals;
- A contribution 0.5% of the Queensland Tourism GSP and 12% of the Fitzroy tourism Gross Regional Product, based on the Queensland Tourism targets for 2016;
- Access to high quality tourism, residential, and recreational opportunities for existing and future residents of the region, including residents attracted to the region by further development in the State Government's Gladstone State Development Area; and
- The ability to accommodate 15% of the projected Miriam Vale Shire growth and 5% of the Gladstone Regional Council area growth in a sustainable low impact/footprint development;

Compared to other coastal locations in Central Queensland and to other islands of the Great Barrier Reef WHA as a whole (such as the Whitsundays and Hinchinbrook Island), Hummock Hill Island itself has lower comparable conservation significance that would be preserved if it remained undeveloped. Historical information during sand mining lease negotiations in the early 1980's noted the lower conservation significance of Hummock Hill Island (refer to Section 5.1) and excluded it from preservation as a National Park at that time.

The Island does provide limited habitat for species of conservation significance (such as the Black Breasted Button Quail), however essential habitat for these species (such as littoral vine forest) is outside the development footprint and a vegetation buffer is located between the development and habitat for these species. Queensland Herbarium have noted that the region (and Island) does not have a high level of biodiversity in comparison to areas such as the Whitsunday Coast and Wet Tropics area. Those areas of the Island with higher conservation significance, particularly the coastal zone and endangered regional ecosystems are not directly or indirectly affected by the development, hence, whether or not the project proceeds does not affect the ongoing conservation value of these areas.

Hummock Hill Island, and in particular un-allocated State land is not managed at present by the Government. If the proposed development did not proceed, it is unclear whether the Island would be brought under the management jurisdiction of any State Government agency; however, the proponent has not identified any such plan, nor has any particular interest emerged during consultation with State Government agencies. Hence, it is likely that if the proposed development did not proceed, the Island would remain as unmanaged State land.

4.3 Reason for Choice

The proposal is to develop a sustainable community on Hummock Hill Island based around the tourism industry. Hummock Hill Island is undoubtedly the best development location for coastal tourism in the Gladstone region, where the majority of the coastline is dominated by National Parks or port and industrial development. The Island has a desirable location, fine beaches and peaceful estuaries.

Industry in Gladstone has a history of having difficulty in attracting staff to live in the area because of a lack of facilities and a perception of pollution of the urban areas from adjacent industrial and port development. The Hummock Hill Island Development will provide people living in the Gladstone Region with a much needed, high quality recreational destination with excellent beaches, sporting and leisure facilities that are not currently available in the region. The development will enhance the social and recreational infrastructure in the Gladstone Region, making the region more attractive to investors, particularly in industry and tourism. Central Queensland will benefit both economically and socially from a sustainable and integrated tourism industry on the island

The Queensland Government Planning Information and Forecasting Unit estimates significant population in the region and the Gladstone and Calliope Shires. The Unit's medium population projection is for an increase from 46,000 persons in 2006 to 70,000 persons in the 20 year period to 2026. This growth will lead to a demand for approximately 9,000 dwellings. Hummock Hill Island can supply a wide range of products (outside the tourism allocation) in the residential market to meet a proportion of this demand.

Special Lease No. 19/52155 was issued for the purpose of undertaking feasibility studies and environmental investigations to prove up a major development project on the Island for business, industrial, commercial, residential, tourist and recreation purposes. Upon receiving necessary development approvals the proponent must provide basic infrastructure, including access roads, a bridge across Boyne Creek, water supply, wastewater treatment and electrical power to the Island. The proponent then has the opportunity to purchase and develop 436 ha of land from the State for the uses listed above. The major up front investment required to provide the basic infrastructure will be approximately $30 million which can only be recovered though development of project of a scale similar to that proposed. Development of this environmentally sustainable infrastructure would not be justified by a smaller scale development or alternatively would make the proposed tourism and residential markets too exclusive for a dominantly intrastate tourism market.

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LAND

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5. Land

5.1 Existing Environment

5.1.1 Geology and Geomorphology

Reference to the 1:250,000 *Geological Map Series for Monto Qld* (Geological Survey of Queensland, 1981 – Sheet SG 56-1) shows that Hummock Hill Island comprises three main geological units (refer Figure 5.1), including:

- PRm – Permian to Triassic aged granodiorites, tonalite and diorite;
- Qb – Quaternary aged coastal beach ridges; and
- Qm – Quaternary aged mangrove swamps and saltpans.

Reference to the 1:250,000 *Geological Map Series for Rockhampton Qld* (Geological Survey of Queensland, 1974 – Sheet SF 56-13) labels the north-west section of the Island as:

- Pug – Upper Permian aged granodiorite and minor adamellite;
- Cz – Holocene aged sand, gravel, soil; coastal sand and swamps; and
- Qhn – Holocene aged mangrove swamps, mudflats, saltpans.

Whilst some descriptive differences between the above geological mapping is present, descriptions from 1981 mapping will be used for detailed descriptions below.

5.1.1.1 PRm – Miriam Vale Granodiorite

Areas of higher elevation and basement rock underlying Hummock Hill Island are formed from part of the north-easterly margin of the Miriam Vale granodiorite (PRm), which is a large granitic batholith[1] from the Permium-Triassic period (286 to 213 million years before present). This forms the basement rock for the Island and surrounding waters. Previous studies (Tod Group, 1993) found the dominant rock type on Hummock Hill Island to be a microgranodiorite and aplite with a high degree of grain size variability, mineralogy and texture. This variation has been attributed to different cooling rates during formation of the area on the periphery of the main batholith.

Jointing and textural differences, in general, govern the overall geomorphology of Hummock Hill Island with more readily eroded coarse gronodiorite underlying lower plains and under sand deposits, with finer grained microgranodiorite forming the more elevated central ridgeline. Figure 5.2 presents some typical forms of granodiorite found on Hummock Hill Island. Little sign of structural instability is evident on the central granodiorite ridge of the Island, with slopes generally being considered stable.

[1] A batholith is a large emplacement of igneous intrusive (also called plutonic) rock that forms from cooled magma deep in the Earth's crust. Batholiths are almost always made mostly of felsic or intermediate rock-types, such as granite, diorite or lighter coloured forms of andesite.

LEGEND

- PRm — Miriam Vale Granodiorite
- Qb — Qhcb-QLD
- Qhe/m-YARROL/SCAG
- Qhmt-YARROL/SCAG
- Development Footprint
- Precinct Plan

This figure must be read in conjunction with the data disclaimers located at the front of this report . The data acquired for this project is known to be of low spatial resolution and as such no representation or warranties about its accuracy, reliability or suitability are given. Assumptions and conclusions made from this figure and the associated data must be made with full understanding of the data limitations. SKM accepts no liability or responsibility whatsoever for or in respect of any use of or reliance upon the figure and the associated data Note: No GIS data available for Eastern portion

0 0.5 1 2 Km

N W E S

Figure 5.1 - Regional Geology of Hummock Hill Island

Hummock Hill

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Figure 5.2 – Typical forms of Granodiorite from Hummock Hill Island

The majority of the proposed development is situated on QRm, including the proposed access road along Clarks Road (Refer to Figure 5.1).

5.1.1.2 Qb – Coastal Beach Ridges

The 1:250,000 *Geological Map Series for Monto Qld* (Geological Survey of Queensland, 1981 – Sheet SG 56-1) labels low lying areas of the Island as Quaternary aged (2 Million years BP[2]) beach ridges (Qb). It is more likely that the current land surface in Qb areas are Holocene age (<10,000 years BP) underlain by older Quaternary sediments.

Based on geological mapping (1:25,000 *Geological Map Series for Monto Qld* (Geological Survey of Queensland, 1961)) there are 1,240 ha of Qb deposits on Hummock Hill Island in three main areas as shown in Figure 5.1, these being the west end of the Island, a coastal strip between the northern headland and Sandfly Creek and the eastern end of the Island. The proposed development is situated over 156 ha (12 %) of these deposits conserving 88 % of Qb deposits.

Areas designated as Qb on Hummock Hill Island are characterised by low relief ridges and are separated by inter-ridge depressions or swales, and labelled as beach ridges in geological mapping as described above. Stephens (2007) states that the Holocene aged Qb deposits are beachridge or foredune strandplains, consisting of the Tiber Point strandplain and the Norton Point strandplain (refer to Figure 5.1). The strandplains consist of Holocene age sand ridges and inter-ridge swales probably formed during the mid to late Holocene sealevel "stillstand" – the relatively stable sea level period from about 6,500 years before present (yr BP) to the present day.

[2] Before Present

Hesp (1984) describes beach ridges as the product of swash built berms, located at the high tide mark, and wind-blown (aeolian) incipient foredunes. Gradual colonisation of the swash built berm and incipient fore dune by vegetation then occurs, advancing the whole system towards the sea as shown in Figure 5.3. As vegetation colonises the foredune's seaward face the beach ridge becomes stable and gradually becomes vegetated with larger shrubs and trees. A new foredune is built up on the sea-ward side of the recently stabilised foredune with a depression or swale between the new and old crest. He notes that "*beach ridges are in fact relict foredunes.*"

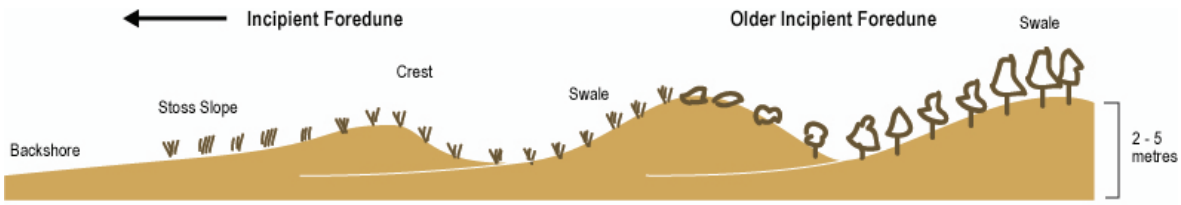

Figure 5.3 –Typical profile and evolution of a beach ridge system (Hesp, 1984)

Otvos (2000) notes that the following features are common to beach ridge systems in Australia, North America and Europe as also found by Hesp (1984), Thom (1984), Tanner (1995), Otvos (2000) and Orford *et. al.* (2003):

- Berm or Swash Bar – a landward sloping high tidal berm formed by high tide swash currents;
- Berm Ridge/Incipient Foredune – larger and more permanent wave built intertidal ridge often with erosional scarps, located between the foreshore and landward margin of the backshore often with aeolian features;
- Backshore (strandplain-type) foredune – semiparallel, narrow foredune sets that merge into relict (stabilised by vegetation) beach ridges;
- Swale – a long, narrow, generally shallow, trough like depression between two beach ridges roughly aligned with the coastline and underlain by sub-tidal or super-tidal sand.

Stephens (2007) states that shore-parallel aeolian foredunes can only be preserved in a shoreline accretion setting (including short-term cut-and-fill), and in such a setting the beachface is also accreting, although the beachface sands do not have to be in the form of ridges. Any significant expanse of foredune ridges is always underlain by beachface sands. He notes that beachridges are generally prograded when an abundance of sediment exists and the offshore gradient is low such as the situation on Hummocck Hill Island.

The linearity of the foredunes surmounting the beachface sands, and the fact that they formed directly at former positions of the shoreline shows that the Hummock Hill Island strandplains consist of foredune beachridges. Stephens (2007) states it is possible that the Tiber Point strandplain beachridges represent a single phase of coastal progradation. The regularity and simple form of the beachridges suggest that beach and dune stability was high during their formation.

Typical sediments of the beach ridge and swale system consists of fine-grained quartz sand, coarse sand at depth and minor organic rich silt with disseminated heavy mineral sands. Previous drilling conducted in 1993 (Tod Group, 1993) of the Tiber Point strandplain found these sediments to range between 0.6 m near the headland area to greater than 10 m depth towards Colosseum Inlet.

Stephens (2007) identifies the beachridges on the Tiber Point strandplain comprise beachface sediments (shelly siliceous fine-medium sand) topped by finer grained siliceous sand in low foredune ridges with linear crests that parallel the former positions of the shoreline during coastal accretion. Available drill data show that the thickness of the foredune cap varies from about 0.5m to 1.5m. The ridges are very regular and symmetrical, and have morphologically and topographically simple shapes.

Although the modern shoreline of the Tiber Point strandplain may still be in a state of incipient progradation (depending on the trend of present sealevel), the bulk of the foredune beachridges are also likely to have formed in the period 5,500 to 3,000 yr BP (Holocene aged). Hence although the modern foredune is part of the active beach system, the landward foredune ridges are essentially relict (Stephens, 2007).

Queensland EPA[3] notes that beach ridges are common features along the Queensland coast. They are restricted to parts of the coastline and sand islands where wave action is only moderate and accumulative processes dominate or are in equilibrium.

Stephens (2007) notes the relict foredune beachridges of Hummock Hill Island are not unusual. Rather wherever coastal bays provide space, and there is a sand supply, wave action has produced similar strandplains. Several of these are protected in national parks and include:

- Wild Cattle Island immediately north of the Island- protected as a National Park;
- Eastern Rodds Peninsula located 20 km east of the Island – protected as a National Park;
- Middle Island 30 kmsouth east of the Island – not protected as a National Park; and
- Eurimbula National Park 35 km south east of the Island

Stephens (2007) also notes that extensive Holocene strandplains are also present north of the Island, located at:

- Cape Capricorn to Cape Keppel on Curtis Island – protected in a conservation park;
- Cattle Point to Keppel Sands in Keppel Bay; and
- Farnborough to Bangalee, north of Yepoon.

Coastal dunes and beach ridges provide erosion buffers to major storm events, including cyclones (Qld EPA[4]) where the shoreline may be eroded and subsequently re-established by natural

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[3] *http://www.epa.qld.gov.au/publications/p00081aa.pdf/Function_characteristics_and_zonation_of_dune_vegetation.pdf* Accessed April 2007.

processes. As such erosion prone areas are designated along coastlines that may be vulnerable to erosion (refer Section 9.2). Current erosion prone areas are separate Lots outside the current Lease and no building works, bar beach pedestrian access infrastructure are proposed in these areas.

Areas of State Significance (Natural Resources)

Under the State Coastal Management Plan (SCMP) areas that contribute to protecting coastal resources and their values are designated areas of State significance (Natural Resources) and include:

- Significant coastal wetlands;
- Significant costal dune systems;
- Endangered regional ecosystems; and
- Protected areas (State land), land declared critical habitat, and areas of major interest as defined under the *Nature Conservation Act, 1992*.

These areas are generally identified in the respective Regional Coastal Management Plan (RCMP) or "*in the absence of a regional coastal management plan, is a system or landform identified, listed or mapped in a regional coastal plan or, in the absence of a regional coastal plan, is a system or landform that has a high degree of ecological integrity* ***and*** *biodiversity conservation values*[4]*……*". The SCMP provides a set of criteria for assessment of area

The Wide bay Burnett Regional Coastal Management Plan has not been released for public comment (as of November, 2007). Draft mapping provided by Qld EPA shows the Qb areas of the Island to be listed as significant coastal dune systems, however this mapping has not yet been through public consultation and review. The underlying policy of areas of significant coastal dune systems is to protect the biophysical values of coastal dunes that are seen to have recreational amenity values. If a use or activity is to occur in these areas it must have a demonstrated net benefit to the State. It is noted that no definition of "biophysical values" is provided in the SCMP and as such the identification of relevant features and values is difficult to establish.

The western section of the proposed development will be located in 156 ha (12% of the total) of relict beach ridges on the Island. It is also noted that relict beach ridge systems on the Island are under an Exploration Permit – Mining, as discussed in Section 5.1.1.4, due to the presence of mineral deposits such as ilmenite, rutile and zircon.

5.1.1.3 Qm - Mangrove Swamps and Saltpans

Holocene age depositional sediments associated with deposition of slope wash and marine sediments at the mangrove fringe are present on the land-ward side of Hummock Hill Island. Typically the depositional sediments in these areas consist of inter-bedded sands, marine clay and

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[4] No definition of *ecological integrity* ***or*** *biodiversity conservation values* is provided in the SCMP

gravel that may be quite thick in places, though invasive drilling has not been conducted in this or previous investigations.

The Tod Group (1993) noted that marine sediments and muds in the vicinity of the proposed bridge area consist of a limited thickness of soft clay present along the mangrove fringe, the main channel being predominantly coarse grained sediments. A 300 m section of Clarks Road and abutments of the proposed bridge are located in Qm deposits.

5.1.1.4 Location of known mineral resources

Reference to the Department of Mines and Energy, Major Mineral Resources, Mines and Projects, 4th Edition[5] data identifies a registered Mineral Occurrence/Inactive Prospect, No. 486524 Hummock Hill Island. The prospect consists of three deposits associated with "*modern coastal deposits*" associated with the relict beach ridge systems discussed in Section 5.1.1.2 above. The three deposits are named after their location on the Island as:

- West End – occurring in Lot 1, Lot 3 and Lot 7 on FD841442;
- Central – occurring in Lot 3 and Lot 8 on FD841442; and
- Eastern – occurring in Lot 4 on FD841442.

An Exploration Permit for Mineral (EPM, #7164) and Mineral Development Licence (MDL, # 310) is registered with RZM Pty Ltd. Commodities listed are:

- Ilmenite - small – 5,000 to 5,000,000 tonnes;
- Rutile – small - 2,000 to 200,000 tonnes; and
- Zircon – small - 500 to 500,000 tonnes.

Review of various EPM applications find a number of resource estimates for mineral sand deposits on Hummock Hill Island. An EPM renewal application dated from 1992 provides an estimate of the Island resource broken down to three main areas, these being:

- West End – 4.2 million m^3 at 2.4% heavy mineral (HM);
- Central – 1.2 million m^3 at 7.2 % HM; and
- East End – 7.4 million m^3 at 3.3 % HM.

Information from EPM applications to the Qld Department of Mines and Energy (Qld DME) notes that the Hummock Hill Island resource is not viable as a single resource (based on commodity prices at the time of various EPM renewals). Viability of mineral resources on the Island is generally considered in conjunction with the Byfield deposit north of Yepoon and Middle Island deposits, below Bustard Head, to the east of the Island. Hummock Hill Island deposits are the lesser of these

[5] http://www.webgis.nrm.qld.gov.au/webgis/webqmin/Run.htm - Accessed, 25/07/07

three mineral sand deposits estimated at approximately 5% of the Byfield resource (around 12% when combined with Middle Island).

An undated briefing note associated with an EPM application dating from around 1990 notes that mining companies surrendered mining leases in the early 1980's "*to allow for national and environmental parks to be declared at Deepwater, Round Hill Head, Eurimbula, Rodds Peninsula, Curtis Island and Byfield.*" Negotiations were ongoing at this time to conclude conservation of the "*…most significant coastal areas as parks and the progression of mineral exploration and mining in certain other areas.*" Wild Cattle Island was excised from the exploration authority and conserved as national park as part of the subsequent rounds of negotiation. A compromise between use of the land as a resort and mining was considered possible at this time due to the lower conservation values of Hummock Hill Island.

The following components of the proposed development are located areas of mineral sands as ascertained from Figure 5.1:

- Tourist Park, School Camp and Beachfront Tourist Hotel;
- Bushland Residential area;
- Lagoon Villas;
- Riparian Eco-home sites; and
- Beachfront Holiday Homes.

These areas consist of 156 ha of Qb representing 29% of the West End resource and 12% of the entire Hummock Hill Island resource. Mineral resource in the Central and East End will not be directly impacted by construction of tourist or residential development.

5.1.1.5 Fossil Sites

Due to the igneous nature of the geology and lack of any sedimentary depositional sequences of a suitable age, no significant fossil sites are likely to exist or have been found on Hummock Hill Island.

5.1.1.6 Earthquake Potential

The following is extracted from notes attached to the Gladstone Earthquake Risk Map issued by Queensland University Advanced Centre for Earthquake Studies (QUAKES).

"The Queensland catalogue contains a total of 409 earthquakes in the Gladstone map region. Shown here are Richter magnitude ML > 0 events. Gladstone lies on the northern edge of what appears to be a high seismicity belt stretching from Brisbane to Gladstone.

Figure 5.4 shows no earthquake recorded within 30 km of the Island. However, the proposed development possibly falls within the area of influence for medium sized earthquakes as evidenced by the range of structural damage of the 1918 Earthquake. Subsequent smaller earthquakes appear to have been "felt" within the region but with little apparent structural damage.

Reference to the Draft Australian Standard DR04303 – Structural Design Actions part 4: Earthquake Actions in Australia (2004) provides an earthquake Hazard Factor (Z) of 0.1 – 0.11 for Hummock Hill Island and adjacent areas. Proposed development will be located on a range of soils as discussed in Section 5.1.2.1 ranging from loose sands in the western section of the development to residual soils on the Miriam Vale granodiorite. Whilst the earthquake risk is relatively minor compliance with AS 1170.4 – 1993, subsequent revised versions and any related standard will be required for all proposed constructions of the proposed development to minimise earthquake effects.

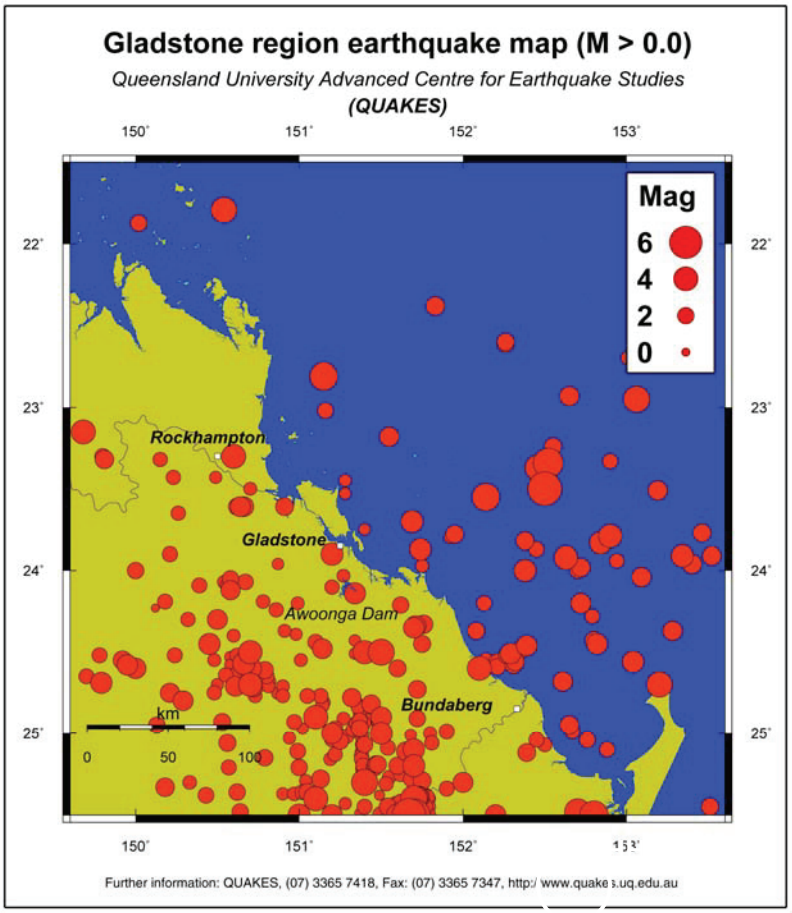


Figure 5.4 – Gladstone Earthquake Risk Map (Source: QUAKES)

5.1.2 Soils

5.1.2.1 Landform and Soil Classification

Soil types on Hummock Hill Island relate closely to underlying geology and resulting topographical landforms as found by Tod Group (1993) and Dames and Moore (1995). Further soils investigation was conducted by SKM (2005) based on methods outlined in the *Australian Soil and Land Survey Field Handbook* (MacDonald et al. 1998) and *Australian Soil Classification* (Isbell, 2003).

Four basic landforms were identified by SKM (2005) that, in general, confirm the Tod Group (1993) and Dames & Moore (1995) investigations. Identified landforms and resulting soil complexes are outlined in Table 5.2.

The proposed development will be distributed over a number of the land unit and soil types as shown in Table 5.3.

Soil permeability testing conducted by Dames & Moore (1995) in a number of the above soil types returned permeability ranging from 0.029 m/day (Pzm1 - Solodic B Horizon) to 12.3 m/day (Pzm1- Soloth A Horizon). Results of Dames and Moore (1994) soil permeability testing are presented in Table 5.1. Soil permeability throughout the proposed development will influence surface runoff generation, stormwater flow, soil erosion potential and irrigation rates.

Table 5.1 – Field Measured Soil Permeabilities (after Dames & Moore, 1995)

Land Unit	Test depth (m)	Soil Type	T 251 (mm/min)	Permeability2 (m/day)	Equiv SPTR3 (Minutes)
Qb3	0.15 - 0.4	Sand (A-B horizon)	0.3	11.2	0.7
Czs1	0.075 - 0.325 0.25 - 0.55	Solodic (A Horizon) (B Horizon)	18.5 65	0.2 0.049	37.5 153
Pzm1	0.05 - 0.30 0.25 - 0.55	Soloth (A Horizon) (B Horizon)	0.3 56	12.3 0.057	0.6 147
Pzm1	0.05 - 0.30 0.25 - 0.55	Solodic (A Horizon) (B Horizon)	0.3 110	12.3 0.029	0.6 259
Pzm1	0.25-0.5	Soloth (B Horizon)	62.5	0.051	147
Pzm1	0.2 - 0.5	Solodic (B Horizon)	96	0.033	227
Pzm2	0.12 - 0.42	Red Earth (B Horizon)	6.4	0.5	15

1 - T25 mm - Time for water level in the test hole to fall 25 mm after a pre-soaking period

2 - Permeability determined in accordance with procedures given by WRC (1991)

3 - SPTR = Standard Percolation Test Rate determined in accordance with the procedure given in the Sewage and Water Supply Act, Amendment Act 1981, No. 81.

Figure 5.6 presents the distribution of landforms and soils on Hummock Hill Island. Further details may be found in Appendix A7.5.

Table 5.2 – Summary of Land Units and Resulting Soils

Land Unit	Geology & Landform	Factual key[1]	Soil Description
Qb - Coastal Sand Dunes, Beach ridge and Swale Deposits			
Qb1	Low frontal dune & beach system with sparse Casuarina spp. and Pandanus spp. with a sparse ground cover of Spinefex spp.	Uc1.11	Beach and aeolian siliceous sands.
Qb2	Narrow elongate depressional swales and poorly drained depressions/drainage paths with	Uc2.33 Dy5.61	Siliceous sands with peaty or organic rich surficial layer and diffusely mottled sub-soils.

Land Unit	Geology & Landform	Factual key[1]	Soil Description
	fringing Melaleuca spp.		Sandy (gleyed) podzolic soils with pale, mottled apedal very moist sandy clay.
Qb3	Undulating low dunes and beach ridges with intervening depressional swales, with moderate dense littoral vine scrub, large emergent melaleucas and Moreton Bay Ash.	Uc2.21	Fairly deep siliceous sands underlain by extremely weathered granodiorite.
Czs — Cainozoic Alluvial Outwash and Residual Soil			
Czs1	Near level to very gently sloping plains and lowland drainage flats typically with mixed eucalypt woodland and locally with gum—topped box on lowland flats and melaleuca in lower—lying and depressional areas; casuarinas occur towards the seaward fringe.	Db-Dy2.13 Dy3.13 Uf6.41	Mostly deep, sandy to loamy surface (hardsetting) duplex soils (Db—Dy 2.13, Dy3.13—solodic soils) with diffusely mottled sandy clay or medium to heavy clay subsoils, locally with uniform clays or thin loamy duplex soils with brown medium to heavy clay subsoils (Uf 6.41, Db2. 13) towards to coastal zone region.
Czs2	Gently sloping outwash plains locally dominated by poplar box and blue gum, below the east facing footslopes of Hummock Hill.	Gn2.113 Dy3.43	Mainly gradational locally weak duplex soils with brown sandy surface soils over reddish to yellow brown clayey sand underlain by sandy clay or EW granodiorite below 1.5 m (approximately) (Gn2.113; Dy3.43).
Qm — Recent Coastal Mangrove Flats and Tidal Mud			
Qm1	Near flat to very gently sloping tidal mudflats saltpans with small occurrences of saltwater couch and samphire marsh grass flats discontinuously along the landward fringe.	Uf6.61 Dd2.12 Dy3.12	Typically saline uniform clays (Uf6.61) and fine sandy or clayey silts over gleyed clay subsoils; sandy surface duplex soils (Dd2.12, and Dy3.12) occur on the fringe areas of saline marshes.
Qm2	Tidal mangrove swampland flats with sparse mangroves fringing tidal inlets.	Uf6	Saline clays (Uf6) over distinctly gleyed fine sandy or silty clay substrate soils.
Pzm — Upper Permian Miriam Vale Granodiorite; Granodiorite, tonalite, Diorite			
Pzm1	Gentle to moderately steep moderate dissected footslopes and inclined plains fringing land units Pzm3 and Pzm4; slopes typically <10% mostly in the range 2—5%, with mixed eucalypt woodland chiefly ironbark bloodwood and Moreton Bay ash.	Uc-Um2.12 Dy3.41 Dy3.43	Soils are either shallow to moderately deep sand or clayey sand (Uc—Um2.12) underlain by weathered rock, or moderate to deep brown, yellow brown or mottled duplex soils (yellow podzolics or soloths (Dy3.41) or solodic soils (Dy3.43)), which have sandy or loamy sand surface horizons commonly with a bleached sub—surface (A2) horizon and acidic to alkaline yellow—brown and grey mottled sandy clays or heavy clay subsoils underlain by EW granodiorite between about 0.6—1.0 m.
Pzm2	Broad low rounded ridge with marginal slopes in the range 10—20%; partially cleared with mixed eucalypt woodland on the steeper and lower slope areas.	Gn3.41	Soils are deep (1 m+), red earths, (which locally trend to non—calcic brown soils) with sandy clay loam surface soils and a gradual to clear change to a red slightly acid to neutral medium clay subsoil (B) horizon with medium blocky structure (Gn3.11).
Pzm3	Low rocky hills and rises with slopes mostly in the range 10— 20%, with	Dy3.41	Soils are dominantly shallow gravelly yellow duplex soils (Dy3.4l) with acidic

Land Unit	Geology & Landform	Factual key[1]	Soil Description
	mixed eucalypt woodland chiefly ironbark, bloodwood and Moreton Bay ash.	Um6.43	sandy clay subsoils underlain by EW rock between 0.2 — 0.5 m; sandy to loamy lithosols (Um6.43) occur locally mostly associated with areas of rocky outcrops.
Pzm4	Steep dissected and low rounded hilly lands with slopes in the range 20—35%, with mixed eucalypt woodland chiefly ironbark, bloodwood and Moreton Bay ash.	Um6.43 Dy3.41	Soils are dominantly lithosols (Um6.43) associated with areas of outcrop and boulders, and shallow gravelly yellow duplex soils (Dy3.4l) with acidic sandy clay subsoils underlain by EW rock between 0.2—0.5 m.

1 – to convert Factual keys to Australian Soil Classification refer to Appendix 5 of Isbell (2003)

The proposed development will be distributed over a number of the land unit and soil types as shown in Table 5.3

Table 5.3 – Area of the Proposed Development footprint in Land Unit & Soil Types

Land Unit	Factual key[1]	Development Footprint Area
Qb2	Uc2.33 Dy5.61	Road crossings behind Beachfront Holiday Homes
Qb3	Uc2.21	Tourist Park, School Camp, Beachfront Tourist Hotel, Lagoon Villas, Bushland Residential, Riparian Ecohomes, Education Centre/Sports Facilities (part), Beachfront Apartments
Czs1	Db-Dy2.13 Dy3.13 Uf6.41	Boyne Channel Residential, Golf Course Apartments, Golf Course (part)
Qm1	Uf6.61 Dd2.12 Dy3.12	Boyne Creek Boat Ramp, Bridge Abutments, Clarks Road (300m)
Pzm1	Uc-Um2.12 Dy3.41 Dy3.43	Village Centre, Boyne Channel Apartments, Boyne Channel Residential, Golf Course, Golf Course Residential, Golf Course Apartments, Golf Course Clubhouse, Hillside Terraces (part), Airstrip, Seaside Cottages, Beachfront Holiday Homes, (part), Headland Resort Holiday Homes, Town Centre, Education Centre
Pzm2	Gn3.41	Beachfront Holiday Homes (part)
Pzm3	Dy3.41 Um6.43	Boyne Channel Apartments (part), Golf Course (part), Golf Course Apartments (part), Golf Course Residential (part)
Pzm4	Um6.43 Dy3.41	Ridgetop Residential, Boyne Channel residential, Hillside Terraces (part)

1 – to convert Factual keys to Australian Soil Classification refer to Appendix 5 of Isbell (2003)

5.1.2.2 Soil Erosion Potential

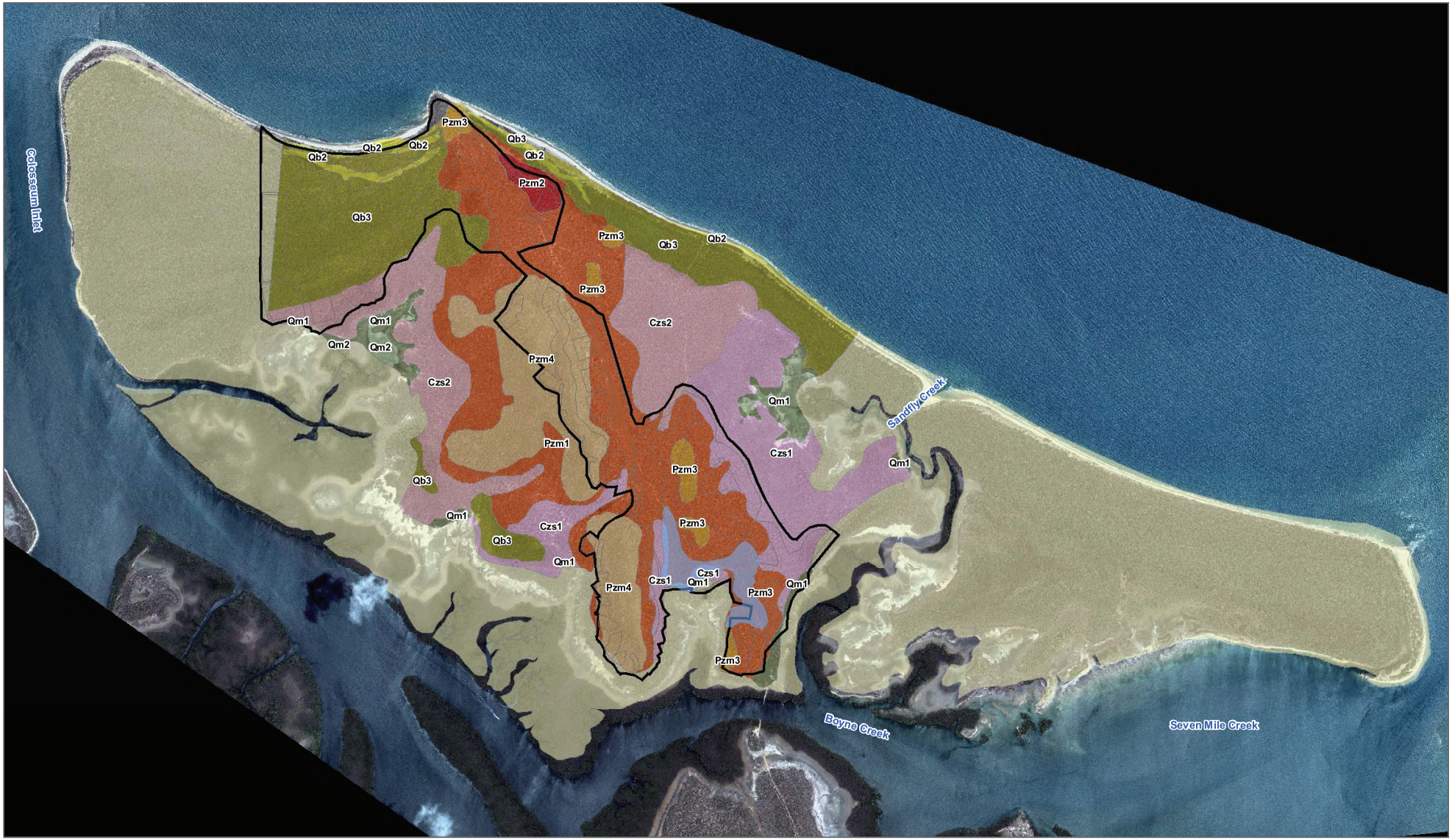
Dense grass or other vegetative cover exists over most of the Island with little active disturbance of soils beyond existing tracks. Soil erosion was evident along some of the inland tracks particularly on steeper slopes. Soil erosion consisted mostly of sheet wash and minor rills with deposits at the bottom of slopes. One section of deeper erosion was identified at the northern base of the central

ridgeline where an ephemeral creek discharged across the Pzm1 soils of the alluvial plain. A section of the erosion gully showing the Pzm1 soil is presented in Figure 5.5 below.

Erosion potential of disturbed areas varies with soil type across the island. The erosion potential of a soil is determined by incipient rainfall, amount of vegetation cover, length of slope, degree of slope and soil erodibility. Shallow rocky soils (Lithosols – Pzm4) have a relatively stable surface, but have a very high erosion risk due to their high slope. Hard setting texture contrast soils (Pzm1, Pzm3 and Czs1) also have a very high erosion risk due to the sandy hardsetting surface and sodic B horizon. There is also a high risk of gully erosion in areas of gum topped box and poplar box open forest (Czs2). Wind erosion is a potential issue, particularly for exposed coastal sand dune systems and it can be difficult to revegetate and restabilise areas once these sensitive areas have started to erode.

Figure 5.5 – Side of Erosion Gully in Pzm1 and Pzm4 Soils

Erosion hazards can also be based on chemical soil characteristics including exchangeable sodium percentage which predisposes soil dispersion, Calcium:Magnesium ratios which can inhibit soil dispersion, particle size distribution which is critical with respect to physical stability, R1 Dispersion Index (% dispersed silt + clays/ total silt + clays) and profile morphology and observed erosion problems. The most significant erosion risks are due to raindrop impact, sheet erosion, rills and gullies and tunnelling where soils are likely to be exposed during construction activities.



LEGEND

- Development Footprint
- Precinct Plan
- Indicative Groundwater Discharge Zone

Land Unit Classes

CLASS

- Czs1
- Czs2
- Pzm1
- Pzm2
- Pzm3
- Pzm4
- Qb1
- Qb2
- Qb3
- Qm1
- Qm2

Figure 5.6 - Land Units and Soils Map

This figure must be read in conjunction with the data disclaimers located at the front of this report . The data acquired for this project is known to be of low spatial resolution and as such no representation or warranties about its accuracy, reliability or suitability are given. Assumptions and conclusions made from this figure and the associated data must be made with full understanding of the data limitations. SKM accepts no liability or responsibility whatsoever for or in respect of any use of or reliance upon the figure and the associated data

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5.1.2.3 Water-logging and Salinity

Some areas on Hummock Hill Island have a natural tendency for waterlogging and subsequent increases in soil salinity due to groundwater accumulation and seepage. These areas are generally texture contrast soils, such as Pzm1 on gently undulating topography underlain by weathered granodiorite. Areas of periodic waterlogging have been identified in a number of break-of-slope areas on Hummock Hill Island, indicated by a change in vegetation and the presence of melaleuca trees (refer to Figure 4.9). Where cleared of vegetation these groundwater discharge zones can become larger and more waterlogged with subsequent salinity, scalding and erosion issues.

Salinity levels in soils on Hummock Hill Island are low in sandy surface A horizons, but increase to high levels in the lower B horizon. The B horizons are strongly sodic and have a low Calcium:Magnesium ratio that can cause dense poorly drained clays that will disperse readily if exposed. These characteristics also mean they are very slowly permeable and are naturally prone to waterlogging in low gradient areas. Thus the changing the hydraulic balance (e.g. removing vegetation or the addition of effluent irrigation water) on these soil types could potentially cause salinity problems if it was not managed properly. Figure 5.8 – presents a salinity hazard map of Hummock Hill Island.

Observation during field inspections reveals two main groundwater flow systems operating in this landscape that influence the location of potential groundwater discharge areas. The first system consists of steep hills of jointed granodiorite having limited connectivity between the hills and the adjacent lower slopes (refer Figure 5.7) such as east of the airstrip and in the Boyne Channel residential areas. Evidence of groundwater discharge is not prominent at the break of slope at the base of these hills. Clearing of vegetation in groundwater recharge areas on the top steep hills is only weakly linked to potential groundwater discharge at the break of slope at the base of hills. As such, soil salinisation due to break of slope groundwater discharge is unlikely in these situations, even with low density development in up-slope groundwater recharge areas.

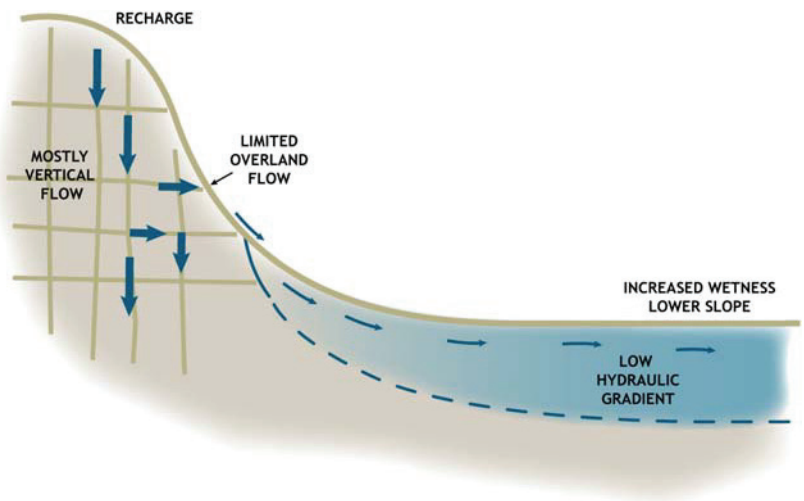

Figure 5.7 – Steep Hills or Disconnected Hillslope Model

LEGEND

- Development Footprint
- Hummock Hill Island Precinct Plan
- Indicative Discharge Zone

Figure 5.8 - Indicative Salinity Hazard and Groundwater

This figure must be read in conjunction with the data disclaimers located at the front of this report . The data acquired for this project is known to be of low spatial resolution and as such no representation or warranties about its accuracy, reliability or suitability are given. Assumptions and conclusions made from this figure and the associated data must be made with full understanding of the data limitations. SKM accepts no liability or responsibility whatsoever for or in respect of any use of or reliance upon the figure and the associated data

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The second groundwater flow system operating on Hummock Hill Island is a catena or continuous hillslope system (refer Figure 5.9) within the Boyne Village and Golf Course Precincts. Groundwater discharge areas, or areas of periodic soil waterlogging occur at the break of slope and lower slope positions where there is a change in hydraulic gradient causing groundwater to "back-up" and accumulate causing soil waterlogging. Clearing of medium to tall vegetation at the break of slope can increase soil waterlogging due to lower plant soil uptake. This can lead to increased surface evaporation and subsequent salinisation of soils leading to a loss of soil fertility and in severe cases scarring. Maintaining vegetation cover at breaks in slope with low to medium height shrubs helps keep groundwater levels below the soil surface and reduces soil salinisation problems.

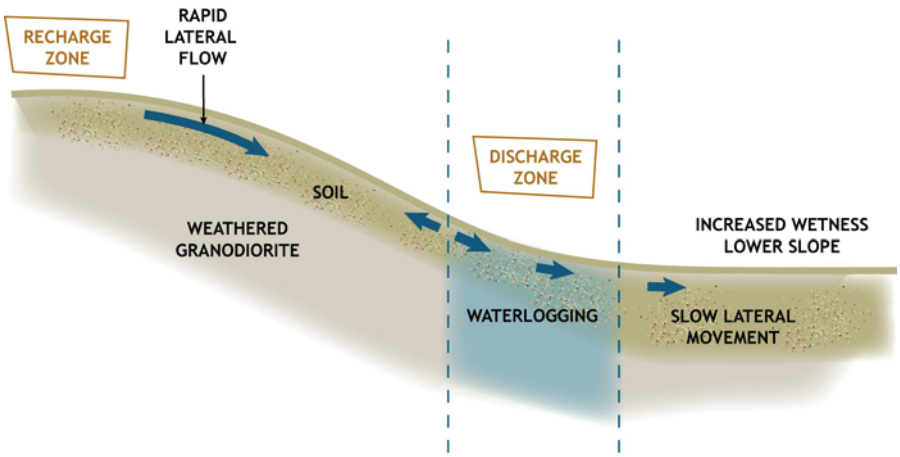

Figure 5.9 – Catena or Continuous Hillslope Model

5.1.2.4 Geotechnical Issues

The Tod Group (1993) investigated geotechnical properties of soils on the Island for various aspects of the proposed construction. Detailed geotechnical assessment of soils for the proposed development will be conducted during subsequent development applications and design stages. A summary of preliminary geotechnical assessments conducted by Tod Group (1993) are outlined as follows:

- Roads and Drainage – in decomposed granite areas soil moisture is lower (0 – 5%) than the optimum required for soil compaction. Average water required to provide optimum compaction requirements was calculated as 75 litres per cubic meter. Compaction of in-situ soils for general embankments and sub-grades was considered to be relatively easy, with compaction carried out to requirements in AS3798-1996.

  Soils consisting of fine sands were identified as requiring an optimum moisture content to avoid dilatency during compaction. Sub-grade material would be required as soon as possible following initial compaction to avoid erosion issues.

- Road Pavements – most roads on the Island are anticipated to be on soils derived from decomposed granite, with the exception of the western section of the proposed development

where roads will be on sands. The Tod Group (1993) provide the following sub-grade CBR[6] ratios:

- Fine Sand – 15-20 %;
- Decomposed Granite – 15%;
- Clayey Sand – 15 – 16%;
- Sandy Clay – 7%;
- Silty Clay – 3.5%.

These CBR values will require further assessment as part of detailed design works for initial infrastructure and ongoing phases of the development over the 15 year construction period.

- Building Foundations – maximum building height will be four storeys in the Town Centre and hotel areas. Borehole testing conducted by the Tod Group (1993) found SPT "N" values to range between 4 and 13 blows. Further detailed investigation will be required to assess building foundation requirements for the proposed development;
- Bridge Footings – A detailed geotechnical assessment of the proposed bridge crossing was not conducted by the Tod Group (1993) or for the current EIS, these issues being part of the detailed design stage of development. Foundations for bridge piers at this time were considered to be either caissons into rock, pad footings on rock or piled foundations (southern abutment only).

Detailed geotechnical investigation for infrastructure will be conducted by a suitably qualified person prior to construction activities commencing.

5.1.2.5 Acid Sulfate Soil

Acid sulfate soils are commonly found in areas of Holocene aged (<10,000 yrs BP) sediments below 5 m AHD which accounts for much of the eastern section, western section and the mangrove fringe of Hummock Hill Island. There are two possible areas within the development footprint that may be affected by potential acid sulfate soils (PASS). These are:

- The north-west relict beach ridge and swale system area incorporating bushland residential, resort hotel, tourist-park and lakes.

  Whilst no direct excavation beyond the lakes is proposed, filling (greater than 500 m^3) may trigger specific assessment under the State Planning Policy (SPP) 2/02 *Planning and Managing Development Involving Acid Sulfate Soils*.

- The proposed access bridge and boat ramp in Boyne Creek.

  Construction activities will disturb PASS in the intertidal zone. Filling activity for bridge abutments and boat ramp will be greater than 0.5 m in thickness and 500 m^3 in volume triggering the SPP2/02. Depending on the proposed bridge design, piers may be required in

[6] Californian Bearing Ratio

Boyne Creek to support the bridge structure. Whilst bedrock is anticipated to be relatively shallow some PASS will be disturbed during construction again triggering the SPP 2/02.

A number of boreholes were advanced (SKM 2005) to investigate the depth to hard rock in supratidal saltpans in the proposed boat ramp area. Supratidal saltpan areas were found to have only shallow sediments of <0.5 m, often with outcrops of decomposed rock. Moving from the saltpans to mangroves the depth to rock increased to approximately 0.5 m. On the channel side of the mangroves the sediment depth was approximately 0.65 m although samples were not able to be recovered at this location.

The distribution of potential acid sulfate soil (PASS) is limited to shallow mangrove mud in the tidal zone. Soils above this mangrove zone in the supratidal saltpan zone are considered to be residual soils formed in situ on hard rock geology rather than by deposition of marine sediments and subsequently have a low PASS risk.

Two sites in the proposed bridge and boat ramp vicinity were sampled and analysed for potential acidity (refer to Appendix A7.5). Marine sediments within this area returned net acidity between 0.34 and 1.12 % sulphur, above the action criterion specified in QASSIT (1998) and Dear et al. (2002) of 0.03%S and will therefore require treatment during proposed construction works. Management of acid sulphate soil issues is discussed in Section 5.1.2.6 below.

5.1.2.6 Contaminated Land

A search of the Environmental Management Register (EMR) and Contaminated Land Register (CLR) administered by Queensland Environmental Protection Agency (Qld EPA) did not reveal any of the land parcels on the Island to be listed as contaminated sites. However, historical use of the site for cattle farming has left a legacy of potential contamination associated with:

- A former cattle dip located in historical cattle yards south of Tiber Point;
- Diesel fuel storage near the main homestead;
- A small (<4 m^2) fuel/waste oil spill area located adjacent the entrance gate of the former stockyards; and
- Asbestos cement sheeting used in construction of the homestead buildings.

Previous investigation of soils around the former cattle dip (Woodward Clyde, 1993) found levels of arsenic (total) to range from 2.5 to 337 mg/kg. It is likely that the observed levels of arsenic are likely to be derived from the historical use of arsenic-based pesticides in the dip such as arsenic trioxide for the control of cattle ticks. Arsenic-based cattle dip formulations were removed from the market in June 1983 and the use of arsenic-based products for sheep and cattle was banned in January 1987. Woodward Clyde (1993) also found concentrations of the organochlorine pesticides Ethion to range from 1.0 to 780 mg/kg and DDT and derivatives to range between 0.17 and 1.1 mg/kg.

Appendix 9 of the Draft Guidelines for the Assessment and Management of Contaminated Land in Queensland (DEH, 1998) provides a series of risk-based “Investigation Thresholds´ for selected

contaminants that may be used as a general guide for contamination assessment and potential health risk, based on the proposed end use of the land.

Arsenic concentrations observed from Woodward Clyde (1993) investigations exceed the Environmental Investigation Level (EIL) of 20 mg/kg in three locations adjacent to the former cattle dip, S1 (35.5 mg/kg), S2 (337 mg/kg) and S6 (175 mg/kg). The latter two sites also exceed the Health-based Investigation Level (HIL) for arsenic in a low density residential exposure scenario (100 mg/kg). It is noted that S1 and S2 are from different depths at the same location at the SE corner of the dip drying pad. A higher concentration of arsenic in S2 from 0.2 -0.4 m depth suggests some migration deeper into the soils of this area.

Historical investigations conducted by Woodward Clyde (1993) did not include an assessment of potential arsenic bioavailability or the speciation of arsenic. The above guidelines assume 100% bioavailability and are based on all potential forms of arsenic (total arsenic). Soil geochemistry and arsenic speciation may reduce the potential solubility (and subsequent bioavailability) thereby reducing potential contamination risks to human receptors during development.

Concentrations of the organochlorine pesticide DDT and its direct metabolites (DDD and DDE) found by Woodward Clyde (1993) exceeded the EIL of 0.2 mg/kg in S1 (located in the south east corner of the dip drying pad). Based on concentrations found in deeper soils at all locations sampled during the 1993 investigation vertical migration through the soil profile appeared limited. Soil contamination by DDT and derivatives appears to be limited to surface soils.

The organophosphate pesticide Ethion was also found in soils around the cattle dip during 1993 investigations. Concentrations in surface soils ranged between 1.1 mg/kg in S1 (SE corner of the dip drying pad) and 780 mg/kg in S5 (adjacent to the dip entrance gate). Deeper soils below 0.2 m in S2 and S6 returned very low levels of ethion in comparison. This is likely due to Ethion adsorbing strongly to soil particles and being nearly insoluble in water. As such it is unlikely to leach or contaminate groundwater. A sample of water collected (SKM 2005) from the base of the cattle dip returned 299 µg/l of Ethion. Whether the sampled water was groundwater seepage or residual dip water is unknown.

No EIL or HIL is prescribed in Queensland or Australian soil contamination advisory documents for ethion. Reference to the USEPA Region 9 Preliminary Remediation Goal (PRG) for Residential Soil is 31 mg/kg. Concentrations in S5 (780 mg/kg) on Hummock Hill Island exceed this value.

No assessment of hydrocarbon or asbestos contamination was made by Woodward Clyde (1993). Further investigation will be required to establish the lateral and vertical extent of contamination from arsenic and DDT and derivatives, ethion and hydrocarbons and also asbestos. Management and mitigation of contaminated land is discussed further in Section 5.1.2.7.

5.1.2.7 Land Use

The Island is not used currently used for any economic activity nor has any improvement. Cleared areas and natural ecosystems in various stages of regrowth comprise the majority of the proposed development area. A single unimproved vehicle track links the causeway and the northern headland

and also a number of shacks adjacent to the beach midway between the northern headland and Sandfly Creek. Historical aerial photography indicates a number of additional tracks existed, however, these have overgrown with undergrowth due to lack of use following cessation of pastoral activities.

Vehicle access to the Island is restricted by Boyne Creek, however, at very low tide access is possible via a constructed causeway extending from the end of Clarks Road, an unsealed road, some 15km east of the Bruce Highway. There is currently no power, telecommunication (with the exception of intermittent mobile phone coverage), water or wastewater infrastructure servicing the Island.

Use of the Island is limited to the coastal fringe in areas of Unallocated State Land. During the public consultation process, it was noted that some low scale passive recreation activities such as camping is carried out by boat owners on the Colosseum Inlet shoreline opposite the Esplanade, in Sandfly Creek and on the southern tip of the Island, all outside the current Development Lease. Water based recreational activities are conducted in coastal and estuarine waters adjacent to the Island. In particular the area is becoming an increasingly popular area for boating and fishing activities as population increases in the Tannum Sands and Turkey Beach area. Current land uses on the Island are outlined in Figure 5.10.

Based on surveys conducted by SKM (2005) no good quality agricultural land is present on the Island that may be impacted by the proposed development activities. Figure 5.10 presents current land uses associated with the Island. The mineral lease which currently exists over sand deposits on the Island is discussed in Section 5.1.1.4. Adjacent land use to the proposed project site includes Unallocated State Land, Fish Habitat Areas, World Heritage Area and Marine Parks (refer to Section 9.1).

A Pastoral Lease has existed on the Island since the 1870's and the Island has been subject a number of times to clearing activities such as ring barking and logging and pastoral activities. Sheds, fencing and a cattle dip associated with former pastoral activities is located near the headland are evidence of former pastoral activities. Land clearing has also been conducted over much of the Island since the 1870's for maintenance of the pastoral lease and as a source of wood for railway sleepers.

Little arable use has been made of the Island except for a few citrus trees near the shack on Hummock Hill. Anecdotal evidence points to historical use of this limited area of red earth soils for intermittent lucerne cultivation when the land was used for grazing (Tod Group, 1993).

Table 5.4 lists the agricultural land class for each land unit identified on the Island as well as a comment on why each land unit falls within a particular class. Class C land has been separated into C1 and C2 classes that identify C2 land as being only marginally suitable as pasture land. Based on surveys conducted by SKM (2005) (refer to Appendix A7.5), no good quality agricultural land is present on the Island. Figure 5.11 agricultural land classes on the Island.

Table 5.4 – Agricultural Class of Identified Soil Units on Hummock Hill Island

Land unit	Class of agricultural land	Comments
Qb – Coastal Sand Dunes, Beach ridge and Swale Deposits		
Qb1	D Non-Agricultural Land	Low water availability and high erosion
Qb2	D Non-Agricultural Land	Low water availability and high erosion
Qb3	D Non-Agricultural Land	Low water availability and high erosion
Czs – Cainozoic Alluvial Outwash and Residual Soils – Sand; Clayey Sand and Clay		
Czs1	C2 Pasture Land	Very low fertility and water logging
Czs2	C2 Pasture Land	Very low fertility
Qm – Recent Coastal Mangrove Flats and Tidal Mud Flats and Saltpans		
Qm1	D Non-Agricultural Land	Salinity and water logging
Qm2	D Non-Agricultural Land	Salinity and water logging
Pzm – Upper Permain Miriam Vale Granodiorite; Granodiorite, tonalite, Diorite		
Pzm1	C2 Pasture Land	Very low fertility and poor drainage
Pzm2	C1 Pasture Land	Low fertility
Pzm3	C2 Pasture Land	Very low fertility
Pzm4	D Non-Agricultural Land	Very steep slopes and shallow stony soils

LEGEND

Precinct Plan

Figure 5.10 - Hummock Hill Island Land Use Map

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0 0.5 1 2 Km

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Hummock Hill

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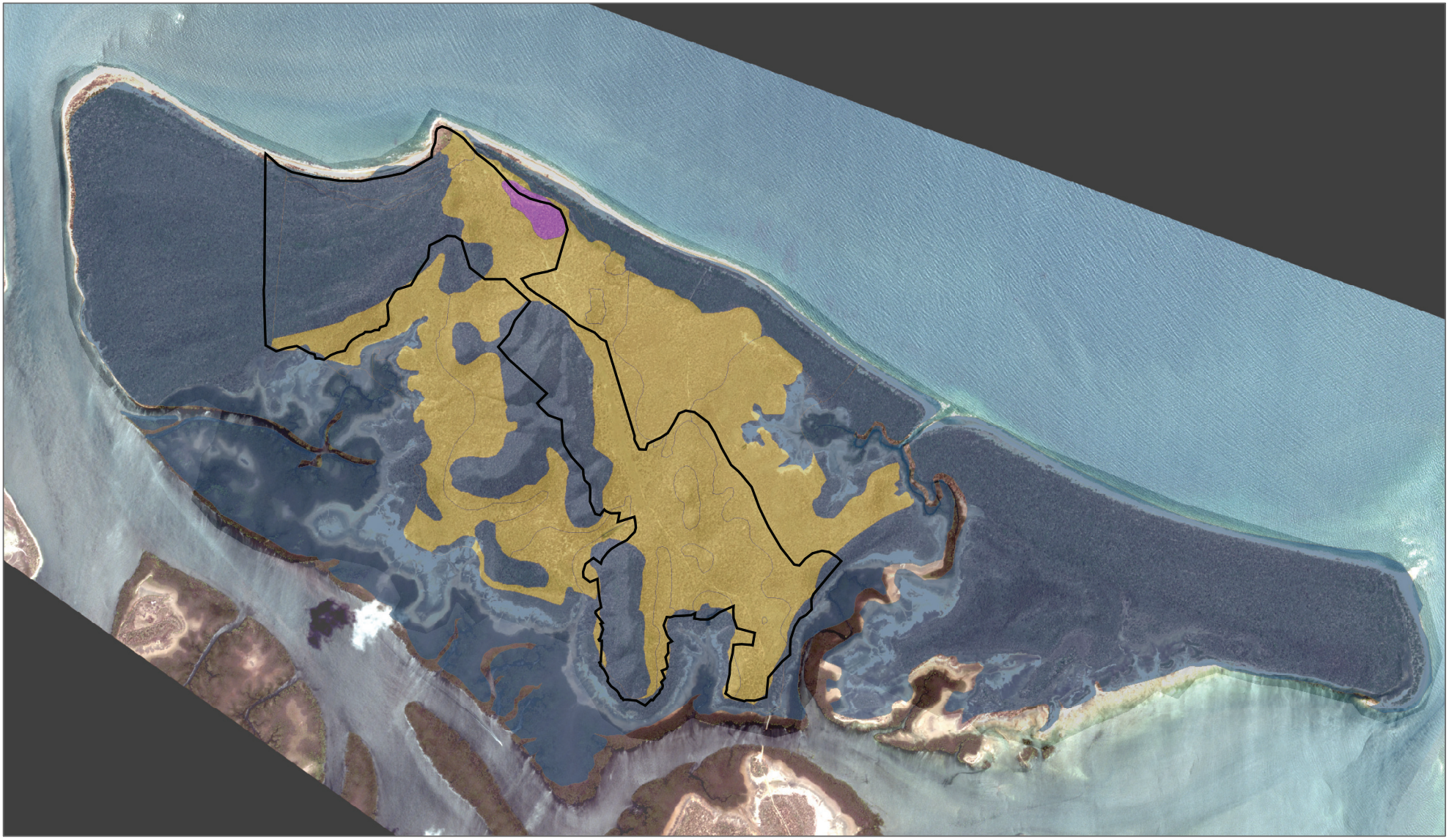

LEGEND

Agricultural Land Classes

- Class C1 - Pasture Land
- Class C2 - Pasture Land
- Class D - Non-Agricultural Land
- Development Footprint

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Figure 5.11 - Agricultural Land Classes

Hummock Hill

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5.1.2.8 Sensitive Environmental Areas

A summary of sensitive environmental areas are provided in Table 5.5. Details of environmentally sensitive areas that may be influenced by the proposed development are provided in individual sections within the EIS.

Table 5.5 Summary of Sensitive Environmental Areas Within or Adjacent to the Proposed Hummock Hill Island Development

Sensitive Environmental Area	Feature	Refer to Section
Habitats of NC Act or EPBC Act listed Species	12.2.2 – Microphyl Rainforest on coastal dunes – Black Breasted Button Quail Estuaries & beaches – Beach Stone Curlew, Turtles, Dugong, Saltwater Crocodile	14.1 15.2
"Endangered" or "Of Concern" REs	Of Concern Regional Ecosystems 12.1.1 – *Casuarina glauca* on estuarine deposits 12.2.2 – *Microphyll rainforest* on coastal dunes 12.12.8 – *Eucalyptus melanophloia* woodland on hills 12.12.12 – *Eucalyptus tereticornis* and E. crebra dominated forests 12.12.28 – *Eucalyptus moluccana* open forest on alluvial plains Endangered Ecosystems 12.3.3 - *Eucalyptus tereticornis* dominated forests on alluvial plains 12.3.10 - *Eucalyptus populnea* dominated forests on alluvial plains	14.1
Good representative examples of REs poorly represented in protected areas	12.3.10 - *Eucalyptus populnea* dominated forests on alluvial plains	14.1
Sites listed under International treaties	Great Barrier Reef World Heritage Area	15.1
Sites containing near threatened or bio-regionally significant species or essential, viable habitat for near threatened or bio-regionally significant species	None Identified during surveys	-
Sites in, or adjacent to, areas containing important resting, feeding or breeding sites for migratory species listed under the CMSWA, JAMBA and CAMBA	12.3.3. - *Eucalyptus tereticornis* dominated forests on alluvial plains Estuaries and beaches - Beach Stone Curlew	14.1 14.1
Sites containing common species which represent a distributional limit and are of scientific value, or contains feeding, breeding, resting areas for species of special cultural significance	None Identified	-
Sites containing high biodiversity that are of a suitable size or with connectivity to corridors/protected	12.2.2 – Microphyl Rainforest on coastal dunes Intertidal mangroves and saltflats	14.1 15.2

Sensitive Environmental Area	Feature	Refer to Section
areas to ensure survival in the longer term, containing natural vegetation in good condition or habitat in good condition and/or degraded vegetation that still supports a high level of biodiversity		
Sites of high habitat diversity and areas of high endemism	None Identified	-
Ecosystems which provide important ecological functions	Intertidal wetlands of mangrove and salt flats	15.2
Sites of palaeontological significance such as fossil sites	None	5.1
Sites of geomorphological significance such as lava tubes or karst	None	5.1
Erosion prone areas declared under Section 70/1 of the *Coastal Protection and Management Act, 1995*	Northern coastline areas	9.2
Areas of remnant vegetation classified as being of State or regional significance for biodiversity conservation	12.3.3 - *Eucalyptus tereticornis* dominated forests on alluvial plains 12.3.10 - *Eucalyptus populnea* dominated forests on alluvial plains	14.1
Significant coastal dunes and significant coastal wetlands as defined by the State Coastal Management Plan and mapped by the Draft Wide Bay-Burnett Regional Coastal Management Plan	Areas of Qb1 to Qb3 Wetlands mapped in Queensland Wetlands Map (Version 1) – Calliope - 9149	5.2 15.2
Protected areas which have been proclaimed under the *Nature Conservation Act, 1992* and *Marine Parks Act, 2004* or are under consideration for proclamation	Terrestrial -None Identified Marine – Great Barrier Reef Coastal Marine Park	- 15.1
Areas of major interest, or critical habitat declared under the *Nature Conservation Act, 1992* or high nature conservation value areas or areas vulnerable to land degradation under the *Vegetation Management Act, 1999*	None Identified during surveys	-

5.1.3 Landscape Character

Landscape character on the Island has been defined from various elements of land cover, land form and land use. A description of these landscape elements is provided, followed by the grouping of homogenous landscapes derived from these elements which are called the "landscape character units".

5.1.3.1 Land Cover

Land cover on the Island is dominated by native woodland and forest. Four major ecosystems have been identified on the Island:

- Grey ironbark woodland in the centre of the island extends along the crest of the main range and down into the plains;
- Open dry sclerophyll forests and woodlands in the north section of the Island;
- Fore dune communities along the coast, contain she-oaks, Spinifex and a stand of littoral vine forest; and
- Mangrove, salt marsh and seagrass communities located in the intertidal zone on the southern side of the Island.

5.1.3.2 Land Form

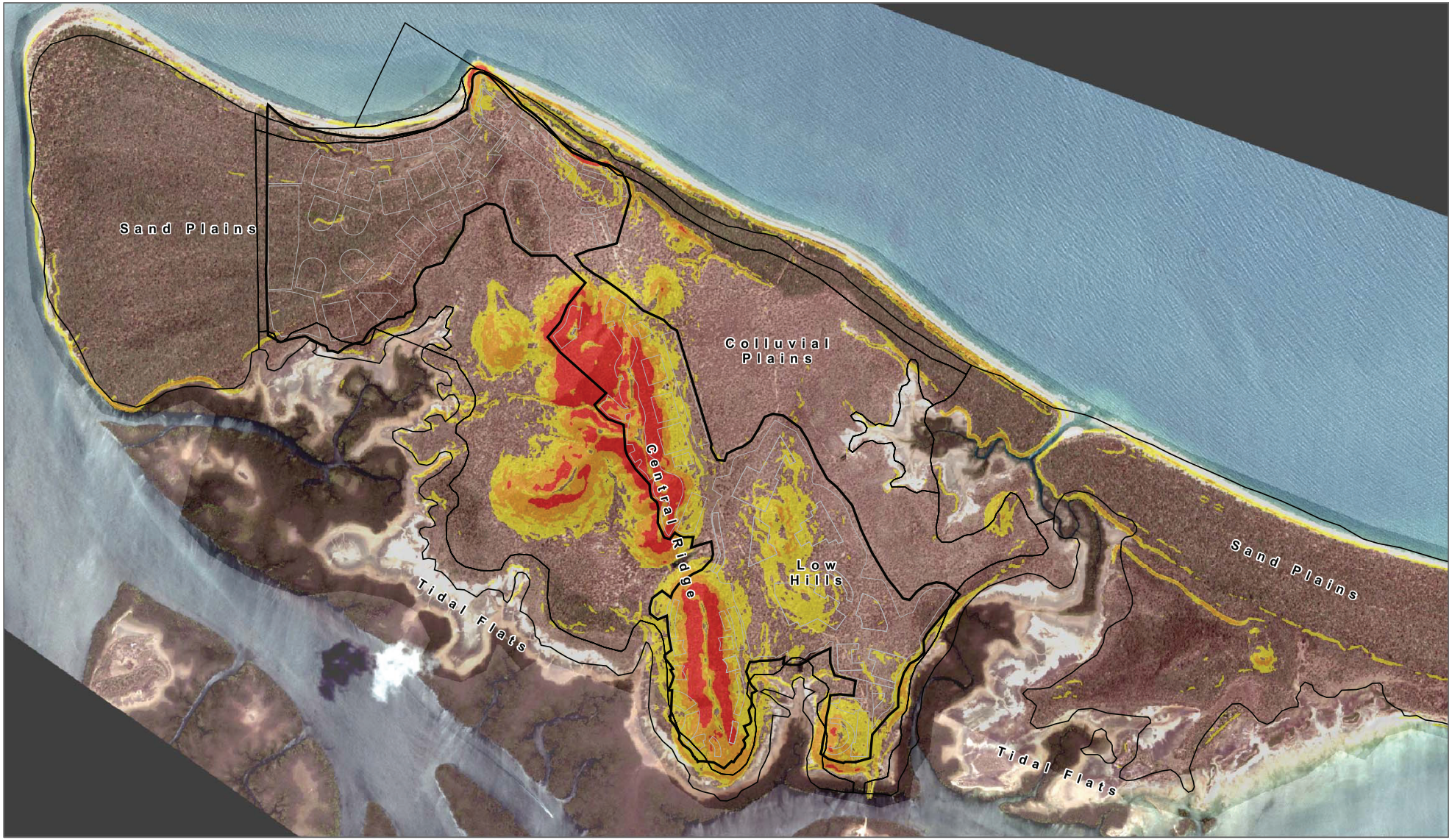
Six broad land form patterns are represented on the Island based on MacDonald *et. al.* (1990). Table 5.6 outlines and describes the main landforms identified on Hummock Hill Island and Figure 5.12 illustrates the slope and land form analysis in relation to the development footprint.

Table 5.6 – Landform Patterns on Hummock Hill Island (after MacDonald *et al*, 1990)

Landform Pattern	Landform Descriptors
Beaches	Very gently inclined to gently inclined aggraded slopes at <5%, occasionally gently undulating plain with a wave built berm at the slope crest, intertidal.
Sand Plains	Very gently inclined to gently inclined aggraded gently undulating plain with relict parallel beach ridges with slopes between 5-10%.
Tidal Flats	Very gently inclined to gently inclined aggraded gently undulating plain, intertidal.
Colluvial Plains	Gently inclined to moderately inclined aggraded slopes between 5-10% undulating rises typically forming the waning lower slope.
Low Hills	Gently inclined to moderately inclined eroded rolling rises with slopes between 10-20% on granodiorite with occasional tors.
Central Ridge	Moderately inclined to steep ridge with slopes greater the 20% with a crest leading to maximal upper slopes that lead into waning mid and low slopes, eroded, steep low hills to steep hills with drainage depressions and ephemeral creeks.

5.1.3.3 Landscape Character Units

Characteristic patterns and combinations of landscape elements which have broadly similar patterns of land cover, land use and land forms can be classified into landscape character units (LCUs) (Landscape Institute with the Institute of Environmental Management and Assessment 2002). The various LCUs are outlined in Table 5.7. Figure 5.13 illustrates the locations and extent of these landscape character units on the Island in relation to the proposed development footprint.



LEGEND

Slope Analysis (%)

- < 5
- 5 - 10
- 10 - 20
- > 20

- Cadastre
- Development Footprint

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Figure 5.12 - Slope and Landform Analysis

Hummock Hill

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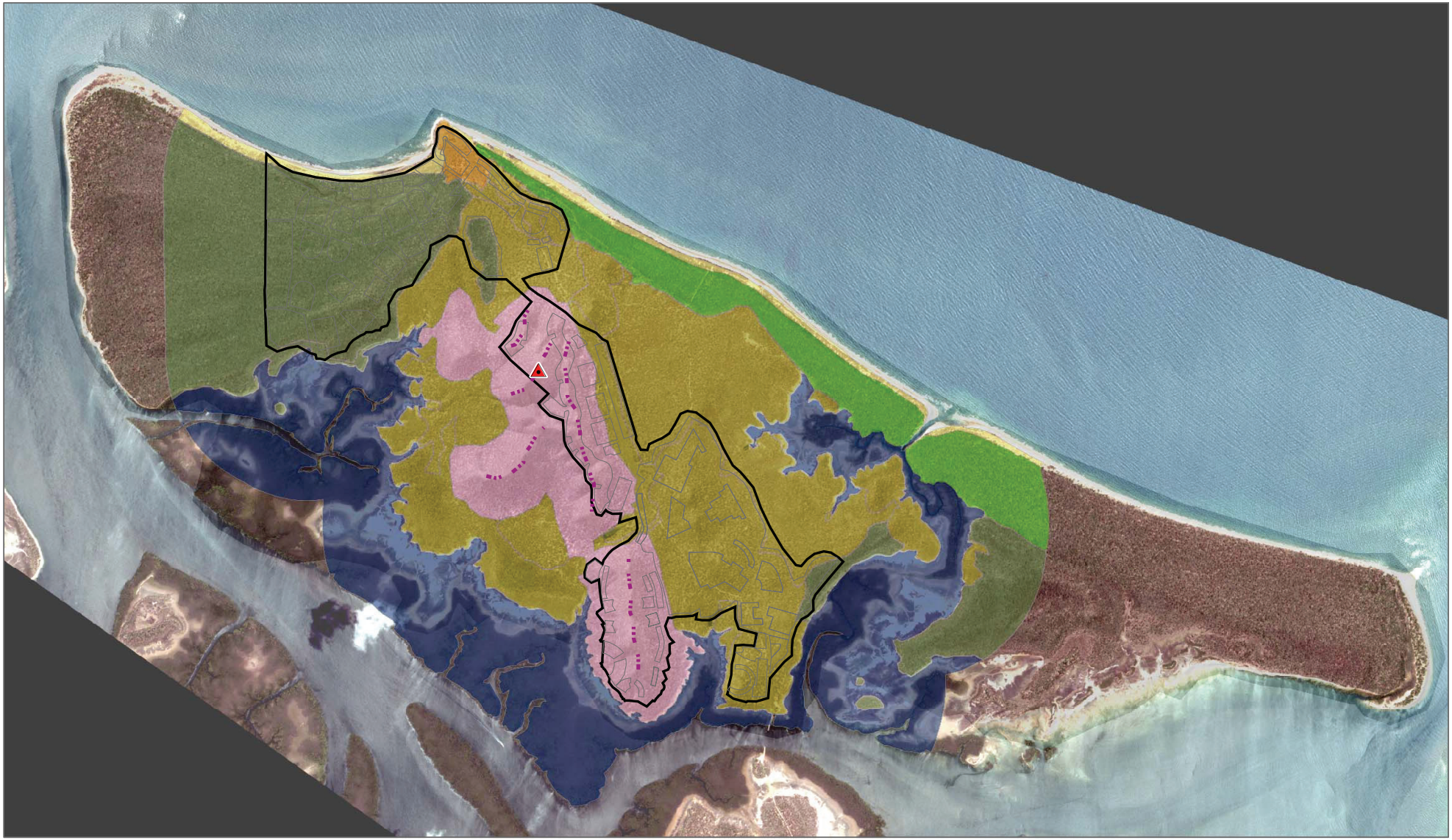

LEGEND

- Hummock Hill 135-AHD
- Main Ridgeline
- Precinct Plan
- Development Footprint

Landscape Character Units

- LCU 1 - Foredunes and Beaches
- LCU 2 - Tidal Wetlands
- LCU 3 - Littoral Vine Forest
- LCU4 - Grassy Woodlands on Undulating Plains, Low Hills
- LCU 5 - Ridgeline Communities
- LCU 6 - Open Eucalypt Woodland
- LCU 7 - Rocky Headland

Figure 5.13 - Landscape Character Units

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Hummock Hill

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Table 5.7 – Landscape Character Units of Hummock Hill Island

Landscape Character Units	Description of Character Elements	Typical example of Character Unit
LCU-1 Fore Dunes and Beaches	▪ The beaches are level to very gentle inclines subject to intermittent submersion from tidal flows. ▪ Fore dunes consist of gentle sloping and undulating land to very steep embankments. ▪ Land cover is dominated by sand deposits containing low grade mineral sands. ▪ Along the front of the dunes low lying pioneer species such as coastal spinnifex and creepers dominate. ▪ Behind the pioneer species low shrubs and trees such as coastal she oaks at a height of approximately 5 metres grade into littoral vine forest greater than 5 metres.	
LCU-2 Tidal Flats	▪ Level landform pattern with extremely low relief subject to intermittent submersion. ▪ Vegetation is distinct from the sandy regions with salt marshes, mangrove communities, sand and mud flats, and intermittent low density sea grass communities.	
LCU – 3 Littoral Vine Forest	▪ Low lying relict beach ridges and strand plains. ▪ Vegetation communities include microphyll/notophyll vine forest. ▪ These are the only closed canopy forests on the island. ▪ The vine forest appears patchy in the undulating coastal beach ridges/strand plains with dry melaleuca woodlands present in the lower swales. ▪ Vegetation heights under 12m with a dense and closed canopy at around 6m.	

Landscape Character Units	Description of Character Elements	Typical example of Character Unit
LCU-4 Grassy Woodland on undulating plains	▪ Topography within the LCU is near level to very gently sloping plains and lowland drainage flats and colluvial plains. ▪ *Open canopy cover dominated* typically with mixed eucalypt woodland *with grassy understorey and occasional herbs*. Occasional melaleuca in lower—lying and depressional areas; casuarinas occur towards the seaward fringe. ▪ Below the east facing foot slopes of Hummock Hill the gently sloping outwash plains dominated by poplar box and blue gum. ▪ Vegetation is considered "advanced re-growth" after the area was selectively cleared when the island was used for pastoral activities and logging. ▪ The evidence of past pastoral activities is scattered throughout the LCU typified by abandoned fences, drains and turkey nest dams. ▪ Tree heights are generally above 10 metres in height.	
LCU -5 Ridgeline vegetation communities	▪ Topography within the LCU contains broad low rounded ridge with marginal slopes in the range 10—20% and steep hilly lands with slopes in the range 20—35%. ▪ Partially cleared with mixed open canopied eucalypt woodland on the steeper and lower slope areas predominately ironbark species. ▪ A predominantly grassy understorey. ▪ Broken views are available from the ridgeline. ▪ Tree heights are generally between 8 and 15 metres in height.	

Landscape Character Units	Description of Character Elements	Typical example of Character Unit
LCU-6 Open Eucalypt woodland	▪ Gentle to moderately steep moderate foot slopes on sand plain and relict beach ridges inclined typically <10% mostly in the range 2—5%. ▪ Mixed eucalypt woodland chiefly ironbark, bloodwood and Moreton Bay Ash ▪ Tree heights are generally above 10 metres in height.	
LCU-7 Headland	▪ Rocky granite outcrop visually prominent component of the northern point of the island approximately 30 metres high. ▪ Land cover is dominated by grasslands. ▪ The headland offers views to the south east along the beaches and fore dunes of the island. ▪ Landscape exhibits modifications from previous settlements including abandoned homestead, cattle yards and sheds.	

5.1.4 Visual Amenity

Landscape viewsheds from key vantage points around the Island are illustrated in Table 5.8. The viewshed is defined by the topographic height of the landform, identifying what land is likely to be seen from a certain point. These images have not taken into account height and density of vegetation on the land or other structures such as buildings which may screen aspects of the proposed development.

The viewshed boundary mapped on these figures is considered the boundary of possible visual impact. True visibility is affected by other factors such as screening by vegetation, contrast with surrounding areas and distance from the view point.

5.1.4.1 Identification of Sensitive Receptors

Key vantage points are identified as “sensitive receptors”. The term “sensitive receptor” refers to a physical landscape area, special interest or viewer group that is likely to experience an effect of change in the landscape (Landscape Institute with the Institute of Environmental Management and Assessment, 2002). It includes views from lookouts, shipping channels, residences and public spaces likely to have a view of the proposed project.

The sensitive receptors identified for this project include:

- The Esplanade at Tannum Sands (R1);
- The Beach at Tannum Sands (R2);
- Bangalee (R3);
- Squatters Community (R4);
- Clarks Road (R5);
- Mundoolin Rocks (R6);
- Great Barrier Reef World Heritage Area (R7);
- Great Barrier Reef World Heritage Area (R8);
- Great Barrier Reef World Heritage Area (R9);
- Seal Rocks (R10);
- Gladstone Harbour (R11); and
- Aerial View (R12).

Sensitive receptor locations in relation to Hummock Hill Island are illustrated in Figure 5.14. Table 5.8 below describes the views available from the receptors with photographs provided to illustrate.

ID	Sensitive Receptor Location
R1	Tannum Sands Esplanade
R2	Tannum Sands Beach
R3	Bangalee
R4	Squatters Community
R5	Clarks Road
R6	Mundoolin Rocks
R7	GBRWHA
R8	GBRWHA
R9	GBRWHA
R10	Seal Rocks
R11	Gladstone Harbour Channe

LEGEND

Sensitive Receptors

Cadastre

Figure 5.14 - Identified Sensitive Receptors of Potential Visual Impacts

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0 0.5 1 2 3 Km

N S W E

Hummock Hill

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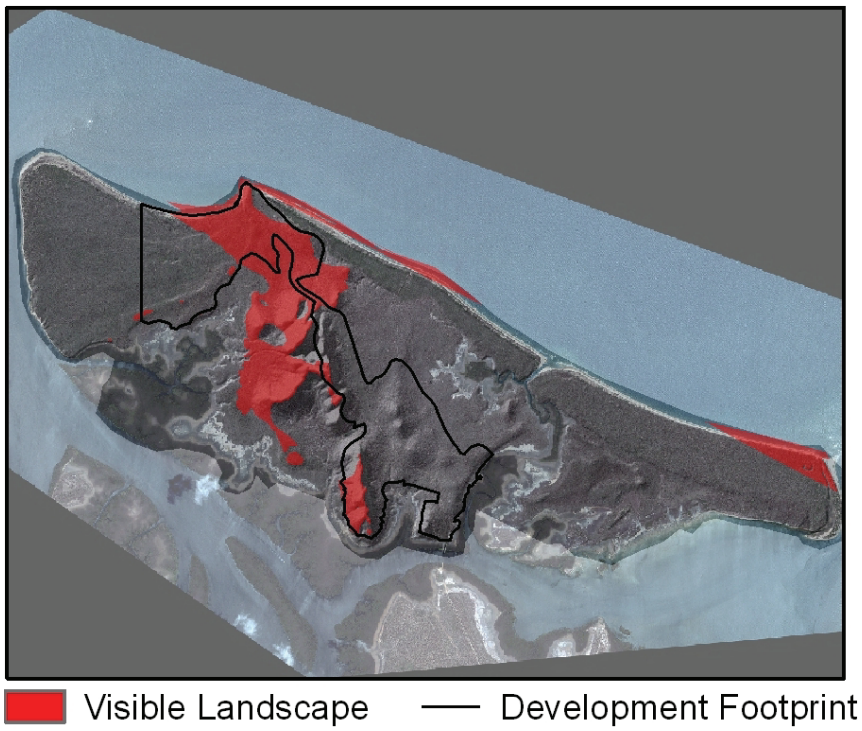
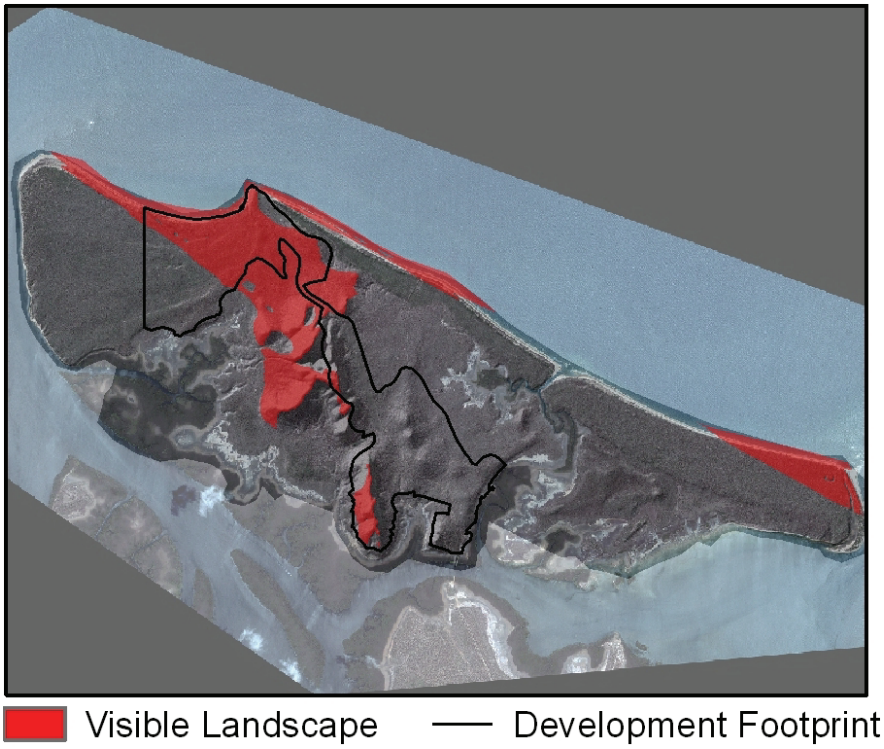
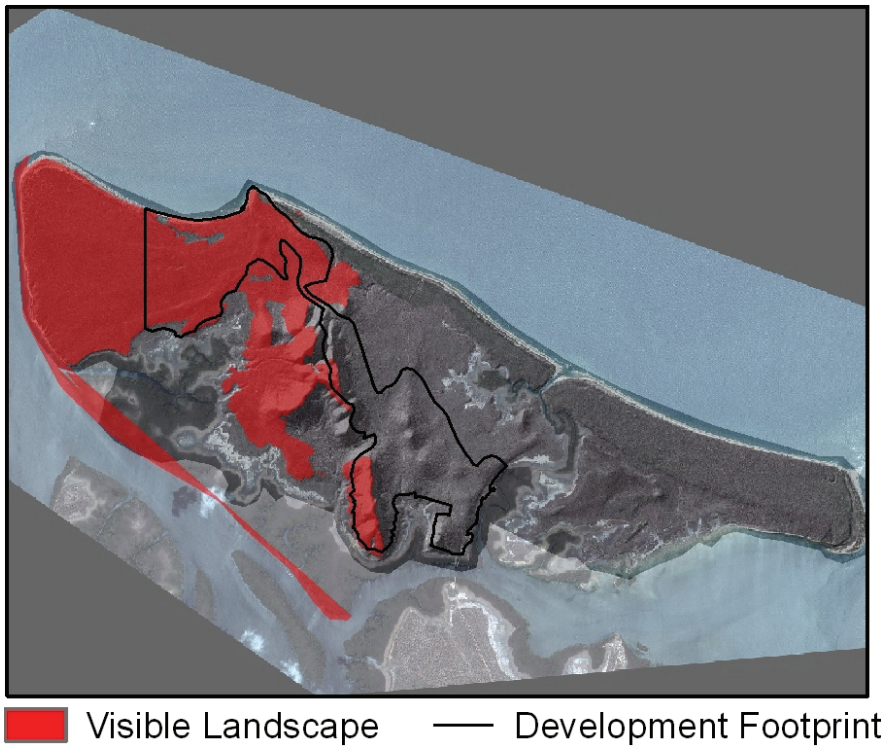
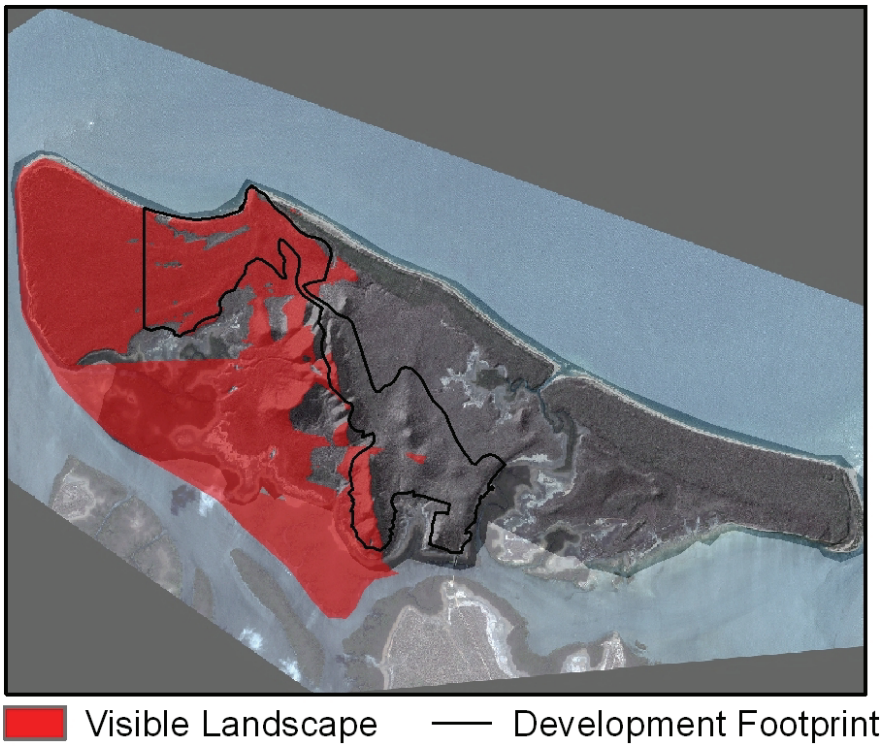
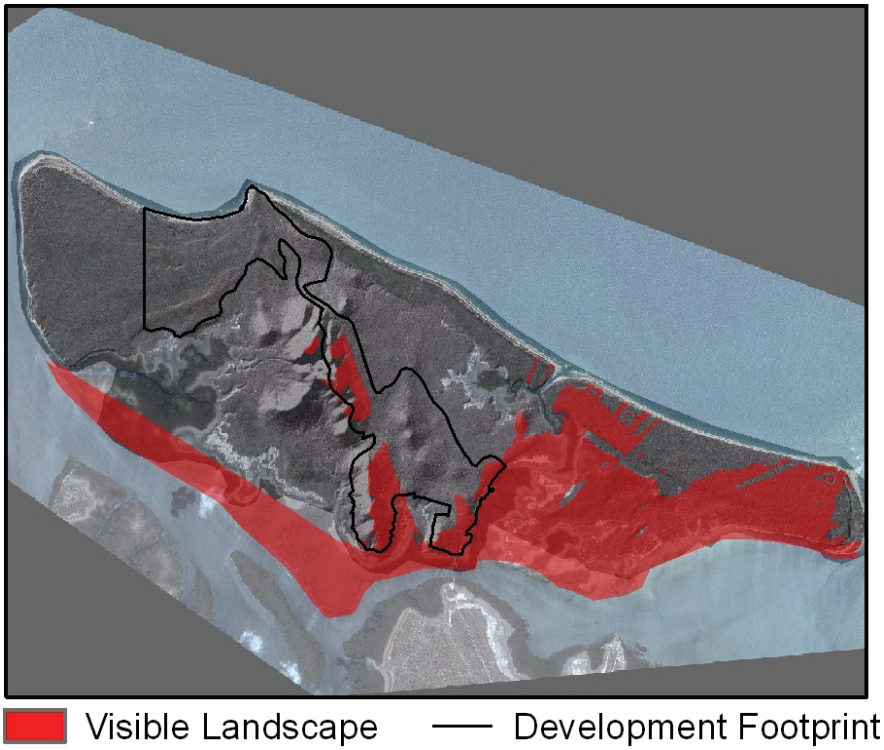
Table 5.8 - Views of hummock Hill Island from Identified Sensitive Receptors

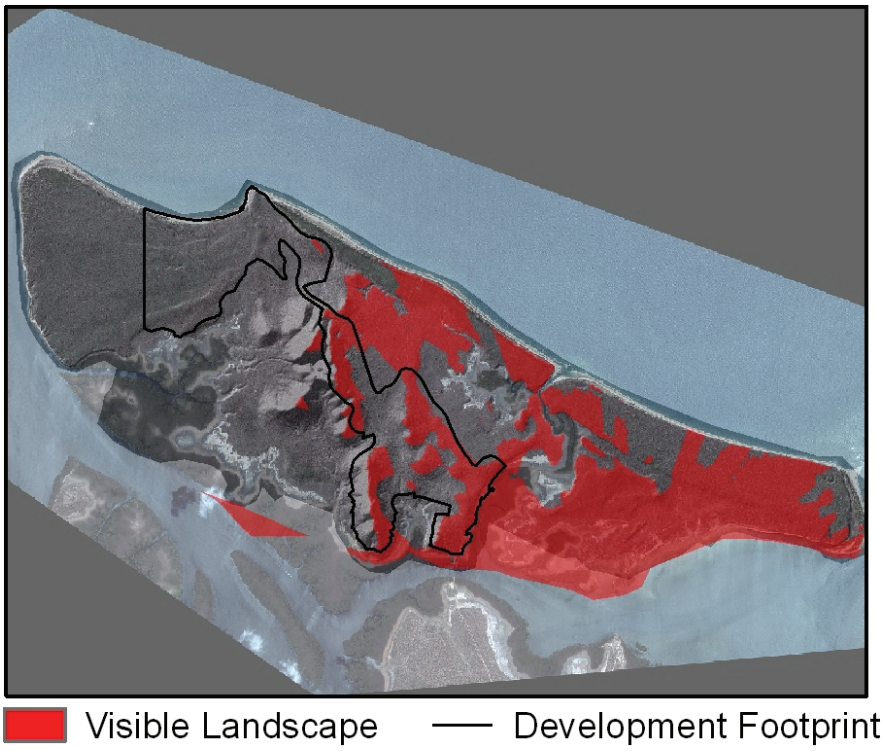
R1 Tannum Sands Esplanade >10km to the project	Description of Viewing Outlook
 View from Tannum Sands Esplanade  Visible Landscape — Development Footprint Digital viewshed from Tannum Sands Esplanade – R1	With wide views to the south, Hummock Hill Island forms a relatively small proportion of the overall landscape from this location. The northern section of Wild Cattle Island dominates the mid-view with Hummock Hill Island in the far distance. The view can be described as containing predominately natural characteristics where the natural coastal vegetation and water elements dominate.

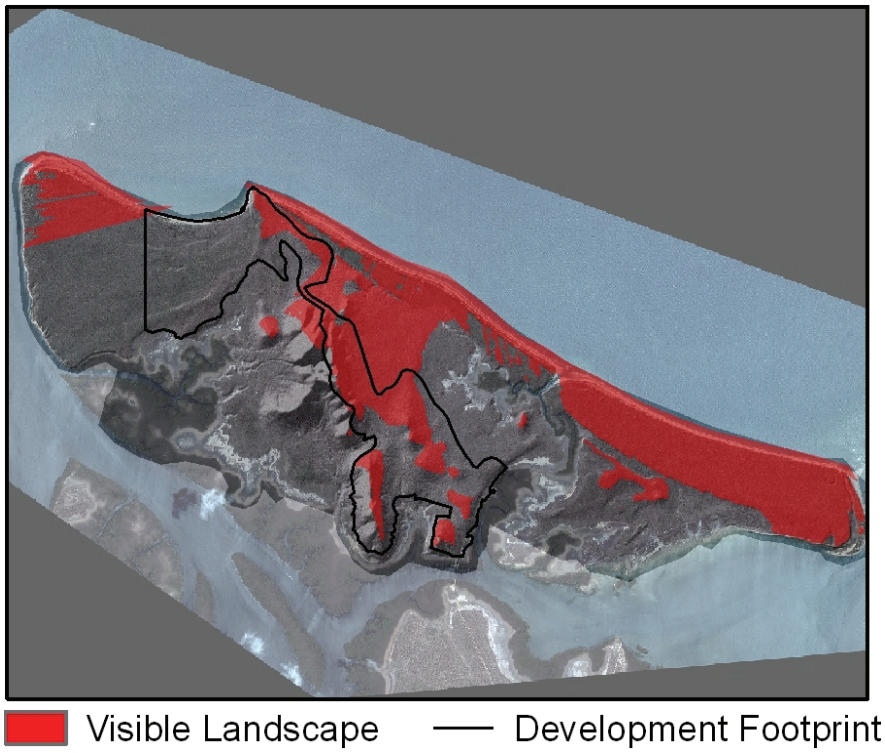
R2 Tannum Sands Beach >10km to the project	Description of Viewing Outlook
 View from Tannum Sands Beach  Visible Landscape — Development Footprint Digital viewshed from Tannum Sands Beach – R2	The visual features looking from this location to the south are dominated by the wide views of the water and nearby coastal vegetation with little or no sign of man made structures. Hummock Hill Island forms a minor component in the middle ground of the overall landscape.

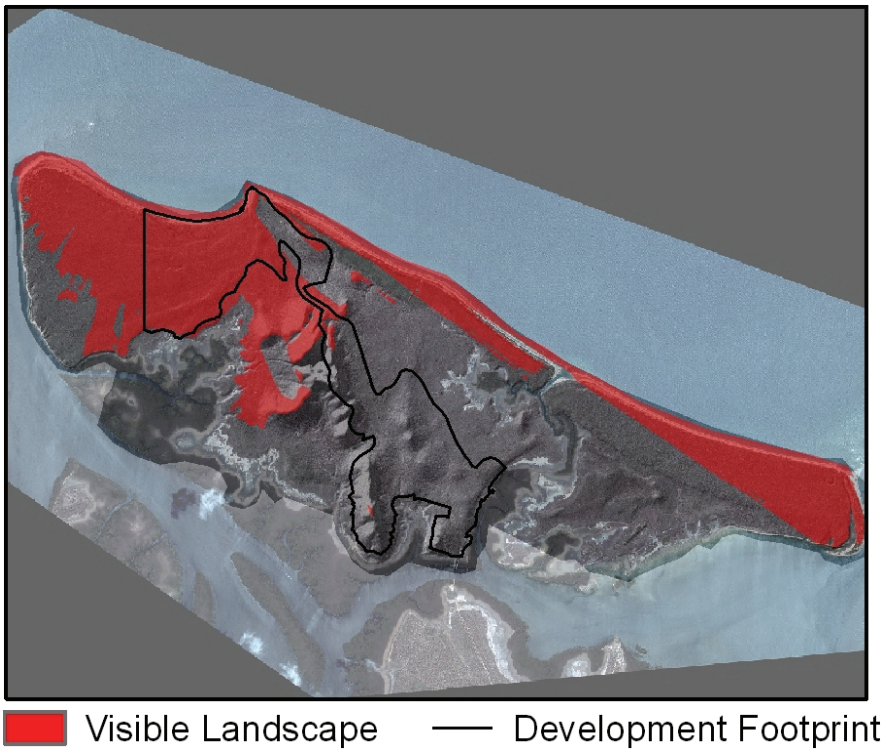
R3 Bangalee 2km to western sloes & >5kms to southern ridge	Description of Viewing Outlook
 View from Bangalee (photo taken from water directly in front of Bangalee)  Digital viewshed from Bangalee – R3	The views over Colosseum Inlet toward the Island are unobstructed with the foreshore vegetation highly visible. The elevated ridge and hillock on the Island are not visible in this view due to screening by the vegetation communities in the middle distance.

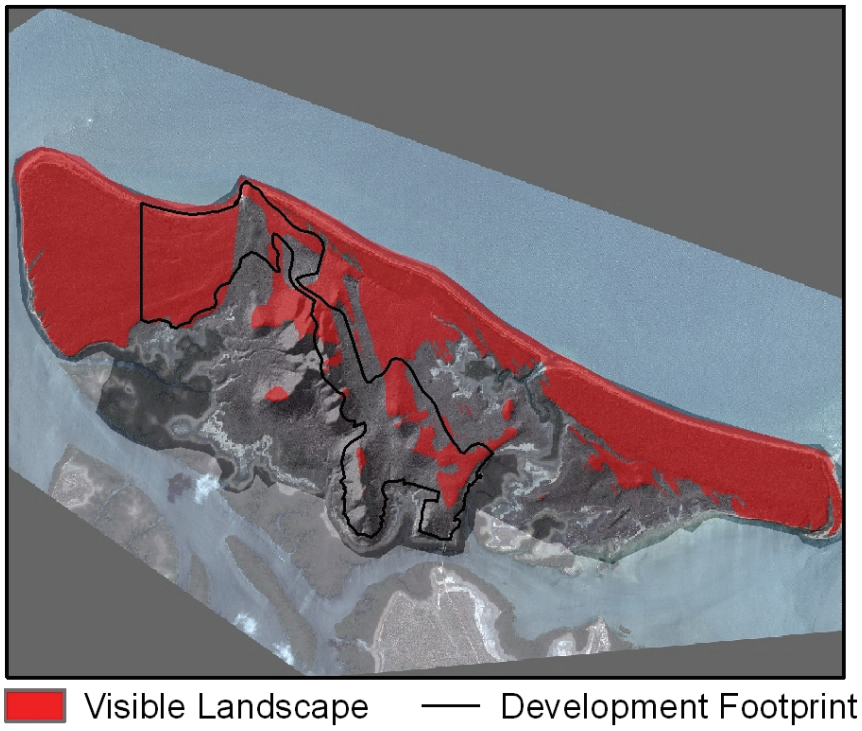
R4 Squatter's Community >3km to the slopes of Hummock Hill	Description of Viewing Outlook
 View from Squatters Community (photo taken from water directly in front of community)  Digital viewshed from Squatters Community – R4	The views from within this community are also unobstructed over the water. Hummock Hill and the central ridgeline is visible above the foreshore vegetation in the far distance and forms a relatively minor component of the view.

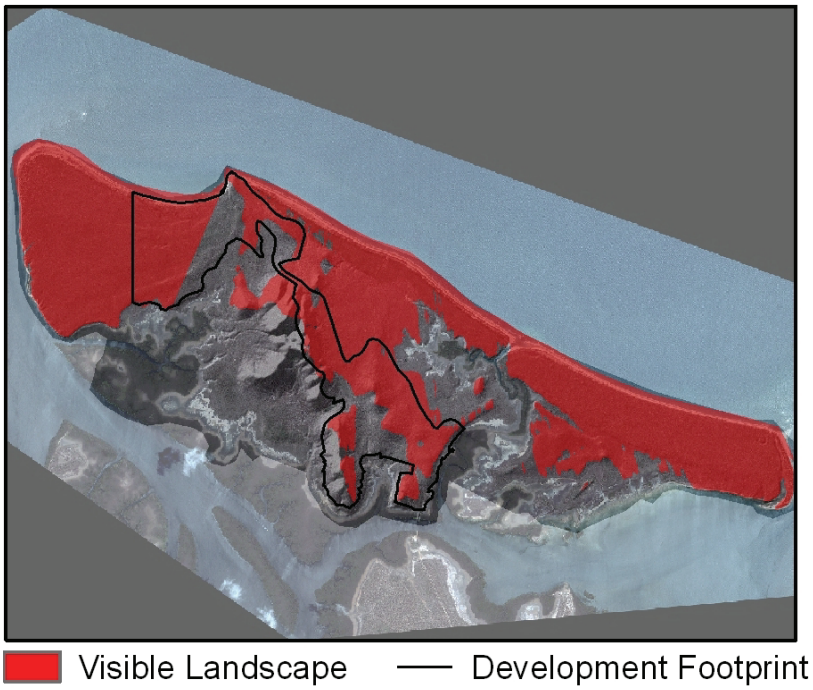
R5 Clarks Road approximately 500m from the project	Description of Viewing Outlook
 View from end of Clarks Road at the causeway  Digital viewshed from end of Clarks Road – R5	The Island is quite visible from this location with the southern ridge and hill of the Island visible in the middle distance. Boyne Creek and the southern coastline of the Island forms the dominant view of the near distance.

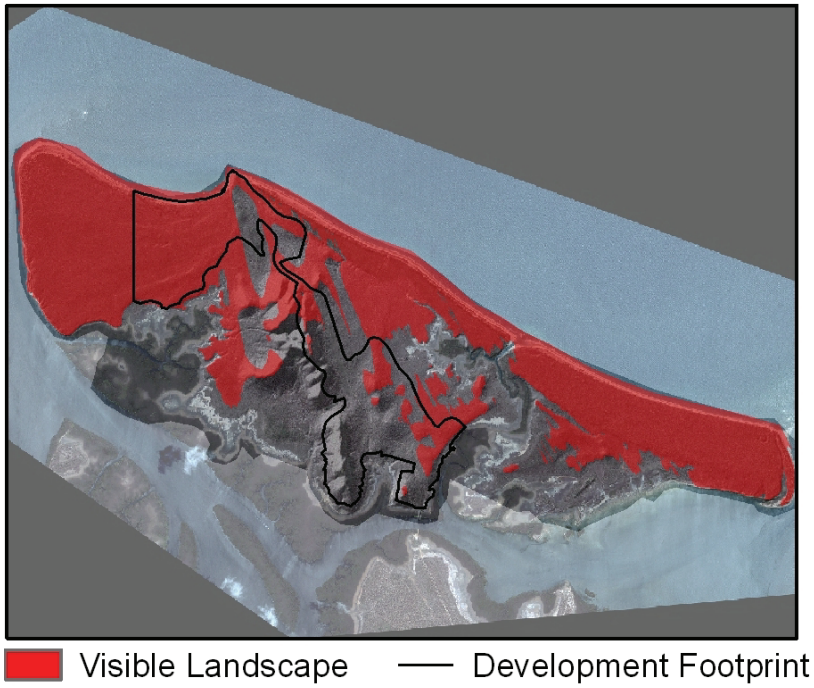
R6 Mundoolin Rocks 2.5km to the south eastern slopes	Description of Viewing Outlook
 View from Mundoolin Rocks Settlement (photo taken from water directly in front of the settlement)  Digital viewshed from Mundoolin Rocks – R6	The viewing outlook is unobstructed across to south eastern aspects of the Island. The south eastern slopes of Hummock Hill are visible in the middle to far distance and the entrance to Sandfly Creek is visible in the near middle distance. Boyne Creek forms the predominant view for the near to middle distance. Only the northern landfall of the causeway across Boyne Creek is visible from this location.

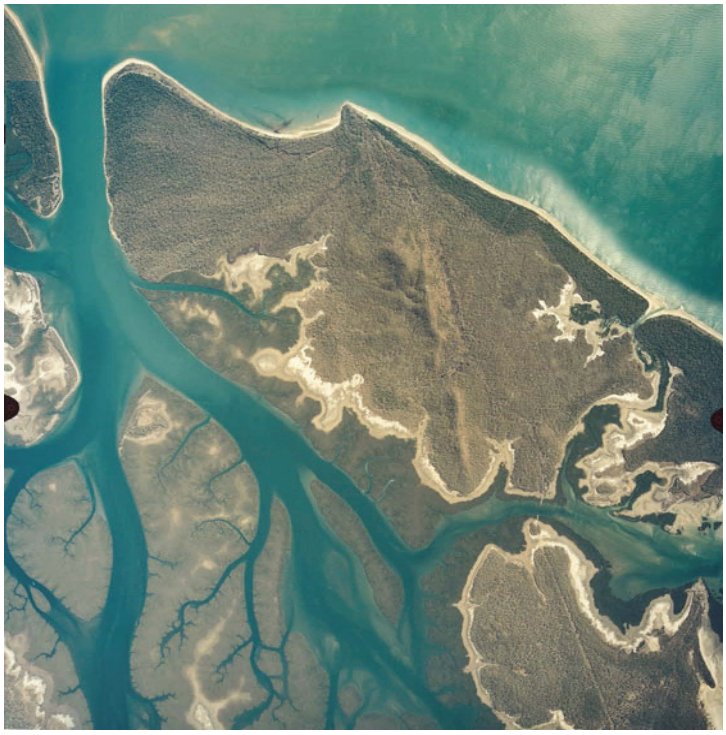
R7 GBRWHA approximately 1 km to Hummock Hill	Description of Viewing Outlook
 View from the north east looking west towards the northern headland  Digital viewshed from GBRWHA - R7	The north eastern slopes of Hummock Hill at 135 metres AHD and the central ridgeline form the middle distance view. The near middle distance view is of the main beach and littoral vine scrub. The low ridge of the colluvial plain is visible rising behind the vine forest in the near middle distance. Near distance views are of coastal waters. The characteristics of the open woodland canopy is evident with vegetation on the slopes more sparse that the foreshore vegetation.

R8 GBRWHA 1.9 km to headland	Description of Viewing Outlook
 View from GBRWHA northern side Island  Digital viewshed from GBRWHA - R8	Hummock Hill forms the middle to far distance views from this location. The headland is and north beach form the middle distance views. The relative sparseness of vegetation on the headland is evident from this distance. Foreshore vegetation along north beach appears quite dense in comparison to the sloping sections of Hummock Hill where vegetation is less dense.

R9 GBRWHA 2 km to headland	Description of Viewing Outlook
 View to the south from GBRWHA northern side Island  Digital viewshed from GBRWHA - R9	The northern headland and main beach forms the middle distance view from this location with the near distance view being coastal water. A wide range of views are available from this location. Dawes Range (on the mainland) is visible to the west, Tannum Sands and Gladstone to the north and uninterrupted views to the horizon over the water to the east. Hummock Hill Island forms the main view of the middle distance with the northern headland and northern aspects of Hummock Hill and the central ridgeline being visible.

R10 Seal Rocks 6.6km to Hummock Hill	Description of Viewing Outlook
 View from Seal Rocks  Digital viewshed from Seal Rocks – R10	Hummock Hill and the North Beach coastline are visible in the middle to far distance with the Dawes range clearly visible in the far distance. From this location the landscape appears as two distinct regions. From Tannum Sands north to Gladstone there is high visibility and occurrence of man made structures. These structures are highly visible particularly at night with industrial complexes, Boyne Island and Tannum Sands clearly visible. The presence of heavily urbanised development is compounded on the horizon to the east and north east where the large commercial transport ships queue for passage into Gladstone Harbour. At night the ships lighting are highly visible. In contrast the coastal landscape south of Tannum Sands appears absent of development. Coastal vegetation communities and vegetated landforms are the main views of the middle distance.

R11 Gladstone Harbour Shipping Channel 8.7km to Hummock Hill	Description of Viewing Outlook
 View from Gladstone Harbour Shipping Channel  Digital viewshed from Gladstone Harbour Shipping Channel – R11	Hummock Hill Island forms a relatively small part of the possible views from this location, and is visible in the far distance with the Dawes Range being more visible in the far distance. Near and middle distance views are coastal water.

R12 Aerial View 5,000 feet above Hummock Hill	Description of Viewing Outlook
 R12 Aerial View Note: All of the Island is visible from the air	The waterways and estuary form the dominant view from the air. The rural uses adjacent to the Bruce Highway are also visible when Hummock Hill Island comes into view. The southern expansion of Tannum Sands down the western side of Wild Cattle Creek is clearly viewed from this location. Hummock Hill Island forms a small proportion of the view available. The duration of the view of the Island is relative to the speed of the aircraft.

The **significance** of the sensitive receptors varies according to a number of factors which include:

- View from the receptor (e.g. permanent or intermittent views) (Wood 2007);
- The dominance of the view from the receptor; and
- Receptor type and importance of view.

In Table 5.9 below, the sensitivity of the receptors are ranked in the context of the above factors.

Table 5.9 – Visual Sensitivity and Importance of Receptors

Visual Sensitivity & Importance of Receptors		Sensitive Receptors within Viewshed
High	Recreational users of the Great Barrier Reef World Heritage Area, National Parks and public lookouts where the landscape dominates the view from the receptor. Residential properties where the landscape dominates the view from the receptor.	R3, R4, R5, R6, R7, R8, R9
Medium	Recreational users of the Great Barrier Reef World Heritage Area, National Parks and public lookouts where the landscape is clearly visible to the receptor but is not the dominant view. Residential properties where the landscape is partially visible to the receptor with broken or partially screened views.	R10, R12
Low	Views from roads, shipping channels and industrial estates. Recreational users of the Great Barrier Reef World Heritage Area, National parks and public lookouts where the landscape forms a relatively small amount of the receptors overall view. Residential properties where the landscape forms a relatively small amount of the receptors overall view or is mostly screened from view.	R1, R2, R11

5.1.4.2 Landscape Values

Determining how people value the landscape and the views to and from a certain point is subjective because people find the landscape valuable in different ways. People who live or work in an area may have different perceptions of the landscape than that held by visitors because of their more regular contact with the landscape and the ongoing changes within it (Landscape Institute with the Institute of Environmental Management and Assessment 2002).

Legislation and Policy documents provide a reliable indicator of community values. Consultation with community stakeholders is generally a requirement in the preparation of these documents.

For the purpose of this section the valued aspects of visual amenity and landscapes are considered through reference to the various sections of applicable legislation and/or policy which identify visual amenity and landscape values. These items are considered in the context of their relative significance defined by the scope of the document. Table 5.10 illustrates the hierarchy of legislation and/or Policies identified and a description of values identified in each.

Table 5.10 – Landscape Value based on Significance of Legislation and/or Policy

Significance	
High - International and National Legislation and/or Policy	Values identified in the Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC) which seeks to protect matters of National Environmental Significance such as world heritage areas. Values identified in the Great Barrier Reef Marine Park Act 1975 (Cth) (GBRMP).
Medium - State & Local Planning Instruments	State Coastal Management Plan, Queensland. This has the effect of a State Planning Policy. Both the existing and proposed draft Planning Schemes for Miriam Vale Shire.
Low	None Applicable.

World Heritage Values

Hummock Hill Island is included within the southern section of the Great Barrier Reef World Heritage Area. Part of the criteria against which the Great Barrier Reef was listed as a World Heritage Area was that it must "*contain* unique, rare and superlative natural phenomena, formations and features and areas of exceptional natural beauty".

This criterion is addressed through the identification of the values within the Great Barrier Reef area as detailed in sections 12 and 15A (World Heritage) of the EPBC Act. Values associated with these criteria are listed in Table 5.11.

Table 5.11 – Landscape and Visual Amenity Values of the Great Barrier Reef World Heritage Area

Natural criteria against which the Great Barrier Reef was inscribed on the World Heritage List in 1981.	Examples of World Heritage values of the Great Barrier Reef for which the property was inscribed on the World Heritage List in 1981.
Criterion (iii) contain unique, rare and superlative natural phenomena, formations and features and areas of exceptional natural beauty.	The Great Barrier Reef provides some of the most spectacular scenery on earth and is of exceptional natural beauty. The World Heritage values include: ▪ the vast extent of the reef and island systems which produces an unparalleled aerial vista; ▪ islands ranging from towering forested continental islands complete with freshwater streams, to small coral cays with rainforest and unvegetated sand cays; ▪ coastal and adjacent islands with mangrove systems of exceptional beauty; ▪ the rich variety of landscapes and seascapes including rugged mountains with dense and diverse vegetation and adjacent fringing reefs; ▪ the abundance and diversity of shape, size and colour of marine fauna and flora in the coral reefs; ▪ spectacular breeding colonies of seabirds and great aggregations of over-wintering butterflies; and ▪ migrating whales, dolphins, dugong, whale sharks, sea turtles, seabirds and concentrations of large fish.

Hummock Hill Island contains some of the values identified in Table 5.11, though in comparison to other areas in the World Heritage Area such as the Whitsunday region or Great Keppel Island it would not be considered "*superlative*"[7]. For instance there are no permanent "*freshwater streams*" on the island with ephemeral watercourses only (refer to Section 8).

The Island's land form is not a "*towering forested continental island*" or considered rugged but is best defined, as per McDonald et al (1990) as a hillock. The highest point on the Island is approximately 135 m above AHD with the remainder of the Island relatively level with some slight undulation. More impressive landscapes of "*exceptional natural beauty*" are considered to exist on the mainland south west of the island such as Eurimbula National park and Castle Tower National Park.

Although there are some occurrences of littoral vine forest on the Island, vegetation cover consists predominantly of open canopy ironbark woodland. These are not rare or unique with an abundance of similar vegetation present within the bioregion. Gum topped box woodland is present on the Island representing an outlier of the Brigalow Belt bioregion that is not well represented within the South East bioregion.

There are no known "*spectacular breeding colonies of seabirds*" on the Island or evidence of "*great aggregations of overwintering butterflies*". Further information on the values of flora and fauna on the Island are contained in Section 13.

More superlative features of the Great Barrier Reef are considered to be located generally further to the east and north of the Rodds Bay region. Users of the Reef may utilise the nearby marine environment for boating or recreation or to access Port Curtis and Gladstone and views of the Island are afforded to people utilising this part of the Great Barrier Reef World Heritage Area. The sensitive receptors R8-R12 represent a sample of views from within the World Heritage Area. Although these views are generally unobstructed across a level marine environment, the distance to the observer will have a strong bearing on what can be seen and the extent to which modifications to the visual environment will become intrusive.

State Coastal Management Plan

State Coastal Management Plan (SCMP) provision applies to all coastal regions of the State in conjunction with any regional coastal management plan. The Island is located within the Wide Bay Coast region of Queensland and at the time of writing, the Wide Bay Regional Coastal Management Plan has not been issued for public comment.

Coastal management outcomes sought along the coastal landscapes of the Queensland Coast are described in 2.7 of the SCMP as "*The scenic and cultural values associated with coastal landscapes are protected*".

The coastal management outcome is supported by the principles listed below:

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[7] Defn: surpassing all others

- ***7A** - The values of coastal landscapes are conserved and recognised for their importance to the quality of life of both residents and visitors, as well as to the economic development and growth of Queensland.*
- ***7B** - The dominance of the natural character of the coast (excluding developed urban areas) is retained, including elements of landscape and vegetation.*
- ***7C** - The cultural and spiritual values of coastal landscapes are recognised and conserved through the involvement of the relevant Indigenous Traditional Owner communities.*

Schedule 2 of the SCMP provides criteria for identifying Areas of State Significance (Scenic Coastal Landscapes). Schedule 2 of the SCMP also lists areas of Level 1 Scenic Quality (areas that are highly outstanding and distinctive) and High Scenic Management Priority (areas considered as having scarce scenic quality). Whilst Port Curtis/Gladstone and the Town of 1770 are listed in the High Scenic Management Priority classification Rodds Bay, Rodds Peninsula and Bustard Head are not listed as an example in Schedule 2 of the SCMP. Section 2.7.1 of the SCMP states that where "*areas of state significance (scenic coastal landscapes)*" have not been identified by a regional coastal plan, regional planning strategies and planning schemes are encouraged to protect scenic landscape values.

Sections of the Island's landscape show obvious signs of human activity such as the headland, Boyne Creek and former pastoral areas. Other areas include the grassy woodlands on the undulating plains where the open forest shows signs of advanced re-growth from the formerly cleared/thinned status during historical pastoral use. Areas such as the littoral vine forest have had mineral survey lines cut as evidenced in historical aerial photography, now re-grown. Historical investigations reveal that sections of the Island has been cleared at some time since the 1870's. Infestation by lantana was also noted in the early part of the 20th Century to the extent that the Queensland Government intervened and introduced a natural fly predator to control lantana infesting the western section of the Island.

Based on the long history of disturbance on the Island and the criteria for assessing scenic values in Schedule 2 of the SCMP, the Island is not considered to fall within the classification as an Area of State Significance (Scenic Coastal Landscapes). Despite this conclusion Master Planning of the proposed development has considered scenic impacts and has designed accordingly to minimise visual impacts. Scenic value requirements of the SCMP are included in and considered under the Miriam Vale Shire Council Planning Scheme as discussed below.

Planning Scheme for the Council of Miriam Vale Shire

The Planning Scheme makes frequent mention of the protection and enhancement of visual amenity and areas that are valuable to the community. For example in section 1.5.9 the Planning Scheme states that the "visual amenity" and appearance of the "hills" and "coastline" shall be protected and enhanced. Areas of natural vegetation, wildlife habitats and wetlands are also sought to be protected. There are controls on land clearing particularly on the "crests of ridgelines" and land which is "visually sensitive". It is noted that this term is not defined in the Scheme however value judgements can be made to include the coastline, the crests of ridges and hills and the naturally vegetated areas including wetlands and forests and open space areas.

Draft Planning Scheme for Miriam Vale Shire

The draft Planning Scheme for Miriam Vale Shire is considered because consultation with the general public, interested parties and State agencies has been undertaken in the preparation of the draft scheme. It is in this draft format that landscape values have been identified below.

As part of the overall desired environmental outcomes sought for the Shire, the Planning Scheme seeks to ensure the Shire's coastal, semi-rural and rural values and the natural environment and ecosystems are managed to ensure:

- Areas of visual and ecological importance are conserved or rehabilitated; and,
- Biodiversity is protected and maintained.

Further it states that "*open space networks are established and maintained with emphasis upon areas of high scenic quality, remnant vegetation, habitat areas, existing open space, riparian areas, coastal foreshores and where possible, linkages of these areas within the network*".

The Overall Outcomes sought for areas on the coast, as detailed in the Coastal Management Code include:

(a) The frontal dunes, coastal vegetation and coastal landform are maintained in their current form, allowing natural coastal processes to continue unhindered;

(b) People and property are protected from damage or injury resulting from natural coastal processes (i.e. storms and storm surge, high velocity winds, and alterations to frontal and secondary dune systems); and

(c) Development within the 'coastal zone' is not visually intrusive when viewed from the beach or from developed areas overlooking the development.

Consistent with the themes identified in the other planning instruments discussed above, the draft Planning Scheme values views and outlooks onto the coastal region, and in particular those areas that retain natural vegetation.

5.2 Impacts and Mitigation Measures

5.2.1 Land Use Suitability Impact Identification

5.2.1.1 Construction Impacts & Mitigation

Land Use Change

Construction phase activities of the proposed development will occur over 16 years between 2008 and 2023. Less than 30% of existing land uses within Lot 3 on FD841442 (less than16% of the Island) will change as part of the proposed development. Table 5.13 presents the pre and post development land uses together with the potential area and percentage of the lease and whole Island changed.

Table 5.13 – Potential Land use Changes within the Proposed Hummock Hill Island Development

Pre-Development	Post Development	Land Area Changed (Ha)	Lease Area Changed (%)	Island Area Changed (%)
Non-RE and RE	Tourism	21	1.8	0.9
Non-RE and RE	Medium Density Residential	30[1]	2.5	1.3
Non-RE and RE	Low Density Residential*	139[1]	12	6.2
Non-RE and RE	Town & Village Centre	10	0.8	0.4
Non-RE and RE	Education & Community	31	2.6	1.4
Non-RE and RE	Golf Course & Open Space[2]	107	9.2	4.7
RE	Utility Services	3	0.3	0.1
Total Land Area Changed	**Actual Footprint**	**341**	**29.3**	**15.1**
Total Land Are Remaining	**Conservation and Natural RE**	**822**	**70.6**	**84.9**
Total Lease Area		1,163	-	-

RE = Regional Ecosystem

1 = MVSC Transitional Planning Scheme requires a maximum building footprint of 50% of the Lot area

2 = Includes retained vegetation outside tees, fairways and greens

Around 70% of current land use within the lease area will be retained in its current natural state based on the footprint alone. On a whole of Island basis this equates to 84.9% of the Island land use remaining unchanged.

Current adjacent land uses to Lot 3 and Hummock Hill Island will not be directly impacted by construction activities such as earthworks. Adjacent land will retain capacity to continue with existing current land uses, i.e. ecosystems.

An additional retention of natural vegetation will occur at the individual Lot level, based on a maximum allowable building footprint of 50% for residential lots as required by both the Miriam Vale Shire Council Transitional Planning Scheme and the proposed Plan of Development. Mitigation of

current land use change will include off-setting of "of concern" terrestrial ecosystems as described in Section 14. No net loss of current terrestrial ecosystem land-use will result from the off set of "of concern" ecosystems on Lot 3 with an equal or greater area of terrestrial ecosystem being acquired and preserved for conservation purposes.

Areas of State Significance (Natural Resources) – Significant Coastal Dune Systems

The western section of the proposed development containing the Lagoon Zone and Bay Zone will be located on 156 ha (12%) of relict beach ridges in the western strandplain. Remaining beach ridge systems will remain outside the proposed development in either erosion prone areas or Unallocated State Land and will as such be preserved, maintaining existing ecological integrity and biophysical values of these remaining systems.

The assessment of the relict beach ridge system in the western section of the Island against the SCMP criteria was conducted by Cardno (2007). A significant coastal dune system, under the SCMP is required to have *"a high degree of ecological integrity **and** biodiversity conservation values, and satisfies **all** of the following criteria:*

1) **it is a good example of a coastal dune system;**

   Stephens (2007) and CQU (2006) have shown that the dune systems on Hummock Hill Island do demonstrate aspects of a "good example of a coastal dune system".

   Stephens (2007) indicates the dune systems on Hummock Hill Island generally comply with this criterion. However, Stephens (2007) states that the dune systems on Hummock Hill Island are Holocene formations that have probably been formed within the last 6000 years. As the dune system does not include Pleistocene dune formation it can be argued that the dune systems on the Island are not representative of the various dunal types natural occurring in the region and are therefore not a good example of a coastal dune system in a regional context (refer to Appendix A7.3).

2) **access to it is limited, and has not compromised its significant ecological values (including level of integrity);**

   While the Island has had relatively limited access to the public it has had a long history of cattle grazing. This agricultural use has resulted in understorey clearing, the introduction of non-native weed species and modified natural regimes. The flora assessment by CQU (2006) has shown that the dune systems on the subject section of the development site supports "not of concern" regional ecosystems and therefore it can be argued that the subject section of the development site does not have significant ecological values.

   While Stephens (2007) indicates the dune systems on Hummock Hill Island generally comply with this criterion from a geomorphological perspective the impact of historical agricultural uses on the ecological values must be considered.

3) **it is undeveloped, or relatively undeveloped and any works or structures have not compromised its significant ecological values;**

In relation to this criterion, the site is relatively undeveloped and contains scattered agricultural use structures. However, it has been demonstrated above that the regional ecosystems within the area mapped by the EPA as "significant coastal dunes" is a "not of concern" regional ecosystem under the *Vegetation Management Act 2005*. It is therefore assumed that this criterion does not apply to the subject section of the development site.

Stephens (2007) again indicates the dune systems on Hummock Hill Island generally comply with this criterion from a geomorphological perspective. However Cardno (2007) noted that the site supports a "not of concern" regional ecosystem and was not identified as ecologically important when mining leases were being surrendered in the region. Although the site is relatively undisturbed it does not contain significant ecological values and does not comply with this criterion.

And one or more of the following criteria:

4) **it is a system that is in dynamic equilibrium, and contains intact representations of the various dunal zones and various dunal types naturally occurring in that region;**

   In relation to the dune systems on an open coast it is only the frontal dunes, and potentially secondary dunes, that are in a state of dynamic equilibrium. The term "dynamic equilibrium" refers to the coastal processes that lead to erosion and accretion at the beach face. For the subject section of the development site the EPA has determined an "erosion prone area" of 80m from the seaward toe of the frontal dune and it is considered that this estimate of potential erosion provides a good approximation of the active beach and dune system. Therefore the inclusion of hind dune areas landward of the "erosion prone area" boundary does not satisfy this criterion.

5) **for a coastal sand dune system, the various dunal zones are intact or relatively intact (i.e. the zones have not lost more than 5-10 percent of the original existing vegetation cover), particularly in the foredune and in the exposed seaward slopes and crests of secondary and hind dunes;**

   The relict dune systems on Hummock Hill Island satisfy this criterion.

6) **it supports native plants or animals or natural communities that have been identified as being, or are considered to be, endangered or vulnerable at the bioregional level;**

   The flora assessment by CQU (2006) has shown that the dune systems on the subject section of the development site do not support endangered or vulnerable regional ecosystems defined under the *Vegetation Management Act 2005*. It is therefore understood that the subject section of the development site does not satisfies this criterion.

7) **it supports a significant number of the bioregional populations of any native plant or animal;**

   The subject section of the development site satisfies this criterion.

8) **it is important as a habitat for animals at a vulnerable stage in their life cycles (e.g. migratory species at breeding or nesting stages);**

The subject section of the development site satisfies this criterion.

9) it is of cultural significance

A cultural heritage survey has identified this area as having cultural significance. This criterion is therefore satisfied.

Cardno (2007) and Stephens (2007) reviewed of the geomorphology and flora and fauna studies of the Island and concluded that the dune systems on Hummock Hill Island exhibit some aspects that comply with the significant coastal dune system criteria defined in the State Coastal Management Plan. However, it has been shown that the dune systems, particularly those on the western side of the Island, do not "*exhibit a high degree of ecological integrity* ***and*** *biodiversity conservation values*" together or mee all of the first three criteria, due to historical agricultural use, introduction of non-native flora species (weeds) and the classification of the area of concern as a "not of concern" regional ecosystems.

Historical use for pastoral purposes, vegetation clearing, lantana infestation and mineral sands exploration will have compromised the ecological integrity of these areas at one time or another. The Island was considered to have a "*low conservation value*" by the Government in the early 1990's as part of the land negotiations between National Parks and Wildlife Service (Qld Parks and Wildlife Service) and Department of Mines and Energy (Qld DME).

The SCMP also allows for the demonstration of net economic benefit to the State for development in areas of Areas of State Significance (Natural Resources). The economic benefits of the proposed project are discussed in Section 17. In summary economic analysis of the proposed development has revealed a:

- net regional benefits from the project of approximately $54 million (in NPV terms);
- net State benefits from the project of approximately $87 million (in NPV terms);
- $635 million ($390 million NPV) value for total construction and building expenditure;
- A $270 million ($167 million NPV) direct contribution to regional value added income from building and construction;
- A $390 million ($240 million NPV) direct and indirect contribution to regional value added income from building and construction;
- A $460 million ($280 million NPV) contribution to Queensland from construction and building work;
- Generate 260 regional construction jobs per year (directly and indirectly) with a peak of 460 regional jobs per year;
- Generate $1,060 million ($380 NPV) in total direct and indirect regional tourism expenditure;
- $1,240 million ($450 million) in total direct and indirect contribution to the State; and
- An estimated 3,300 person years of direct employment from the project, with an average of 190 jobs per year, and a peak employment of 350 persons;

- An estimated 5,400 person years of direct and indirect employment in construction at the State level, with an average of 300 jobs per year, and a peak employment of 550 persons;
- Provide substantial employment opportunities following construction, with a maximum in the order of 700 jobs locally and 850 jobs per year at the State level by 2024.
- $42 million in tourism expenditure that equates to around 5% of the proposed 2016 visitor expenditure target for the Fitzroy of the Queensland Tourism goals;
- A contribution 0.5% of the Queensland Tourism GSP and 12% of the Fitzroy tourism Gross Regional Product, based on the Queensland Tourism targets for 2016;

In summary, the proposed development will impact 12% of the relict beach ridge systems on the Island and is considered to have a net economic benefit to the State. Relict beach ridge strandplain areas do not appear to demonstrate a "*high degree of ecological integrity* ***and*** *biodiversity conservation values*" together due to historical pastoral uses, extensive clearing, lantana infestation and the Island being singled out for mineral and resort development in the 1990's due to its lack of conservation value. It is also considered that 88% of the remaining relict beach ridge systems on the Island will be retained in erosion prone areas and Unallocated State Land. It is also noted that the relict beach ridge systems on the Island are under an EPM as discussed below. Relict beach ridge systems within the western strandplain of the Island do not appear to meet all the criteria of the SCMP. The net economic benefit to the State from the proposed development is significant.

Mineral Resources

Construction of the proposed development will reduce the area available for mineral sands exploitation by 156 ha (12 % of the total deposits on the Island). This will occur entirely within the West End prospect that is estimated to be 4.2 million m^3 at 2.4% heavy mineral (HM). This equates to 30% of the West End resource and 12% of the entire Hummock Hill Island resource. Remaining mineral sands in the Central and eastern deposit of the Island will remain available for sand mining operations with a suitable buffer zone of 100 m from the nearest residential properties.

The Hummock Hill Island mineral sand deposits not a viable commodity in isolation, based on exploration permit renewal information, and need to be considered together with the Middle Island and Byfield deposits to be economically feasible. Sterilisation of 12% of the total deposits on the Island is not considered to reduce the economic viability of the three deposits as a whole; the West End deposit being the lowest grade at 2.4% HM. Upgrade of Clarks Road and provision of bridged access to the Island will also increase the viability of remaining deposits. As such the impact to mineral sand deposits is considered to minor. Discussions with the EPM holder have also raised the opportunity of the mineral deposits being mined prior to developing the West End deposit impacted by the proposed development.

Good Quality Agricultural Land

No good quality agricultural land has been recorded within the proposed development area or lease area. Based on the similarity of soil types over the remainder of the Island, (i.e. Qb) GQAL is not present directly adjacent to the development lease. No impact to GQAL will result from the proposed development.

Some agricultural land use is conducted adjacent to Clarks Road, consisting of pastoral land use within open woodland. Upgrade of Clarks Road to a two lane sealed road will occur entirely within the current road corridor boundaries and will not change adjacent land use capacity.

Areas of Conservation value

Terrestrial land uses, above the HAT, on the Island and within Lot 3 are not designated for conservation. Unallocated State Land outside Lot 3 is currently terrestrial ecosystems with minor recreational land use in erosion prone areas next to Colosseum Inlet and Sandfly Creek. Construction activities on Lot 3 will have minimal, if any, direct impact on existing land use within these areas.

Tidal areas adjacent to Lot 3 are currently designated as conservation land uses, either as Coastal Marine Park, Fish Habitat or significant tidal wetlands under the Queensland Wetlands Mapping methodology. Construction of the proposed development will directly impact less than 1 ha of Coastal Marine Park and tidal wetlands, namely the construction of the access bridge and boat ramp in Boyne Creek. No designated Fish Habitat area will be changed during construction or operation, the proposed bridge and boat ramp being within a 200 m wide exclusion zone of the Colosseum Fish Habitat Area. More detailed discussion of impacts to these features is discussed in Section 14. Mitigation measures detailed in Section 14 demonstrate that construction activities may be conducted with minimal impacts to tidal wetlands.

5.2.1.2 Operational Impacts & Mitigation

Potential changes to current land use during operation of the proposed tourism and residential development on Lot 3 are outlined in Table 5.14.

Table 5.14 – Operational Land Use Changes

Existing Land Use in Lot 3	Land Use Change
Unimproved Land	Improvement of the land including construction of buildings and infrastructure
Regional Ecosystems	Change from terrestrial ecosystem to housing & associated commercial premises etc, for less than 40% of Lot 3.
Cleared Land & Re-growth	Change to residential, hotels, motels and commercial precinct
Unimproved Vehicle Tracks	Return of unimproved vehicle tracks to terrestrial vegetation in locations outside proposed road network. Former vehicle tracks will be closed or have access limited.
Adjacent Land	

Existing Land Use in Lot 3	Land Use Change
Unallocated State Land	No overall change in land use. Small loss of less than 2 ha of unallocated State Land from access to Colosseum Inlet Boat Ramp
Recreational Camping	No direct loss of suitable recreational camping sites on unallocated state land or in current erosion prone areas. Some reduction in recreational camping suitability in erosion prone areas adjacent Colosseum Inlet due to increased population is possible. Improvement of serviced camping facilities within proposed development area with associated facilities.
Intertidal Wetlands	No change of land use
Marine Park	No change of land use
Conservation (Fish Habitat Area & wetlands)	No change in land use
Terrestrial Ecosystems (Clarks Road)	No change in land use
Agricultural Land (Clarks Road)	No change in land use

A number of operational land use changes have been identified in Table 5.14 for land within Lot 3, no direct land use change has been identified on adjacent land on the Island or adjacent to the main access route, Clarks Road. Operational land use changes are proposed to be mitigated as outlined below:

- Mineral Development License – Negotiation with EPM and MDL holder on sterilised lease value;
- Regional Ecosystems - Changes to terrestrial ecosystems are discussed in Section 14 and will be mitigated by off-setting "Of Concern" terrestrial ecosystems directly impacted by the proposed development, as required under the *South East Queensland Regional Vegetation Management Code, 2006*;
- Cleared Land and Regrowth - Changes to cleared land and re-growth land use are discussed in Section 14.2 and will be mitigated by off-setting threshold and "Of Concern" terrestrial ecosystems directly impacted by the proposed development under the SE Qld RVMC;
- Unimproved Vehicle Tracks – where these are located within the proposed road alignment, unimproved vehicle tracks will be upgraded to a two lane paved road. Remaining tracks will be allowed to regenerate to natural ecosystems following ripping to mitigate soil compaction and allow vegetation regrowth.
- Unallocated State Land - A very small proportion of Unallocated State Land will be impacted by the proposed Colosseum Inlet public boat ramp access road, potential impacts are anticipated to be minimal based on the small area of Unallocated State Land utilised for the road corridor that will be designated public road. Impacts will be offset by the benefits of increased safe boat access to Colosseum Inlet
- Recreational Camping – recreational camping on Unallocated State Land adjacent to Colosseum Inlet may be impacted due to the increased public access of this area. Improved camping facilities will be available as part of the proposed development. Recreational camping on other areas of Unallocated State Land on Hummock Hill Island is not anticipated to be impacted to a significant degree and alternative sites from the Colosseum Inlet area will remain unaffected.

5.2.2 Land Disturbance

5.2.2.1 Construction Impacts & Mitigation

Land Erosion

Disturbance to land within the development area, and in particular clearing of vegetation can lead to exposure of identified erosion prone soils if not controlled. Specific details of erosion hazards and impacts during construction are dealt with in Section 5.2.4 below.

Groundwater Discharge Zones

Groundwater discharge zones identified in Section 5.1.2 have a natural tendency for waterlogging and potential increased salinity. These areas are generally texture contrast soils such as Pzm1 on gently undulating topography underlain by weathered granodiorite (refer to Figure 5.8). Periodic waterlogging of these soils has been identified in a number of break of slope areas, indicated by a change in vegetation and the presence of melaleuca trees.

Based on soil surveys conducted by SKM (2005) the following areas fall within indicated discharge zones and will require management during the construction process:

- Golf Course Holes 7 and 8;
- Golf Course Driving Range; and
- Golf Course residential areas west of the Cross Island boulevard Boulevard.

Management of potential water logging issues in the above areas will be carried out by the following mitigation strategies:

- Avoid excessive clearing vegetation in discharge areas, particularly in the Golf Course area;
- Minimise excessive clearing of vegetation in upslope recharge areas;
- Retaining as many mature trees as possible, particularly in recharge and discharge areas;
- Limiting effluent irrigation to mid slopes of low hills where possible;
- Diversion of runoff from hard surfaces directly into storage basins rather than infiltrated in grassed swales in areas identified as discharge zones;
- Planting of woody vegetation to use run-off water along swales or in discharge areas;
- Lining of some storage structures within discharge zones in the golf course;
- Irrigation areas such as the proposed golf course will be designed to maintain as many tree belts as possible and water application will be carefully managed;
- Use proprietary irrigation technology that incorporates soil moisture sensors to avoid waterlogging soils from irrigation;
- Use of rainwater tanks for both residential and industrial areas to reduce stormwater drainage that may contribute to waterlogging in discharge zones; and
- The use of water sensitive urban design principles (refer to Section 8 of this EIS)).

Proposed development works within identified discharge zones will incorporate combinations of the above mitigation strategies to reduce changes to hydraulic and groundwater conditions. In particular the mitigation strategies will apply to areas identified as falling within groundwater discharge zones.

Table 5.15 – Site Specific Groundwater Discharge Zone Mitigation Strategies

Area of Impact	Mitigation
Golf Course - Holes 7,and 8	Minimise clearing of tall vegetation particularly in break of slope areas Maintain existing medium storey vegetation to the extent practicable Direct stormwater to lined ponds and finally existing drainage lines Manage irrigation with automatic irrigation system or similar to minimise waterlogging
Golf Course Driving Range	Minimise clearing to edge of driving range Divert surface runoff to lined stormwater basins and minimise standing water Manage irrigation with automatic irrigation system or similar to minimise waterlogging
Golf Course residential areas west of the Boulevard	Minimise clearing of tall vegetation – building footprint to be <50% of lot area Encourage medium height woody vegetation around dwellings Install rainwater tanks to reduce surface water generation Divert runoff from hard surfaces directly to lined stormwater storages based on WSUD principles

Reference to the *Regional Vegetation Management Code: South East Queensland (2006)* states a performance requirement for Salinity (PR S.6) that *'clearing does not contribute to a) waterlogging or b) the salinisation of groundwater, surface water or soil."* The proposed mitigation measures outlined in Table 5.16 are considered to be a suitable alternative solution to meet the above performance requirement.

Construction impacts to groundwater discharge zones from the proposed development and in particular within the Golf Course area will be managed utilising the above mitigation strategies. Based on these mitigation strategies impacts to identified groundwater discharge are considered to be controlled.

Acid Sulfate Soils

Potential acid sulfate soils have been identified within the mangrove zone adjacent the proposed boat ramp and bridge abutments. Marine sediments within this area returned net acidity between 0.34 and 1.12 % sulphur. The QASSIT trigger level for a fine mud texture (> 1000 tonnes disturbance) is 0.03 %S. Construction activities for the Boyne Creek boat ramp will directly disturb (by excavation) around 1500 m^3 of PASS. An Acid Sulfate Soil Management Plan (ASSMP) and

development consent will be required prior to construction of the public boat ramp and bridge based on the above concentrations. The current PASS survey was a preliminary study where the sampling analysis was completed under the QASSIT guidelines. A detailed PASS survey that will be developed in accordance with the QASSIT guidelines will occur (and be triggered) at the detailed design stage.

The ASSMP will be required as part of Tidal Works Approvals (refer to Section 2) for the proposed public boat ramp and bridge in Boyne Creek. The ASSMP outlines requirements to minimise potential acidification issues associated with construction works, handling methods and treatment requirements to reduce potential impacts from these activities such as:

- Minimising the disturbance of PASS;
- Neutralisation of excavated soils with pure fine agricultural lime ($CaCO_3$) at the nominated rate outlined in Table 4 of the *SPP 2/02 Guideline;*
- Application of lime to open excavation faces;
- Storage of excavated PASS material in a dedicated bunded area to capture stormwater flowing from stockpiles;
- Re-use of neutralised soils as general fill (pending geotechnical assessment).

Excavation of stormwater control ponds in the Qb area of the site will trigger requirements for an ASSMP on the basis of excavations being below 5m AHD and >500m^3. The potential for PASS to be present in this area is considered to be low. However, due to proposed works being below 5 m AHD and >1000 m^3 an ASSMP will be required prior to commencement of works in this area. An example ASSMP for construction activities within Lot 3 on Hummock Hill Island is provided in Appendix A.7.5.

Management of ASS during construction works (in conjunction with ESCP controls) will minimise identified impacts.

5.2.2.2 Operational Impacts and Mitigation

Groundwater Discharge Zones

Uncontrolled irrigation of treated waste water will impact identified groundwater discharge zones within holes 7 and 8 and the proposed driving range on the Golf Course. Poorly designed stormwater drainage within adjacent residential areas could also impact groundwater discharge zones by increasing waterlogging and salinisation.

Irrigation management of golf course areas will incorporate actions in Table 5.16 and will utilise proprietary irrigation system utilising information such as incident rainfall, soil moisture, etc. to minimise over irrigation of these areas. Clearing of tall vegetation will be minimised within these areas to ensure that existing groundwater levels are maintained.

Permanent stormwater controls within the small area of low density residential areas will be based on WSUD principles as outlined in Section 3. However particular attention will be paid to directing surface water to lined storages, minimising infiltration into soils that can exacerbate waterlogging in identified groundwater discharge zones. Bioretention devices that incorporate infiltration will

not be used in this area. Proposed low density residential areas within groundwater recharge zones will maintain tall vegetation to the maximum extent practicable to minimise changes to the groundwater recharge system in these areas.

Incorporation of the proposed mitigation strategies and acceptable solutions outlined above and in Table 5.16 will minimise any impacts to the identified groundwater discharge zone.

Acid Sulfate Soils

Disturbance to acid sulphate soils is not anticipated following completion of the project. Any future developments that may be proposed below 5 m AHD would be subject to provisions of the *SPP 2/02* and consequently require investigation and management of PASS.

5.2.3 Land Contamination

Historical activities conducted around the former homestead included a number of potentially contaminating activities as described in Section 3. The scale of soil and groundwater contamination is not widespread due to the limited volumes of hazardous contaminants used. Potential areas of impact are may be limited to areas of initial contamination. Potential hazardous contaminants that may be associated with historical activities are outlined in Table 5.16.

Table 5.16 – Historical Activities, Potential Hazardous Contaminants and Exposure Pathways

Activity	Hazardous Contaminant	Information
Cattle Dip	Arsenic	Detected by Woodward Clyde (1993) in soils surrounding the cattle dip (range 2.5 – 337 mg/kg). Water solubility of 0.13 mg/l. May be present in a number oxidation states with As(V) predominant in oxidising conditions and As(III) reducing conditions. Can be toxic in high concentrations (an essential mineral in small concentrations). Relatively immobile and remains near the source of contamination both laterally and vertically. Mode of toxicity = various but mostly from inorganic arsenic forms.
Cattle Dip	Ethion	Detected by Woodward Clyde (1993) in residual water at the bottom of the dip. Water solubility 0.6 mg/l and a K_{OC} of 4.19. Relatively immobile and remains near the source of contamination both laterally and vertically. Mode of toxicity = acetylcholinetserase inhibitor (acts on the central nervous system).
Fuel Storage	Diesel	A number of fuel drums remain in a storage shed in the former homestead with some minor staining of soil. Water solubility = 5 mg/l. Combination of various hydrocarbons (aliphatic and aromatic). Can be mobile in larger quanitities. Mode of toxicity = various.

Activity	Hazardous Contaminant	Information
Buildings	Asbestos Cement	Former homestead outbuildings constructed with asbestos/cement sheet. Immobile unless in small (approx less than 1 mm) fibrous form. Mode of toxicity – carcinogen if fibres are inhaled.

In order to prevent environmental harm and to make the land suitable for its intended use, remediation of identified contamination of soils will be conducted in accordance with the *Draft Guidelines for the Assessment and Management of Contaminated Land in Queensland (1998)*

A Stage 2 Contaminated Land Investigation assessing identified areas of contamination will be conducted followed by remediation of areas considered to pose a risk to either the environment or the intended use of the land. The Stage 2 Contaminated Land Investigation Report will include a remediation methodology and EMP that will dictate the methods to be used and approvals required to support remediation and control of identified contamination during any construction activities. Submission of the Stage 2 Investigation Report would be made to the Qld EPA to ensure agreement with any proposed remediation approaches.

Following completion of any remediation, a Validation Report can be submitted to Qld EPA to demonstrate that commitments made in the Stage 2 Contaminated Land Report with respect to remediation goals. The report will provide details of remediation activities conducted and validation of remaining soils (and groundwater if contaminated) as being suitable for the intended use of land. The volume, mode of transport and destination of any contaminated soils removed from the site will be recorded and presented to Qld EPA as part of the Validation Report.

It is recommended that the Stage 2 Contaminated Land Investigation is conducted once access infrastructure such as the bridge is completed. This will allow access for suitable equipment to the Island for investigation activities to commence in a timely manner.

5.2.3.1 Construction Impacts & Mitigation

Construction activities that are to occur in areas where contaminated soils have been identified will not be conducted until remediation and validation of that contaminated soils is complete and Qld EPA have provided a notification that the land is considered suitable for its intended use.

During construction some potentially hazardous materials may be used on site, such as fuel and plant maintenance chemicals. Initial construction activities for installation of infrastructure may include prescribed environmentally relevant activities under the *Environmental Protection Regulation* (1998) such as concrete batching, screening and/or fuel storage. The Principal Contractor will obtain the necessary approvals to conduct these activities under IPA, together with the relevant Registration Certificate under the EPAct.

Any such activities will also be managed under a Construction EMP that includes controls such as:

- Sealed and bunded (to AS1940) fuel, oil and grease storage site for plant;

- Fueling activity to be conducted from a dedicated tanker, away from ephemeral creeks or drainage lines;
- Spill kits will be located at all heavy plant work locations; and
- Contracting staff will be trained in spill response and management.

5.2.3.2 Operational Impacts & Mitigation

Operation of the tourist and residential development will include a number of activities that will require hazardous chemicals. Such activities include:

- Potable water treatment chemicals;
- Sewage treatment chemicals such as ClO_2 (Chlorine Dioxide) or H_2O_2 (Hydrogen Peroxide);
- Aviation fuel storage for small turboprop planes;
- Miscellaneous chemicals associated with the boating commercial precinct such as resins and thinners;
- Small quantities of miscellaneous commercial cleaning chemicals;
- Small quantities of miscellaneous residential cleaning chemicals; and
- Miscellaneous water treatment chemicals for swimming pools such as calcium hypochlorite.

Control of operational chemical storage will be subject to Hazardous Goods permitting and regulation and also the Operational EMP.

5.2.4 Soil Erosion Impact Identification

Section 5a outlined the number of soils considered to have a high risk of erosion. These are summarised in Table 5.17 and are located on all areas of the proposed development bar areas of Qb sands and Pzm2 red earths.

Table 5.17 – Soil Type and Erosion Risk

Soil Type	Erosion Risk
Pzm1	High erosion risk due to sandy hardsetting surface and sodic B horizon.
Pzm3	High erosion risk due to sandy hardsetting surface and sodic B horizon.
Pzm4	Relatively stable surface but high erosion risk due to high slope.
Czs1	High erosion risk due to sandy hardsetting surface and sodic B horizon.
Czs2	High risk of gully erosion

Potential impacts arising from uncontrolled erosion will include:

- Loss of topsoil resources, with consequent increased difficulties in re-vegetation of cleared areas and exposure of subsoils which may be particularly susceptible to erosion;
- Creation of unstable gullies which reduce the development potential of land and may require costly stabilisation works;
- Release of sediment laden water into coastal ecosystems. This may cause increase in turbidity and nutrients which in turn impact on some wetland/coastal ecosystems (refer to Section 12);
- Sedimentation within and blocking of drainage structures such as bioretention filters; and

- Deposition of sediments in drainage lines and coastal wetlands may alter surface water flows into coastal wetlands as well as smothering some plants that may not be tolerant to sediment deposition (refer to Section 14).

5.2.4.1 Construction Impacts & Mitigation

Activities conducted during the construction phase of the development may create erosion and sedimentation impacts if not controlled. Soil erosion and sedimentation impacts are likely during various stages of development activities if not controlled such as:

- Survey and marking - resulting in minor vegetation clearance for survey lines with potential erosion in high risk areas;
- Vegetation Clearance - Medium – potential leading to increase in disturbance to erosive soils;
- Bulk earthworks and grading – resulting in increased soil disturbance, leading to erosion of cleared surfaces and soil stockpiles;
- Construction of key infrastructure - erosion of engineered fill for bridge abutments and general work area adjacent to estuary;
- Construction of Social Infrastructure-Medium – erosion of engineered fill, cuttings & stockpiles;
- Golf Course – resulting in erosion within cleared fairways, tees and greens during construction;
- Construction of residential buildings- minor clearing for house footprint (<50% of Lot) resulting in erosion on high risk soils (proportional to slope).

Control of erosion and sediment risks during construction control will be through the development of an Erosion and Sediment Control Plan for each development stage. The Erosion and Sediment Control Plan will be developed in accordance with the *Department of Main Roads Road Drainage Design Manual* (2002) and the *Soil Erosion and Sediment Control Guidelines – Engineering Guidelines for Queensland Construction Sites* (IEAust (Qld)1996) for each stage of proposed works outlined in the development schedule (refer to Section 2). Individual erosion and sediment control construction plans will require specific measures and principles dictating clearing sequences and mitigation measures required to minimise potential erosion and sedimentation impacts to adjacent land and waters.

Effective erosion and sediment control can be achieved by careful attention to the following principles (refer to Appendix A7.5):

- Minimise the time soils are exposed (or hydromulch if exposed for long periods);
- Protect the land surface from erosion;
- Manage runoff and keep velocities low;
- Provide protected concentrated flow paths;
- Capture sediment on-site;
- Integrate erosion and sediment control with the construction schedule; and
- Inspect and maintain the erosion and sediment control practices.

The following are principles for controlling erosion and off-site sedimentation from construction sites:

- Fit the development to the existing topography, soils, and vegetation as much as is possible;
- Schedule construction operations in order to minimize soil exposure during the rainy season;
- Minimize disturbance and soil exposure by retaining natural vegetation, adopting phased construction techniques, and using temporary cover;
- Vegetate and mulch all denuded areas to protect the soil from rainfall. The primary effort for controlling sediment pollution from construction sites should be to minimize raindrop impact on bare soil;
- Utilize proper grading, barriers, or ditches to minimize concentrated flows and divert runoff away from denuded slopes or other critical areas;
- Minimize the steepness of slopes and control the length of slopes by utilizing benches, terraces, contour furrows, or diversion ditches;
- Utilize riprap, channel linings, or temporary structures in the channel to slow runoff velocities and allow the drainage ways to handle the increased runoff from disturbed and developed areas;
- Keep the sediment on-site by utilizing sediment basins, traps, or sediment barriers; and
- Monitor and inspect sites frequently to assure the measures are functioning properly and correct problems promptly.

An Erosion and Sediment Control Plan will be developed for each stage of the proposed development in accordance with the *Queensland Urban Drainage Manual* (2002) and the *Soil Erosion and Sediment Control Guidelines – Engineering Guidelines for Queensland Construction Sites* (IEAust (Qld)1996) or updated versions thereof. All works will require a site specific erosion and sediment control plan dictating clearing sequences and mitigation measures required to minimise potential erosion and sedimentation impacts to adjacent land and waters. All Erosion and Sediment Control Plans will be developed by a suitably qualified engineer and approved prior to commencement of a particular development area.

5.2.4.2 Operational Impacts & Mitigation

Risks of erosion following construction of each development stage will be primarily derived surface runoff during storm events and inadequate storm water control measures. Mitigation of post construction erosion will be based on WSUD such as those outlined in Section 3 and Appendix A7.5.

Design of proposed stormwater drainage structures will consider potential design rainfall changes due to climate change and changes to the design rainfall. It is predicted that rainfall intensity for a 1 in 20 year event may increase between 0 % and 30% (Low global warming Scenario and High Global Warming Scenario respectively) by the Australian Greenhouse Office (DEH, 2006). Allowance for potential changes in rainfall intensity will allow for ongoing sustainable control of potential erosion

and surface runoff generation. Consideration will also be required for stormwater structure design with potentially higher water velocities associated with an increase in rainfall intensity.

5.2.5 Landscape Character and Visual Amenity

5.2.5.1 Sources of Potential Impacts on Landscape and Visual Amenity

Activities that are likely to cause changes to landscape and visual amenity during the construction and operation phases are identified below.

Development of the project will occur in stages so the potential impacts of the construction phase will vary accordingly.

Likely construction phase activities include:

- Construction of a bridge across Boyne Creek between the mainland and Hummock Hill Island;
- Increase in the frequency of heavy vehicles in the area;
- The storage of construction materials and construction equipment;
- Construction works, including vegetation clearing, earthworks, and installation of services such as reticulated water, sewerage systems, stormwater, electricity and telecommunication infrastructure will be undertaken;
- Temporary parking and potential on-site accommodation and working areas; and
- Although it is not anticipated that construction activities would occur in the evening, some lighting may be necessary in and around the construction sites for safety purposes if light is poor. The lighting may be visible from sensitive receptors.

During the operational phase, matters likely to be most relevant to the landscape and visual impact assessment include:

- Building form and physical elements of the development including the physical dimensions, shape, bulk, patterns, edges, orientation, complexity and symmetry;
- Building materials including texture, colour, shade, reflectivity and opacity;
- Illumination of roads and buildings;
- Landform changes such as excavation and fill of private and public spaces;
- Vegetation changes including the extent of existing vegetation retained and the type and position of new landscaping elements such as screening vegetation along roads;
- Increase in the number of participants undertaking outdoor activities on the water such as boating and recreational fishing;
- Vehicle lights and movement; and
- The design and layout of the proposed development including factors such as layout, scale, style, distinctiveness and numbers of scheme components (for more detailed information on the scheme components refer to Section 2.1 of this EIS).

5.2.5.2 Magnitude of Impact

Assessing the magnitude of potential impact is affected by a range of factors including vegetation cover, topography and visual pattern. Areas with a high visual absorption capacity are able to easily accept objects such as buildings and infrastructure with their visual impacts less noticeable (Amir & Gidalizon 1990). Conversely changes in the landscape with low visual absorption capacity will be highly visible over a long period of time. Table 5.18 identifies the visual absorption capacity factors and their numerical values used in this landscape and visual amenities assessment.

Table 5.18 – Visual Absorption Capacity Factors and their Numerical Values

VAC Factor		Categories		
Slope	Range	0-3%	3-10%	>10%
	Numerical Value	3	2	1
	VAC	Low	Moderate	High
Vegetation Height	Range	<5m	5-10m	>10m
	Numerical Value	3	2	1
	VAC	Low	Moderate	High
Visual Pattern	Range	Uniform	Moderate	Diverse
	Numerical Value	3	2	1
	VAC	Low	Moderate	High

Criteria for visual absorption capacity, outlined in Table 5.19, are applied to identified landscape characteristics of Hummock Hill Island and at the bottom of the table the VAC is summed up.

Table 5.19 – Visual Absorption Capacity of Hummock Hill Island

VAC Factor	Hummock Hill Island Values
Slope	The most visually prominent land forms of Hummock Hill Island are the ridges and crests of hills. The slopes of these hills are between 10-30% which is categorised as a High VAC value of 1. On the low lying lands where there a few slopes the visual absorption capacity is low with a score of 3.
Vegetation Height	The vegetation height of the majority of the tree species which will form the screening elements on the island is above 10 metres in height. Vegetation above 10 metres is categorised as high VAC with a value of 1.
Visual Pattern	When viewed from the majority of the sensitive receptors the visual pattern on the island is dominated by the vegetation communities. Despite there being a number of vegetation types on the island it is the uniform spread of vegetation across the island which gives it a dominant look of being naturally vegetated. The VAC of a uniformed landscape is low with a numerical value of 3.
Visual Absorption Capacity	VAC = Slope + Vegetation Height + Visual Pattern divided by 3 VAC on the slopes and hills = 1 + 1 + 3 = 5 divided by 3 = 1.6 – Moderate to High VAC on the low lying lands = 3 + 1 + 3 = 7 divided by 3 = 2.3 Moderate to Low

The assessment in Table 5.18 reveals the visual absorption capacity of the Hummock Hill Island landscape as moderate to high on the steeper slopes of the island and low to moderate on the low lying land.

In addition to VAC there are other factors which also affect the degree of visual impacts on the landscape. These include:

- The duration of changes in the landscape, ranging from long term changes to temporary changes;
- The dominant view from the observer which takes account of distance; and
- Identified landscape values as stated in relevant planning instruments.

In Table 5.19 above, these factors are combined to assess the magnitude of change in the landscape. This scale is then utilised in conjunction with the sensitivity of the receptors identified in Table 5.20 and the hierarchy of landscape values presented in Impacts on Valued Landscape Characteristics Effects which produce a moderate or substantial change on the landscape are considered in Table 5.22. A full assessment against all values is provided in Appendix A7.5. The assessment utilises the impact significance methodology established above and the magnitude of change identified.

Table 5.22 assesses the significance of potential changes utilising a risk assessment matrix model (Table 5.21) adapted from Australian Standard *AS4360 Risk Management*.

Table 5.20 – Visual Magnitude or Scale of Change (after Wood, 2007)

Magnitude of Change in the Landscape	
High	The majority of the proposal is a clearly visible and is a dominant visual element in the skyline. The development obstructs views from the sensitive receptors. 0-1 km. Distance from receptor to development (Department of Main Roads 2004). Broad scale changes to landform and vegetation character are clearly visible as a result of a low visual absorption capacity, proximity, size, absence of intervening vegetation, topography, structures or due to the absence of adequate mitigation measures.
Medium	The majority of the proposal is visible and changes to the skyline are unsympathetic to the existing skyline. Material changes to landform and vegetation character are visible but moderated by visual absorption capacity, distance, scale or other design and mitigation measures. 1-5 km. Distance from receptor to development (Department of Main Roads 2004).
Low	Some parts of the proposal remain visible and represent a small change to views available from the receptor. The principal characteristics of the view are not dominated by the change. >5 km. Distance from receptor to development (Department of Main Roads 2004). Views are significantly moderated by visual absorption capacity, distance, scale or other design and mitigation measures.
Negligible	The proposal is partially visible or appear visually insignificant to all receptors due to visual absorption capacity, distance, scale or other design and mitigation measures.

Table 5.21 – Visual Sensitivity and Importance of Receptors

Receptor Sensitivity & Importance of Receptors	
High	Recreational users of the Great Barrier Reef World Heritage Area, National Parks and public lookouts where the potentially impacted landscape dominates the view of the receptor. Residential properties where the potentially impacted landscape dominates the view of the receptor.
Medium	Recreational users of the Great Barrier Reef World Heritage Area, National Parks and public lookouts where the landscape is clearly visible to the receptor but is not the dominant view. Residential properties where the landscape is partially visible to the receptor with broken or partially screened views.
Low	Views from roads, shipping channels and industrial estates. Recreational users of the Great Barrier Reef World Heritage Area, National parks and public lookouts where the landscape forms a relatively small amount of the receptors overall view. Residential properties where the landscape forms a relatively small amount of the receptors overall view or is mostly screened from view.
Negligible	Where the landscape is barely visible to the receptor.

Table 5.22 – Impact Significance Threshold Matrix

Receptor Sensitivity or Landscape Value	Magnitude of Change			
	High	*Medium*	*Low*	*Negligible*
High	*Substantial*	*Substantial*	*Moderate*	*Slight*
Medium	*Substantial*	*Moderate*	*Moderate*	*Slight*
Low	*Moderate*	*Moderate*	*Slight*	*None*
Negligible	*Slight*	*Slight*	*None*	*None*

Significance of Change	
Substantial	Significant aspects of the proposal dominate the views of high or moderately high sensitive receptors.
Moderate	Some parts of the proposal are visible and present material changes to views from high or moderately high sensitive receptors.
Slight	Some parts of the proposal remain visible and represent a small change to the views of the least sensitive receptors.
None	Where the visible changes to the landscape are barely visible to the receptor.

5.2.5.3 Impacts on Valued Landscape Characteristics

Effects which produce a moderate or substantial change on the landscape are considered in Table 5.23. A full assessment against all values is provided in Appendix A7.5. The assessment utilises the impact significance methodology established above and the magnitude of change identified.

5.2.5.4 Impact on Visual Amenity

Descriptions of the visual impacts of all stages of the project are assessed in relation to the sensitive receptors identified in the surrounding landscape. Table 5.24 assesses potential impacts and changes in viewing outlooks from identified sensitive receptors.

Table 5.23 – Impacts on Landscape Values based on World Heritage Values, State Coastal Management Plan and Miriam Vale Shire Planning Scheme

Landscape Value	Magnitude of the Proposed Changes	*Significance of Change*
Great Barrier Reef World Heritage Values		
High: The vast extent of the reef and island systems which produces an unparalleled aerial vista.	Low: Hummock Hill Island is part of the "continental island systems" in the Great Barrier Reef World Heritage Area however it is visually more connected to the nearby terrestrial landscape when viewed from the air. The superlative features of the Great Barrier Reef such as corals and high islands are located further to the east and north. The Island is visible on the flight path to and from Gladstone Airport and the changes to the landscape will also be visible. However the principle characteristics of the view available from approximately 5,000 feet (1.5 km) will continue to be the highly urbanised areas of Gladstone, Boyne Island and Tannum Sands. These areas have been identified as places to accommodate further development and urbanisation along with development on the southern tip of Wild Cattle Island and at Innes Head.	Slight: Based on the high overall context of the GBR and Island systems the significance would be rated as moderate. Within the local context of Gladstone however, and associated development including shipping channels, viewing distance and opportunity, the aerial impact is not considered to be of such material value and the sensitivity of the receptors is considered to be low to moderately sensitive, the significance of the change is considered to be slight.
High: Islands ranging from towering forested continental islands complete with freshwater streams, to small coral cays with rainforest and unvegetated sand cays.	Negligible: Hummock Hill Island is a continental island with ephemeral creeks. The highest point on the island is not considered to be "towering" at approximately 135 metres above AHD with the remainder of the island relatively flat with some slight undulation. There is only a relatively small amount of "forested" area on the Island. The dominant character units comprise open woodlands. The Littoral Vine Forest is located adjacent to the north east coast and will not be directly impacted by components of the proposed development. The landscape type most affected by the location of the development components are the open canopied woodlands containing iron bark and eucalypt species. These woodlands occur in abundance and are not considered unique natural phenomena of superlative natural	Slight: The diversity of natural settings within the GBRWHA is largely not affected by the project and the significance of the change is considered to be slight.

Landscape Value	Magnitude of the Proposed Changes	*Significance of Change*
	beauty.	
High: Coastal and adjacent islands with mangrove systems of exceptional beauty.	High: There are significant mangrove systems in and around the Island particularly along the estuarine shorelines of Colosseum inlet, Boyne Creek, Sandfly Creek and Seven Mile Creek. The bridge construction will have a relatively large visual impact on a very small localised section of the mangrove system.	Slight: The localised significance of the bridge affecting the visual amenity of "mangrove systems of exceptional beauty" could be considered to be large. However, the actual impact area is very small with limited viewpoints. The significant mangrove and tidal flat systems surrounding the Island will remain unaffected from the majority of viewpoints. The tidal flows in this area have a large influence on the usability of the water for recreational fishing and boating (i.e. uses consistent with those within the GBRWHA) with particular difficulties finding a channel at low tide. This influences local receptor sensitivity which is more likely to be low to negligible. Given that the overall magnitude of the change is considered low, the local significance of the impact is considered slight.
High: The rich variety of landscapes and seascapes including rugged mountains with dense and diverse vegetation and adjacent fringing reefs.	Negligible: The Island's terrain is not considered to be a rugged mountain range but is best defined in McDonald et al (1990) as a hillock. Vegetation on the Island is predominately open canopied woodland with only a few patches of littoral vine forest considered dense.	Slight: The rich variety of landscapes and seascapes available with the GBR WHA are not considered to be significantly affected by the project and the significance of the potential change to this variety is considered slight.
High: The abundance and diversity of shape, size and colour of marine fauna and flora in the coral reefs.	Negligible: From a visual perspective there are no significant impacts likely as a result of the proposal on fauna and flora of the coral reefs of the GBR WHA. Lighting from the development will be angled downwards and away from habitat areas (including beaches and estuarine waters where possible) or fitted with shielding that screen ambient light from habitat areas	Slight: Low density nesting by marine turtles is known to occur on the main beach of the Island. The main area of the development within view of these areas is the headland, all other areas being screened by the littoral vine forest. The use mitigation strategies outlined by Witherington and Martin (2000) and commonly used in other urban areas, such as Bargara, to reduce the impact of visible lighting from the development will minimise any potential impacts to nesting turtles. Subsequently impacts are considered slight.
High:	Not Applicable:	None.

Landscape Value	Magnitude of the Proposed Changes	*Significance of Change*
Spectacular breeding colonies of seabirds and great aggregations of over-wintering butterflies.	There are no known breeding colonies of seabirds on the Island or evidence of rare butterflies. For further information on the fauna studies undertaken on the island please refer to section 14 of the EIS.	
High: Migrating whales, dolphins, dugong, whale sharks, sea turtles, seabirds and concentrations of large fish.	Not Applicable: Marine impacts are considered in other sections of the EIS however from a visual perspective there are no significant impacts likely as a result of the proposal.	None.
State Coastal Management Plan		
Medium: The values of coastal landscapes are conserved and recognised for their importance to the quality of life of both residents and visitors, as well as to the economic development and growth of Queensland.	Low: The development on the Island is likely to result in the present features of the landscape being valued by a greater number of people as access to the Island is improved. Historically in this part of the State the more highly valued landscapes are conserved in conservation areas and National parks. For example Wild Cattle Island located directly south-west of Hummock Hill Island Rodds Peninsula and Eurimbala National Park to the east provide a better representation of unspoilt landscapes with diverse vegetation communities and landscape values. These areas have been conserved as National Park. Hummock Hill by comparison is currently vacant and is not subject to plans for conservation. The plan of development however can protect certain areas on the Island from development and with appropriate management maintain and protect surrounding visual values.	Moderate/Slight: Without the context of the Wide Bay Regional Plan and the identification of specific coastal scenic values and conservation intentions the significance of the change in relation to the expressed State Coastal Plan values are considered moderate to slight. While there will be changes to the coastal landscape brought about by the project it also offers increased opportunities for new residents and visitors as well as associated economic opportunities to appreciate and conserve remaining values. Additional mitigation through sensitive development principles will further minimise impacts.
Medium: The dominance of the natural character of the coast (excluding developed urban areas) is	Low: The Island's existing character is consists of natural vegetation and landforms. Sections of the landscape show obvious signs of human activity and historically the Island has been cleared for pastoral activity. These are presently concentrated on the headland on the	Slight: The overall dominance of the natural character of the coast as a whole is retained and the significance of the change is considered slight.

Landscape Value	Magnitude of the Proposed Changes	*Significance of Change*
retained, including elements of landscape and vegetation.	northern tip of the Island. Approximately 15% of the Island is proposed to be utilised for the development purposes so the dominance of the natural character will continue.	
Medium: The cultural and spiritual values of coastal landscapes are recognised and conserved through the involvement of the relevant Indigenous Traditional Owner communities.	Negligible: A Cultural Heritage Management Plan has been developed in liaison with the local Gidarjil Community, signed and submitted to DNRW as part of the consultation undertaken as part of this development. For more detail on Cultural Heritage issues refer to section 13 of the EIS report.	Slight: There is no change to the broad landform characteristics of the Island and reference should be made to the relevant Cultural Heritage studies and CHMP regarding recognition of the cultural and spiritual values of the coastal landscape affected by the project and proposed mitigation.
Miriam Vale Planning Schemes		
Medium: Miriam Vale Shire's coastal, semi-rural and rural values and the natural environment and ecosystems are managed to ensure: ▪ areas of visual and ecological importance are conserved or rehabilitated; and, ▪ biodiversity is protected and maintained.	Low: The proposed development seeks to protect the areas of ecological importance where possible. This preventative action serves to reduce the development footprint to certain areas and reduces the overall visual impact. Where development is required certain offsets will be provided as described in Section 14.3.1.	Slight: The project does not impact on any area of visual importance identified in the planning scheme. More generally, areas of visual importance such as the skyline, slopes of Hummock Hill, and foreshore areas can be managed to protect conserve and where necessary rehabilitated. The significance of the change in this regard is considered slight.

Landscape Value	Magnitude of the Proposed Changes	*Significance of Change*
Medium: Open space networks are established and maintained with emphasis upon areas of high scenic quality, remnant vegetation, habitat areas, existing open space, riparian areas, coastal foreshores and where possible, linkages of these areas within the network.	Low The natural open space matrix on the Island will continue with retention of 75% of the existing network. Within the remaining development footprint open space networks and corridors will be retained with linkages to the natural open space network of the island.	Slight: In relation to changes to the natural setting to some parts of the Island the significance is considered to be moderate. However, within the context of the project providing opportunities to identify and maintain open space networks of high scenic quality, the significance of the change is considered slight. Off sets proposed under the SE Qld RVMC will result in no net loss of remnant vegetation. Riparian and coastal linkages will be retained on the Island.
Medium: The frontal dunes, coastal vegetation and coastal landform are maintained in their current form, allowing natural coastal processes to continue unhindered.	Negligible: No development is proposed within erosion prone areas/coastal management district to ensure that the visual amenity and biophysical processes of the coastal management district are maintained. As such no development will occur within 80 m of the north beach and main beach or 55 m from the shoreline around the headland. There may be some minor impacts on mangrove communities on the southern side of the island with construction of the bridge but the natural process will not be significantly affected. Some development may be partially visible behind the erosion prone areas/coastal management district, particularly on the headland where some mitigation control will be required.	Slight: The frontal dunes and coastal landform will be maintained and the significance of the change is considered slight. Erosion prone areas are under separate tenure from Lot 3 and are not part of the Special Lease. Natural coastal processes will be retained. The resulting significance of change is considered slight.
Medium: Development within the 'coastal zone' is not visually intrusive when viewed from the beach or from developed areas overlooking the development.	Low: No development will occur within 80 m of the north beach or 55 m from the shoreline around the headland which is consistent with the Coastal Management Overlay of the proposed Planning Scheme. Further, the height of various components and the form development will take (e.g. using sympathetic colours and materials etc) will be integrated with the natural features. Further the existing developed areas of Miriam Vale do not have views	Moderate/Slight: Aspects of the development on the slopes and headland will be visible from the beach and some developed areas on the mainland, although the major developed areas at Tannum Sands are at some considerable distance (>9km) from the project resulting in negligible impacts. When viewed from nearby developed areas such as Mundoolin Rocks the development would be considered intrusive however the significance of the change could be considered moderate. It is noted that bar the proposed Colosseum Inlet public boat ramp, the

Landscape Value	Magnitude of the Proposed Changes	*Significance of Change*
	of Hummock Hill Island so there will be no impact on these areas. Views from nearby beaches and small communities of Mundoolin Rocks to Hummock Hill Island will undergo a material change with some aspects of the project on the eastern slopes visible. There will be some screening provided by the vegetation within the tidal flats but is not of an adequate height to screen all elements of the project when viewed from some areas of the estuaries.	development is not visible from Bangalee.
Medium: Visual amenity and appearance of land which is "visually sensitive" such as the "crests of ridgelines", "hills" and "coastline" shall be protected and enhanced.	Medium: Some elevated areas on the Island are proposed to be utilised either for residential development or access routes to houses on the hillside slopes. The majority of the project is proposed to occupy low areas of the Island behind the north western beach area at Rodds Bay and also the lower north eastern slopes of the central ridge along the current access track from Clarks Road and the proposed bridge. The most exposed development is proposed around the southern ridgeline and present access road to the northern areas and on the headland. The elevated sections along the ridgeline share a moderate to low visual absorption capacity and would require mitigation strategies to cover exposed ground and ensure building materials and colours do not provide strong contrast with the natural environment.	Moderate: Where elements of the project are located near the crests of ridgelines and areas of visible coastline, including the headland, the significance of the change would be considered moderate and mitigation through either avoidance or specific and sensitive design conditions required. Ridge top housing will be located below the ridge crest with retention of screening vegetation.

Table 5.24 – Potential Impacts on Sensitive Receivers

Sensitive Receptor	Receptor Sensitivity	Magnitude of the Proposed Changes on the viewing outlook.	*Significance of Change*
R1 Tannum Sands Esplanade >10km to the project	Low	Low: The development components will be barely visible from the receptor. On the lower sections the tree canopy should provide adequate visual absorption capacity to screen obvious signs of development. Development on the headland may be visible however at a distance of over 10 km the sensitivity to the impact would be considered low. Components of the development on the north eastern side of the Island will be ameliorated by distance and visual adsorption capacity and not be visible.	Slight: Hummock Hill Island comprises a small component of the overall landscape visible from this location and at over 9 km distance, the project will represent a minor change in the overall visual landscape.
R2 Tannum Sands Beach >10km to the project	Low	Low: As above except the only element of the project visible would be the headland.	Slight: The visibility of the Island is largely obscured from view by the north east coast of Wild Cattle Island and again the distance is such that any change would be largely unnoticeable.
R3 Bangalee 2km to western sloes & >5kms to southern ridge	High	Negligible: Views of the proposed development from the small residential community of Bangalee will generally be screened by the existing vegetation of the Island which is of a sufficient height and extent to be able to absorb the changes without any visual changes in the fixed landscape. Development around the southern ridgeline could be exposed however the distance (i.e. >5km) and the sensitivity of any impact could be considered low.	Slight: The views of the increased marine traffic utilising Boyne Creek and Colosseum Inlet is not considered a significant visual impact.
R4 Squatter's Community >3km to the slopes	High	Negligible: Same as for Bangalee	Slight: The views of the increased marine traffic utilising Boyne Creek and Colosseum Inlet is not considered a significant visual impact.

Sensitive Receptor	Receptor Sensitivity	Magnitude of the Proposed Changes on the viewing outlook.	*Significance of Change*
R5 Clarks Road 0-500m from the project	High	High: For the people utilising the marine environment for recreational purposes in this location any proposed bridge will be a visually dominant feature in the landscape. There will also be change associated with traffic and general activity around the entry to the project. The visual dominance of the bridge will decrease as distance from the receptor to the bridge increases however at Clarks Road at 0-1 km distance, the impact will be prevalent.	Slight The localised significance of the bridge affecting the visual amenity at Clarks Road could be considered to be substantial. However the bridge is visible from few locations and viewers from Clarks Road will be tourists and residents. The tidal flows in this area have a large influence on the usability of the water for recreational fishing and boating (i.e. uses consistent with those within the GBRWHA) with particular difficulties finding a channel at low tide. This influences local receptor sensitivity which is more likely to be low to negligible. Given that the overall magnitude of the change is considered low, the local significance of the impact is considered slight.
R6 Mundoolin Rocks 2.5km to the south eastern slopes	High	Low: Components of the proposed development located near the ridges and hill crests will be partially visible from this location. These changes however can be absorbed to some extent by the retention of the existing trees of a height above 10 metres. The natural slope of the land should be maintained. On the lower undulating plains the development should be screened through the retention of much of the existing vegetation on the island. The development on the north western side of the island will not be visible.	Moderate: Where elements of the project are located on the crests of ridgelines and areas of visible coastline, including the headland, the significance of the change would be considered moderate and mitigation through specific and sensitive design conditions will be required to ameliorate impacts further..
Sensitive Receptor	Receptor Sensitivity	Impact of the Proposed Changes on the viewing outlook.	*Significance of Change*

Sensitive Receptor	Receptor Sensitivity	Magnitude of the Proposed Changes on the viewing outlook.	*Significance of Change*
 Indicative view from R7			
R7 GBRWHA 2.7 km to north-east hill slopes	High	Low: The Island forms the main view of the middle distance. Components of the development on the north eastern side of the Island will be visible to some extent. As a result of some selected clearing the vegetation cover will be reduced. The skyline may remain unchanged provided the buildings do not extend above the canopy height. Development should avoid the need to clear vegetation along the ridgeline. Changes to landform along the ridgeline should be	Moderate: Where elements of the project are located near the crests of ridgelines and areas of visible coastline, including the headland, the significance of the change would be considered moderate and mitigation through specific and sensitive design conditions will be required to ameliorate impacts further.

Sensitive Receptor	Receptor Sensitivity	Magnitude of the Proposed Changes on the viewing outlook.	*Significance of Change*
		avoided.	
 Indicative view from R8			
R8 GBRWHA 1.9km to northern headland and 3.6km to Hummock Hill	High	Low: Hummock Hill forms the middle to far distance views from this location. The headland and north beach form the middle distance views. Components of the development on the headland are visible from this location as are the top of taller structures behind the northern beach are. Some housing on the northern slopes of hummock Hill are partially visible in the middle distance however distance and vegetation decrease the impact of these buildings on the view. The skyline is likely to remain unchanged.	Moderate: Where elements of the project are located on the crests of ridgelines and areas of visible coastline, including the headland, the significance of the change would be considered slight to moderate and mitigation through specific and sensitive design conditions will be required to ameliorate impacts further.

Sensitive Receptor	Receptor Sensitivity	Magnitude of the Proposed Changes on the viewing outlook.	*Significance of Change*
 Indicative view from R9			
R9 GBRWHA 2 km north east of the northern headland	High	Medium: The northern headland and main beach forms the middle distance view from this location with the near distance view being coastal water. Headland housing components of the development on the will be visible though the silhouette of buildings is reduced by existing vegetation. The skyline may remain unchanged provided the buildings do not extend above the existing canopy height. Changes to the land form along the ridges should be avoided to ensure the changes are not visually prominent. The southern side of the Island is not visible.	Moderate/Slight: Where elements of the project are located near the crests of ridgelines and areas of visible coastline, including the headland, the significance of the change would be considered moderate and mitigation through specific and sensitive design will be required to further reduce visual impact. Use of screening vegetation and retention of existing tall trees will maintain the vegetated skyline in the area. Private and public lighting of the headland will also be sensitive to the presence of low density turtle nesting on the main beach east of the northern headland.
R10 Seal Rocks 6.6km to Hummock Hill	Medium	Low: Components of the proposed development located on the elevated ridges and hill crests will be partially visible however a combination of distance, visual absorption	Moderate/Slight: Where elements of the project are located near the crests of ridgelines and areas of visible coastline, including the headland, the significance of the change would be considered moderate to slight and

Sensitive Receptor	Receptor Sensitivity	Magnitude of the Proposed Changes on the viewing outlook.	*Significance of Change*
		capacity will reduce impacts. The natural slope of the land should be maintained. The majority of the development on the northern side of the island is likely to be sufficiently screened due to existing vegetation and distance.	mitigation through specific and sensitive design conditions will further reduce potential visual impacts from this location.
R11 Gladstone Harbour Shipping Channel 8.7km to Hummock Hill	Low	Low: Potential views of the development are restricted to a small number of components namely those on the north eastern side of the hills. This part of the island has some potential to visually absorb these components and the distance is such that any change in the landscape will not dominate views.	Slight: Impacts only from development on the slopes of the island again associated with the significant distances and wider frame and diversity of the potential coastal view.
 R12 Indicative view from the Air			
R12 Aerial View	Medium	Low:	Moderate/Slight:

Sensitive Receptor	Receptor Sensitivity	Magnitude of the Proposed Changes on the viewing outlook.	*Significance of Change*
5,000 feet above Hummock Hill		The Island is visible on the flight path to and from Gladstone Airport and the changes to the landscape will also be visible. However the principle characteristics of the view available from a height will continue to be the highly urbanised areas of Gladstone, Boyne Island and Tannum Sands. These areas have been identified as places to accommodate further development and urbanisation along with development on the southern tip of Wild Cattle Island and at Innes Head.	Based on the high overall context of the whole reef and Island system the significance would be rated as moderate. Within the local context of Gladstone however, and associated development including shipping channels, viewing distance and opportunity, the aerial impact is not considered to be of such material value and the sensitivity of the receptors is considered to be low to moderately sensitive, the significance of the change is considered to be slight.

The proposed Hummock Hill Island Development incorporates a number of mitigation measures which aim to reduce the visual effects of the project. The low level development components proposed on the gentle undulating low hills, colluvial plains and sand plains will be substantially screened with the existing surrounding vegetation. On the northern side of the Island the low shrubs and coastal she-oaks provide the initial buffer followed by woodland vegetation with tree heights around 10 metres. Similar screens are available on the southern side of the Island with mangrove communities dominating foreground views from nearby receptors such as Mundoolin Rocks with the woodland plains providing a screen of the buildings and infrastructure.

Although there is a large proportion of the development which may be screened from view, there are still some elements of the proposal which potentially change the landscape and visual amenity to a degree, identified in the assessment as substantial (the access bridge) or moderate. In Table 5.25 below, mitigation strategies are identified to reduce the causes of the greatest landscape and visual impacts. The causes of greatest impacts include:

- The visibility of the elevated hills and ridges and associated skyline;
- The relative openness of the canopy on some elevated hills and ridges;
- The bridge will be a localised visually dominant element within Boyne Creek (the bridge will not be visible from the northern side of the island); and
- From the air, the majority of the development components will be visible.

Table 5.25 lists the mitigation measures required to appropriately minimise/manage the key visual impacts identified in the report.

Table 5.25 – Mitigation Strategies

Source and Potential Magnitude of Change without Mitigation Strategy	Mitigation Strategies	Potential Magnitude of Change with Mitigation Strategy
The bridge causes moderate/substantial localised impacts when viewed from close proximity.	The bridge should be designed to achieve visual permeability. This means that the receptor should maintain some view of the landscape beyond the bridge. An Environmental Management Plan should be adopted for the design and construction of the bridge including measures to avoid impact on the surrounding mangrove system. Landscaping following construction will be in accordance with the Landscape Plan for the development.	Moderate/substantial when viewed from close proximity (within 1km).

Source and Potential Magnitude of Change without Mitigation Strategy	Mitigation Strategies	Potential Magnitude of Change with Mitigation Strategy
Visual changes to the slopes and ridgelines have the potential to cause moderate changes.	Buildings and infrastructure including road cuttings should be sited below any prominent ridge line or hilltop so that there are no visible changes in the skyline. Vegetation that forms the skyline will be retained to maintain the natural character of these features. Screening vegetation within individual lots will also be retained to the maximum extent practicable. The location and design of access roads and driveways should conform to the landform and cause minimum visual impact or erosion hazard. Screen plantings on the sides of roads can mitigate any disturbance cause by initial loss of vegetation.	Slight changes may still be visible but less prominent when located below any prominent ridge line or hilltop. Moderate when viewed from the air but changes could be slight when viewed from the surrounding area.
Visual elements of the project when viewed from close proximity (less than 1km) have the potential to cause a moderate impact.	The roof tops of buildings should not protrude above the canopy height of the surrounding vegetation. Where the cladding of any part of a house (including the roof and rain water tanks) is proposed to be in metal sheet, this cladding be required to be Colorbond or painted in muted tones to reduce reflection. Where the wall cladding of a house is proposed to be in excess of 25% timber siding or fibre cement siding or metal sheet, the cladding can be required to be painted or stained in muted tones prior to occupation of the house or within a specified time thereafter. Reflective factory finished metal sheets i.e. untreated galvanised sheet, aluminium, zincalume, or white, off white or silver paint finishes will not be permitted for roofs unless the slope of the roof is 10% or less.	The intent of the strategy is to minimise the impact however the significance of the change will be slight with proposed mitigation and further reduced from a distance greater than 5km.
Broad changes in land cover can have a moderate impact.	Existing vegetation should be retained on site and selected clearing undertaken for building envelopes and public spaces. Low density housing on the eastern flanks of the central ridge is required to have a building footprint of <50% of the lot area with maximum retention of existing vegetation under the Plan of Development. Landscaped areas in public and private spaces will be planted using species that are native and occur locally on the Island in accordance with the Landscape Plan. Additional plantings can be undertaken including mature trees of a height above 10 metres increasing density and screening qualities of vegetation. A dense under storey can also be planted to reduce visual impact.	Proposed mitigation will reduce visual impacts to slight.

Source and Potential Magnitude of Change without Mitigation Strategy	Mitigation Strategies	Potential Magnitude of Change with Mitigation Strategy
Changes in landform particularly on the visually prominent areas of the Island including the slopes, ridgelines and headland has the potential to cause substantial change from when viewed from a relatively short distance (less than 1km)	The need for earthworks should be minimised on steep slopes with framed construction techniques encouraged in preference to masonry "slab on ground" techniques. Cut/fill levels can be prescribed in the Plan of Development to be of limited height and limited length to ensure minimal changes to landform. Limit development on the hills and slopes to single storey residences reducing vertical bulk and scale and place buildings below the skyline of ridges with maintenance of ridgeline vegetation. Limit development to two storey dwellings or 8.5 metres above natural ground level allowing a greater diversity of housing types and design options.	Slight where visible and negligible when viewed at a distance greater than 5km.
Lighting of the project during construction and post construction can create a moderate change on the landscape.	All lights in buildings and in public spaces will be focussed on the areas required and where possible be equipped with motion sensor switches to minimise light duration. External lighting will be shielded to limit extraneous light where necessary or faced away from costal and habitat areas. All external lighting of the site should conform to the following Australian standards: AS 1158 – Road lighting; and AS 4282 – Control of the obtrusive effects of outdoor lighting.	Slight depending on the distance from the source.
Monitoring	It is considered that the mitigation measures require long-term management and monitoring to assess their effectiveness. Monitoring programs can establish whether or not predicted impacts have actually occurred. Identify unforeseen impacts and omissions from the original assessment and ensure an appropriate response. Check compliance with proposed mitigation measures and development conditions. Check the effectiveness of mitigation measures in avoiding or reducing adverse impacts.	The adoption of monitoring programs can reveal whether the mitigation strategies and design outcomes have worked.

5.2.6 Lighting Impact Identification

5.2.6.1 Construction Impacts & Mitigation

Initial construction activities of key infrastructure over the initial two year period of development will be limited to standard daytime working hours (typically 7:00 am – 5:00 pm). As such lighting impacts will be limited to small storage/lay-down compounds and security areas. Safety lighting will be required for the temporary pontoon from which the proposed access bridge will be constructed to comply with maritime safety requirements. The absence of human receptors within the project area also limits the impacts to residential receptors.

As the development progresses past year two, construction and tourism activities will occur concurrently followed by residential areas. Construction activity will be limited to standard daytime work hours during all phases of this development period. Construction lighting will again be limited to construction storage and lay-down compounds and security areas. If lighting is not controlled, limited impacts will occur to the following:

- Diffuse light pollution to residences at Bangalee and Mundoolin Rocks from security lights;
- Disturbance to arboreal fauna from ambient light pollution from temporary lay-down and security areas as discussed in Section 14;
- Disturbance to migratory bird species that may fly over the area and be disturbed by artificial lighting as discussed in Section 14;
- Disturbance to nesting marine reptiles from ambient light pollution from temporary lay-down areas near or on the headland as discussed in Section 14 and 15; and
- Disturbance to tourists and residents from ambient light pollution during the phased construction process

Mitigation objectives aim to eliminate or minimise diffuse lighting pollution outside required illuminated areas. Achievement of these objectives will minimise adverse disturbance to both human and fauna receptors. All temporary construction lighting (not demountable) will comply with the relevant AS1158 (2005) standard taking into consideration any recommendations that minimise lighting impacts on arboreal fauna outlined in Section 14 and outlined below.

Mitigation of lighting impacts associated with construction activities will include:

- Lighting will be angled downwards and away from habitat areas (including estuarine waters where possible) or fitted with shielding that screens ambient light from habitat areas;
- Construction lighting within the northern headland and Boyne Creek area will be faced away from the coast and angled downwards to illuminate the intended area only;
- Where possible security lighting will be fitted with motion sensors to trigger lights when activity is present within the area, reducing the time lighting disturbance is experienced;
- Where possible screening, either by vegetation or by light shields will be used to minimise light impacts to surrounding habitat, tourist or residential areas; and
- Where located near or adjacent to roads temporary lighting will be faced away from traffic or shielded to avoid interfering with driving safety.

A suite of general mitigation strategies will also be adopted to reduce the impacts of artificial lighting on fauna within the development area, including the following:

- Shielding lights to eliminate skyward illumination could greatly reduce the catch basin of light attraction for migratory birds, particularly oceanic species;
- Floodlights on the ground that face upward to illuminate structures are harmful and should be avoided;

- Lighting systems should be programmed to be extinguished for as long a period as possible during the night. Alternatively all external lights could be triggered by sensors;
- Changing red warning lights (on towers etc) to white strobe lights can reduce impacts on migratory bird species; and
- Incorporation of streetlight filters which permit only the transmission of longer wavelengths can benefit some turtle species.

Incorporation of the above mitigation strategies will achieve the objectives of construction lighting mitigation and minimise disturbance to identified receptors.

5.2.6.2 Operational Impacts & Mitigation

Operational lighting will consist of permanent street lighting, building illumination, security lighting, pedestrian walkway lighting etc. The phased nature of the proposed development will provide a gradual increase in artificial lighting density through the 15 year development period. Initial development will be public infrastructure such as Clarks Road, bridge, cross Island boulevard etc followed by tourist facilities associated with the headland, town centre and ridge top (year three) with gradual infill of inland precincts over the following 12 year period.

Impacts will subsequently be a gradual increase in artificial lighting density over the Island, concordant with the phased program of works. Initial artificial lighting will be associated with the cross Island boulevard (Clarks Road will not have street lighting) and headland area. Artificial lighting in the headland area in particular can impact marine turtles during the nesting season. This area will require specific design mitigation of lighting to minimise impacts to low density marine turtle nesting on the main beach of the Island as discussed in Section 15.

Subsequent uncontrolled artificial lighting impacts from various components of the proposed development will also occur from:

- Diffuse light pollution from street lighting to residences at Bangalee and Mundoolin Rocks from street lights on elevated areas such as the ridge and Boyne Creek areas;
- Increased road traffic along Clarks Road impacting arboreal fauna;
- Disturbance to arboreal fauna from ambient light pollution from street, public area and residential lighting as discussed in Section 14;
- Disturbance to migratory bird species that may fly over the area and be disturbed by street as discussed in Section 14; and
- Disturbance to tourists and residents from uncontrolled ambient light pollution.

Mitigation objectives will be to eliminate or minimise diffuse lighting pollution outside required illuminated areas and maximise opportunities to utilise innovative and emerging solutions to public lighting impacts, such as emerging LED technologies. Achievement of these objectives will minimise adverse disturbance to both human and fauna receptors. All proposed external lighting will be required to comply with the relevant AS1158 (2005) standard taking into consideration any

recommendations that minimise lighting impacts on arboreal fauna outlined in Section 14 and outlined below.

- Lighting will be angled downwards and away from habitat areas (including estuarine waters where possible) or fitted with shielding that screens ambient light from habitat areas;
- Public lighting within the northern headland and Boyne Creek area will be faced away from the coast and angled downwards to illuminate the intended area only;
- Where possible property security lighting will be fitted with motion sensors to trigger lights when activity is present within the area, reducing the time lighting disturbance is experienced;
- Utilise screening either by vegetation (low shrubs on the headland to block the line of site from turtles on the beach) or by light shields will be used to minimise light impacts to surrounding habitat, tourist or residential areas;
- Maintaining vegetation adjacent to roads to screen vehicle lights from receptors;
- Shielding lights to eliminate skyward illumination could greatly reduce the catch basin of light attraction for migratory birds, particularly oceanic species;
- Floodlights on the ground that face upward to illuminate structures are harmful and will not be used on public buildings;
- Lighting systems should be programmed to be extinguished for as long a period as possible during the night;
- Changing red warning lights (on towers etc) to white strobe lights can reduce impacts on migratory bird species; and
- Incorporation of streetlight filters which permit only the transmission of longer wavelengths can benefit some turtle species.

Utilisation of such mitigation in the Master Planning of the proposed development will achieve the intended mitigation objectives and avoid impacts to identified receptors.

5.3 Conclusions

The proposed development will impact 12% of the relict beach ridge systems on the Island which are also subject to an Exploration Permit for Mineral (EPM, #7164) and Mineral Development Licence (MDL, # 310). Whilst the proposed development will sterilise 12% of the mineral deposits, the Islands deposits are not a viable option (under current prices) as a single resource and require combination with other resources such as Middle Island to the south and Byfield to the north. Avoidance of resource sterilisation can be mitigated by exploiting the resource prior to development in these areas, an option that requires further discussions with relevant agencies and EPM/MDL holder.

Relict beach ridge systems within the development footprint have been assessed as a significant coastal dune system under the definition in the State Coastal Management Plan. Relict beach ridges are not considered to demonstrate a "*high degree of ecological integrity **and** biodiversity conservation values*" due to historical pastoral uses, extensive historical clearing, lantana infestation and the Island being singled out for mineral and resort development in the 1990's due to

its lack of conservation value. Retention of 88% of the Island relict beach ridge systems is will maintain the overall function of these systems on the Island. The project is also considered to demonstrate a net benefit to the State in terms of socio economic value as noted above.

The construction works will involve the removal of minimal amounts of vegetation possible and movement of limited quantities of soil creating a potential for erosion and sedimentation to affect water quality and land condition in development areas and downstream receptors. The phased nature of the proposed development over 16 years will minimise large expanses of vegetation and/or soil disturbance at any one time, reducing potential impacts from erosion issues. A site specific erosion and sediment control plan will be developed prior to construction activities minimising erosion and sedimentation during construction. Permanent WSUD measures will control long term erosion issues associated with the proposed development.

Potential groundwater discharge zones have been identified within the southern section of the Golf Course Precinct. Mitigation of potential changes to these areas will revolve around maintaining existing vegetation to the maximum extent possible and/or planting native species in accordance with the landscape plan to maintain existing groundwater levels and reduce salinisation risks.

Some minor disturbance of potential acid sulphate soils will occur in the vicinity of the proposed access bridge and public boat ramp in Boyne Creek. These impacts will be managed through the development and implementation of erosion and sediment control plans, landscaping plan, water sensitive urban design of permanent stormwater drainage and acid sulphate soil management plan.

A limited amount of contaminated soils exist in the vicinity of the former cattle dip, fuel storage shed and isolated historical fuel/oil spill. These areas will be remediated as part of construction works and a validation report provided to Queensland EPA.

The aspects of the proposed development that will have the most significant visual impacts on sensitive visual receptors in the WHA are the construction of the bridge across Boyne Creek. Other construction works including vegetation clearing, earthworks and installation of services such as reticulated water, sewerage and electricity infrastructure and the operation of the proposed development including the building form and layout, illumination of roads and buildings will also require visual impact mitigation.

Mitigation measures based around the retention of existing vegetation screens and/or sensitive landscaping design will reduce the visual effects of the project. Development on the gentle undulating low hills, colluvial plains and strandplains will be substantially screened with the existing surrounding vegetation. On the northern and southern sides of the Island the low shrubs, mangroves and coastal she oaks provide the initial buffer followed by woodland vegetation with tree heights around 10 metres. However, there are still certain elements of the proposal which potentially change the landscape and visual amenity to a degree, general mitigation measures have been proposed to reduce their impact.

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INFRASTRUCTURE AND TRANSPORT

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6. Infrastructure and Transport

6.1 Existing Environment

6.1.1 Infrastructure

No power, gas or water infrastructure is currently supplied or located on the Island. Power and gas infrastructure are proposed to be linked to the Island from the respective main grid along the existing Road Reserve during initial construction works. Details of proposed infrastructure and routes are provided in Section 3.

6.1.2 Road Infrastructure

6.1.2.1 State Controlled Roads

The principle State controlled road (Department of Main Roads) within the study area is the Bruce Highway. The Bruce Highway is a two lane sealed road, between 8 and 11 m in width that forms part of the National Highway network.

6.1.2.2 Local Government Roads

Roads controlled by Miriam Vale Shire Council within the vicinity of Hummock Hill Island are outlined in Table 6.1.

Table 6.1 – Roads Controlled by Miriam Vale Shire Council

Road	Classification	Description
Turkey Beach Road	Rural Arterial	6.2 m wide sealed surface with 1 m shoulders
Foreshores Road	Rural Collector	6.2 m wide sealed surface with 1 m shoulders
Intrepid Drive	Rural Collector	5.5 m wide gravel road
Clarks Road	No Classification	5 m wide basic formation
Mundoolin Rock Road	No Classification	Unformed road corridor

- **Turkey Beach Road** – connects the Bruce Highway to Turkey Beach and connects with Foreshores Road 4.6 km from the Bruce highway;
- **Foreshores Road** – links Turkey Beach Road with Clarks Road. It is noted that this road has been recently upgraded to provide a sealed surface to the Clarks Road turn-off;
- **Clarks Road** – forms the main link to the Island from Foreshores Road. It is currently an unformed road in a 40 m wide road connecting to the existing causeway across Boyne Creek (refer to Figure 6.1). It is a condition of the SL that Clarks Road will be upgraded to provide suitable access for the Island.
- **Mundoolin Rocks Road** – is an unformed road corridor that joins Clarks Road and the small settlement at Mundoolin Rocks. The current access track to this settlement does not follow the road corridor.

Figure 6.1 – Clarks Road at 0.5 km and 8 km from Foreshores Road

6.1.3 Proposed Bridge

The proposed Boyne Creek Bridge will be a balanced cantilever structure consisting of three spans of 40 m, 70 m, and 40 m as described in Section 3.4.4.4. Alignment of the proposed bridge will extend from the existing road corridor at the end of Clarks Road and across Boyne Creek utilising the current causeway alignment. Existing infrastructure at this point is the Boyne Creek causeway consisting of earthen fill, reinforced with medium sized logs. Access to the Island by this causeway is currently only available on low spring tides and requires a four wheel drive vehicle.

As described in Section 3.4.4.4 the proposed bridge will utilise the existing causeway alignment and in particular the existing filled abutments to launch the bridge. As part of the proposed works the existing causeway will be partly removed to re-establish tidal flows through Boyne Creek at low tides. Part of the causeway structure will be retained to preserve the structure for historical reasons (refer to Section 13).

6.1.4 Pedestrian & Cycle Access

The proposed development will include a network of pedestrian and cycle paths to allow access between various sections of the proposed development. Cycle paths will be designed in accordance with relevant Australian Standards. Golf cart paths will also be provided for access around the golf course precinct.

Pedestrian access along Clarks Road is not envisaged due to the 12 km length. Assessment of a dedicated pedestrian/cycle path along the Clarks Road corridor will be conducted as part of detailed design.

6.1.5 Existing Traffic

6.1.5.1 Existing Traffic Volumes

Miriam Vale Shire Council provided traffic volume data on Turkey Beach Road for 2005 (Refer to Appendix A7.4. Based on these volumes, the growth rate for traffic using Turkey Beach Road over the period from 1999 to 2005 was calculated to be 3.4% per annum. Based on this calculated growth

rate, the 1999 turning volumes received from Department of Main Roads were adjusted to 2007 at the intersection of the Bruce Highway and Turkey Beach Road as well as at the intersection of Turkey Beach Road and Foreshores Road. These volumes are taken as the 2007 base (existing conditions) from which a comparison of development volumes was assessed (Refer to Appendix A7.4). Commercial vehicle traffic was taken to be 5%.

The traffic volumes calculated for 2007 were used to forecast the expected traffic at 2013, the completion year of 2023, and the ten year design horizon of 2033 with the same growth rates as outlined above applied to these volumes. These forecast volumes also assume that the development does not proceed and are included in Appendix A7.4

Table 6.2 – Existing Traffic Volumes for Turkey Beach Road (2005)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Avg
Turkey Beach Road	232	230	321	368	336	371	345	352	351	328	364	308	325
TBR – Sandy Ck	295	288	324	285	247	284	238	190	263	247	307	253	266

Units – Vehicle movements/day

Source – Miriam Vale Shire Council

6.1.5.2 Future Traffic Growth

Traffic data on the Bruce Highway approximately 35km to the south of the Turkey Beach Road Intersection at Colosseum Creek was provided by the Department of Main Roads and shows an average of 1.92% per annum growth rate over the last 5 years and a 2.58% growth rate over the last 10 years.

6.1.5.3 Existing Bus Service

A school bus service is provided Miriam Vale Shire Council connecting Turkey Beach to State Primary and Secondary schools at Bororen and Miriam Vale respectively.

No public bus service currently exists servicing Turkey Beach or Foreshores Estate.

6.1.6 Marine Infrastructure

6.1.6.1 Existing Marine Infrastructure

No purpose built marine infrastructure currently exists on the Island. The existing causeway in Boyne Creek is occasionally used to launch small boats. Current public access to estuarine and marine waters around the Island is limited to boat ramps at Turkey Beach, Foreshores Estate and Wild Cattle Creek. Other than these sites boating access requires launching from Tannum Sands or Boyne Island and requires passage over the shallow bar at the mouth of Colosseum Inlet or via Wild Cattle Creek (mid to high tide only) (refer to Figure 6.2).

The existing boat ramp at Foreshores Estate is the only boat ramp currently servicing Colosseum Inlet. Access is restricted to launching from mid to high tide due to the ramp being located in a shallow and rocky inlet. The ramp in Wild Cattle Creek is similarly limited to mid to high tide and is

generally used by small craft only. Access to the ramp is via a dirt road and can require a 4 wheel drive. Table 6.3 summarises existing boat ramp facilities within 30 km of the Island.

Table 6.3 – Public Boat Ramp Tide Access and Distances to Estuaries

Ramp	Tidal Access	Access	Distance* to Seven Mile Ck	Distance* to Boyne Ck	Distance* to Colosseum Inlet
Turkey Beach	All Tide	Sealed Road Concrete Ramp	10 km	16 km	25 km
Foreshores	Mid-to high tide	Sealed & Dirt Road Dirt Ramp	7 km	5 km	0 km
Wild Cattle Creek	Mid to high tide	Dirt Road Dirt Ramp	17 km	10 km	5 km
Tannum Sands	Mid to high tide	Sealed Road Sand Ramp	20 km	15 km	10 km
Boyne Island	Mid to high tide	Sealed Road Concrete Ramp	22 km	17 km	12 km

* -linear distance, real distances will require navigation of various waterways and can be longer.

Community consultation has revealed that the estuaries around the Island are becoming increasingly popular for recreational boating with both the local and regional community. The annual Tannum Hookup fishing competition, that draws competitors from State wide, regularly uses the waters around the Island. Shallow entries to Colosseum Inlet, parts of Seven Mile Creek also currently limit access to these waters from the ocean for recreational craft.

The provision of all tide boat access to the deep waters of Colosseum Inlet and the shallower waters of Boyne Creek is considered an essential part of the proposed development. Such access will allow both tourism and local based boat owners to utilize the recreational opportunities provided by these estuaries with minimal traveling distances and times from the Island to alternate launching points. The nearest alternative launching point would be Foreshores Estate, a tide limited boat ramp as discussed above.

6.1.6.2 Proposed Marine Infrastructure

Permanent public infrastructure for marine transport includes two boat ramps. One boat ramp is located adjacent to the bridge in Boyne Creek and accessed from the proposed commercial marine facility and associated parking area. It is anticipated that the Boyne Creek boat ramp will provide mid to high tide access for recreational boaters. It is proposed that the Boyne Creek boat ramp will be designed with a capacity for two boats to be launched at a time.

A second public boat ramp is proposed to provide all tide water access on the western side of Hummock Hill Island in Colosseum Inlet. A public road links this boat ramp with the main development. The proposed Colosseum Inlet boat ramp will contain parking and public amenities together with all tide access to the deep waters of Colosseum Inlet.

LEGEND

- Town
- Highway
- Approximate Location of Boat Ramps

Figure 6.2 - Existing Boat Ramps Around Hummock Hill Island

This figure must be read in conjunction with the data disclaimers located at the front of this report . The data acquired for this project is known to be of low spatial resolution and as such no representation or warranties about its accuracy, reliability or suitability are given. Assumptions and conclusions made from this figure and the associated data must be made with full understanding of the data limitations. SKM accepts no liability or responsibility whatsoever for or in respect of any use of or reliance upon the figure and the associated data

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Hummock Hill

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Proposed public boat ramps will be designed in accordance with the Australian Standard – *Guidelines for Design of Marinas (AS3962-2001)* established as a guideline for the design of marine facilities, in particular boat ramps. Reference is also made the relevant Queensland Transport standards. Proposed boat ramp construction details are presented in Section 3.

Utilisation of the existing causeway for the proposed public boat ramp in Boyne Creek will minimise impacts to marine fauna in the area as discussed in Section 15.

6.1.7 Air Infrastructure

Gladstone Airport is the primary air facility in the region, located approximately 65 km to the north of Hummock Hill Island, and is predominantly used for passenger transport. The airport is located on 70 ha of land and is owned and operated by the Gladstone Calliope Aerodrome Board. The existing runway has the capacity to carry planes of 90 passengers.

As of 2001 the airport was operating at a capacity of around 15,000 to 17,000 aircraft movements per year (Gladstone Integrated Regional Transport Plan 2001 – 2030 - Queensland Department of Transport, 2001). The main routes serviced are to Brisbane, Rockhampton, Mackay, Townsville and Cairns. Smaller scale light plane and helicopter services also operate to offshore Islands of the Mackay Group of Islands within the Great Barrier Reef.

At least 4 privately - owned airstrips are located within a 50 km radius of the Island. These airstrips appear to be primarily used for private purposes.

It is proposed to include a private, unregistered airstrip facility on the Island as discussed in Section 3. The proposed airstrip will be classified as an unregistered airstrip with less than 6 aircraft movements per day. Construction details of the airstrip are provided in Section 3.4.

6.1.8 Rail Infrastructure

Current rail infrastructure in the vicinity of the Island consists of the North Coast Line that runs roughly parallel with the Bruce Highway. Reference to the Gladstone Integrated Regional Transport Plan 2001 – 2030 (Queensland Department of Transport, 2001) indicates this line is primarily a passenger line servicing the main northern route from Brisbane to Cairns. The North Coast line carries a regular passenger service, with two services per day via the tilt train. An intermittent tourist based service also operates via the Spirit of the Outback and Spirit of the Tropics services. Tilt Train services stop at Miriam Vale.

6.2 Impacts and Mitigation

6.2.1 Utilities Infrastructure Impacts and Mitigation

As discussed in Section 3.4 connection to the existing power supply grid will be at the intersection of Turkey Beach Road and Foreshores Road and gas will be brought to Hummock Hill Island from the major north-south regional gas line at the intersection of Bruce Highway and Turkey Beach Road.

The existing road corridor will be utilised for both gas and electricity alignments. Utility suppliers will install power and gas to the Island along existing road corridors.

6.2.2 Road and traffic Impacts and Mitigation

6.2.2.1 Construction Traffic

Initial development is predicted to see and increase in heavy vehicle traffic as plant and bulk materials are delivered to the bridge and internal infrastructure sites. Based on the proposed development program outlined in Section 3 bulk works are likely to be completed within the first 18 months. Following this period heavy plant volumes will reduce as major infrastructure is completed and work on tourist buildings commences. Subsequently heavy vehicle traffic will consist of trucks delivering bulk construction materials. Heavy vehicle traffic will continue to decrease as initial intensive construction activities associated with town centre and tourist facilities decreases.

6.2.2.2 Proposed Road Network

The Queensland Streets Design Guidelines for Subdivisional Streetworks was used as a guide in determining the capacity of various road classes within the proposed development. These are outlined in Table 6.4.

Table 6.4 – Internal Road Criteria for Hummock Hill Island

	Traffic Capacity	Reserve Width
Access Place and Access Street	750 vpd	14.0 m
Collector Street	3,000 vpd	16.0 m
Trunk Collector Street	10,000 vpd	20.0 m
Sub-Arterial Road	12,000 vpd	20.0 – 32.0 m

Compliance with these criteria will be addressed during the detailed-design phase of the project. It is unlikely that traffic volumes would exceed 10,000 vpd, and as such a sub-arterial road will not be required.

It is noted that a trunk collector street generally does not allow direct access to residential lots. Similarly, a sub-arterial road does not provide direct frontage to residential lots, nor is it desirable to form intersections with Access Streets.

6.2.2.3 Operational Traffic

Forecast volumes of traffic generated by the various land uses in the proposed development at 2013 and 2023, based on phasing information, are summarised in Table 6.5

Hummock Hill

Table 6.5 – Traffic Generation of Proposed Hummock Hill Island Development

Land Use	Amt	Unit	Phasing (units)		Peak Generation (trips/hour)	
			2013	2023	2013	2023
Marine Centre and Retail						
Service Station and store	180	m^2	180	180	119	119
Professional office	10	Employees	10	10	8	8
Landscape/hardware	200	m^2 GFA	200	200	5	5
Food & beverage	200	m^2 GFA	200	200	10	10
Service	2	Employees	2	2	2	2
Conference Centre and Motel	50	Rooms	0	50	0	20
Food & beverage	250	m^2 GFA	0	250	0	13
Lobby retail	60	m^2 GFA	0	60	Internal	Internal
Airstrip					10	10
Headland Resort Hotel	150	Rooms	0	150	0	60
Beach Front Tourist Hotel	150	Rooms	0	150	0	52
Tourist Park	200	Sites	200	200	160	160
Convenience store	100	m^2 GFA	100	100	Internal	Internal
School Recreational Camp Ground	20	Employees	20	20	20	20
Education Centre and Community Purpose						
School	240	Students	80	240	16	48
Community centre					Internal	Internal
Hummock Hill Town Centre						
Supermarket	2500	m^2 GFA	625	2500	97	388
Hair dressing / Beauty salon	60	m^2 GFA	15	60	1	3
Retail	1000	m^2 GFA	250	1000	5	20
Professional office	500	m^2 GFA	125	500	3	11
Video shop	100	m^2 GFA	25	100	1	5
Butcher	60	m^2 GFA	15	60	1	3
Fruit & vegetable	60	m^2 GFA	15	60	1	3
Food & beverage	350	m^2 GFA	87.5	350	4	16
Golf Course & Clubhouse	97.2	Hectares	0	97.2	0	72
Boyne Channel Home Offices	10	Dwellings	0	10	0	6
Headland Resort Apartments	116	Units	116	116	70	70
Headland Holiday Homes	23	Dwellings	23	23	18	18
Beach Front Holiday Homes	150	Dwellings	100	150	80	120
Beach front Apartments	64	Units	64	64	38	38
Seaside Cottages	150	Dwellings	50	150	40	120
Ridgetop Houses	157	Dwellings	157	157	126	126
Hill Side Terraces	206	Dwellings	69	206	55	165
Lagoon Villas	124	Dwellings	83	124	66	99
Riparian Eco Houses	136	Dwellings	0	136	0	109

Land Use	Amt	Unit	Phasing (units)		Peak Generation (trips/hour)	
			2013	2023	2013	2023
Bushland Residential	147	Dwellings	0	147	0	118
Resort Town Apartments	92	Units	31	92	19	55
Resort Village Townhouses	56	Dwellings	0	56	0	45
Golf Course Resort Homesites	270	Dwellings	0	270	0	216
Golf Course Resort Apartments	255	Units	0	255	0	153
Boyne Channel Apartments	96	Units	0	96	0	58

The peak traffic generated by the proposed development will generally coincide with the peak hours of the external road network which is mainly centred on work and school. The development is also expected to generate predominantly light vehicle traffic as the bulk of the development is residential in nature. It should be noted that the peak hour from these various land uses will not generally coincide. Total trips generated based on landuse are summarised in Table 6.6

Table 6.6 – Traffic Generation by Landuse at 50% completion and 100% Completion

	2013	2023
Tourist Trips	190 trips/hour	394 trips/hour
Residential Trips	512 trips/hour	1516 trips/hour
Retail Trips	273 trips/hour	654 trips/hour

6.2.2.4 External Traffic Generation

In order to assess the impact of the proposed development on the external road network, the volume of external trips was estimated to be a factor of the landuse. The following factors were used:

- Tourist - 5%
- Residential - 10%
- Retail - 5%

A worst case scenario was provided by assuming the peak hour split to be 90% outbound and 10% inbound during the morning peak and vice versa during the evening peak. In addition to this, in terms of directional splits, all external traffic was assumed to travel along Turkey Beach Road with 20% travelling eastbound on Turkey Beach Road, and of the 80% travelling westbound to the Bruce Highway, 70% travelling north towards Gladstone and the remaining 10% south towards Miriam Vale.

The development generated directional splits at the intersections of the Bruce Highway / Turkey Beach Road and Turkey Beach Road / Foreshores Road are summarised in Table 6.7.

Table 6.7 – Hummock Hill Island Development Generated Traffic at the Bruce Highway/Turkey Beach Road Intersection

Peak Period	East		North		South	
	Inbound	Outbound	Inbound	Outbound	Inbound	Outbound
2013 AM	1	13	5	47	1	7
2013 PM	13	1	47	5	7	1
2023 AM	4	37	14	129	2	18
2023 PM	37	4	129	14	18	2

The proposed 1,300 lot development in Turkey Beach will be different to the proposed Hummock Hill Island Development as it is residential in nature. The peak hour traffic generation will generally coincide with the peak hour of the surrounding road network which is based around work and school. However, given the distance to external trip attractors outside of Turkey Beach, an external trip factor of 30% has been assumed. A peak hour split of 90% and 10% has again been assumed to provide a worst case scenario, with 10% travelling towards Hummock Hill Island and 90% west to the Bruce Highway, of which 75% has been assumed as northbound and the remaining 15% southbound. This is summarised in Table 6.8.

Table 6.8 – Cumulative Generated Traffic Distribution from Turkey Beach

Peak Period	Towards Hummock Hill Island		North		South	
	Inbound	Outbound	Inbound	Outbound	Inbound	Outbound
2013 AM	2	14	12	105	2	21
2013 PM	14	2	105	12	21	2
2023 AM	3	28	23	211	5	42
2023 PM	28	3	211	23	42	5

6.2.2.5 Cumulative Traffic Impacts

Department of Main Roads has indicated that there is a current application for a 1,300 lot residential subdivision in Turkey Beach that needs to be considered in assessing traffic impacts. No further information regarding the proposed development has been available so it has been assumed that it is of a purely residential nature. It has also been assumed that the expected date for completion is 2023, and that half of the lots will be constructed by 2013. Based on a generation rate of 0.8 trips/hour per dwelling, trip generation for the proposed development is presented in

Table 6.9 – Traffic Generated by proposed Turkey Beach Development

	2013	2023
Turkey Beach Development	520 trips/hour	1040 trips/hour

Combined data from both proposed developments has been used to assess impacts to current road Infrastructure and is discussed in the following section.

6.2.2.6 Road Intersection Impacts & Mitigation

Bruce Highway/Turkey Beach Road

Investigation by Cardno (2007) found that without development, the intersection of the Bruce Highway with Turkey Beach Road will operate within capacity to 2033. With the development of Hummock Hill Island alone, the intersection will continue to work within capacity to 2033. Queues on the Turkey Beach Road approach to the intersection will be approximately 5-6 vehicles during the morning peak in 2033.

Although the intersection will run within capacity at 2033 with full development of Hummock Hill Island as proposed, reference is made to The Department of Main Roads 'Road Planning and Design Manual: Chapter 13: Intersection at Grade'. It is suggested that a Type 'CH' layout be adopted for the Turkey Beach Road approach, providing full channelisation to accommodate the turning traffic onto the Bruce Highway (See Appendix 7.4).

The intersection was also analysed for 2013, 2023 and 2033, taking into account the traffic that would be generated by the proposed 1,300 lot development in Turkey Beach. It was found that some time between 2013 and 2023, the intersection of the Bruce Highway and Turkey Beach Road would become over saturated and reach capacity during the morning peak (refer to Appendix A7.4).

Channelisation was modelled by Cardno (2007), however it was determined that this would not be sufficient to alleviate the traffic. The intersection was then modelled as a roundabout with 'short' turning lanes on each approach and two circulating lanes (refer to Figure 6.3). This intersection treatment would be sufficient to cater for the expected traffic volumes.

Turkey Beach Road/Foreshores Road

The intersection of Turkey Beach Road and Foreshores Road was analysed in a similar manner based on a Type 'BA' unsignalised T-intersection (Refer Appendix A7.4). It was found that the intersection will operate within capacity to 2033 regardless of both the proposed Hummock Hill Island Development. The results of the analysis for the critical approach are summarised in Appendix A7.4, with the Movement Summaries for the intersection.

Although the intersection will run within capacity at 2033 with full development of Hummock Hill Island and the 1,300 lot development at Turkey Beach, reference is made to *The Department of Main Roads 'Road Planning and Design Manual: Chapter 13: Intersection at Grade'*. It is suggested that a Type 'CH' layout be adopted for this intersection to accommodate turning traffic (see Appendix A7.4).

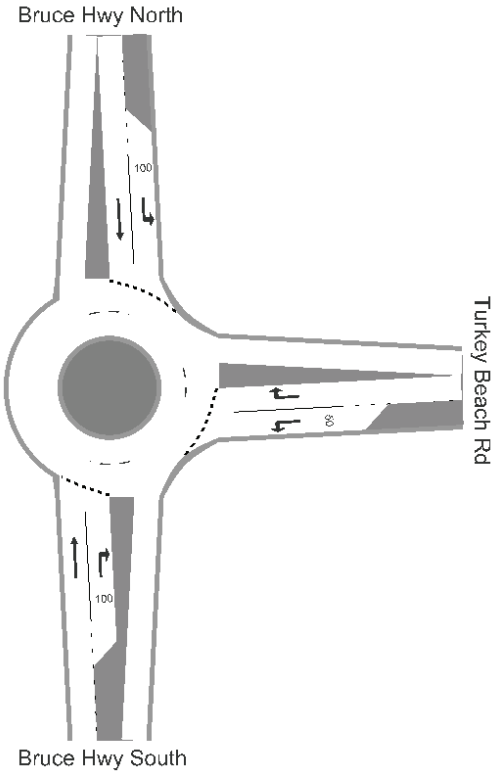

Figure 6.3 – Roundabout Option at Bruce Highway / Turkey Beach Road

Impact Mitigation

The intersection of the Bruce Highway and Turkey Beach Road will operate within capacity with full development of Hummock Hill Island to 2033 with modifications to a Type 'CH' layout to accommodate the turning movements. With simultaneous development of the development in Turkey Beach, however, the intersection will need to be upgraded to a roundabout in order to operate satisfactorily during peak hour.

The intersection of Turkey Beach Road and Foreshores Road will also need to be upgraded to a Type 'CH' intersection to allow for turning movements expected. It is envisaged that an Infrastructure Cost Sharing agreement be reached between Eaton Place and the developer of the 1,300 lot subdivision in Turkey Beach which reflects the amount of traffic that will be generated.

The access route between the Bruce Highway and Hummock Hill Island, including Clarks Road, will have to be upgraded to a suitable rural road standard with a minimum 7.0m of traffic lanes (2 x 3.5 m lanes) and 1.0 m of sealed shoulders and an additional 1.0m of unsealed shoulders on each side.

6.2.2.7 Public Transport Impacts & Mitigation

Based on the anticipated demand, shuttle bus services to and from the Island are anticipated to be supplied by tourism and hotel operators on the Island. Master planning for the proposed development has included provision of public bus services along the main cross Island boulevard.

6.2.3 Marine Infrastructure Impacts and Mitigation

Details of public boat ramp environmental impacts are provided in Section 9.3 and Section 15.3 respectively.

As a proposed tourist and residential development the requirement for suitable access to adjacent waterways is considered an essential component of the development. Existing access points are either tide limited, such as Foreshores Boat ramp or require an excessive travel time both by road and water such as the all tide ramp at Turkey Beach. The need for public boat ramps associated with the proposed development is driven by the recreational demands of both tourists and local residents.

Proposed public boat ramps in Boyne Creek and Colosseum Inlet will provide safe and controlled recreational access to these waters for both tourists and the local population.

6.2.4 Air Infrastructure Impacts and Mitigation

Environmental impacts associated with the proposed private airstrip are assessed in Section 12.3.2 and Section 18.2.4. No impact to commercial air operations at Gladstone airport are anticipated from the proposed development of a private airstrip on the Island.

6.2.5 Rail Infrastructure Impacts and Mitigation

Existing rail networks will not be impacted by the proposed development. Existing rail networks currently have capacity to serve any increased passenger demands associated with the tourist development.

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SECTION 7
CLIMATE AND NATURAL HAZARDS

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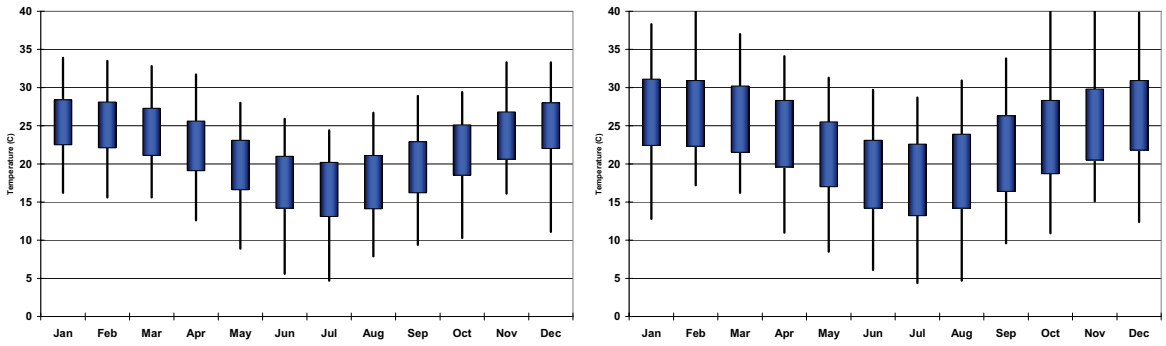
7. Climate and Natural Hazards

7.1 Introduction

The Bureau of Meteorology (BoM) classifies the climate of the Hummock Hill Island area as subtropical with hot wet humid summers and low winter rainfall (650 – 1,200 mm annually). No weather station is located in the immediate vicinity of the Island, however Bustard Head Lighthouse (Stn. # 039018) is located 30 km directly east and Gladstone Radar (Stn. # 039123) is located 30 km to the north-west.

7.1.1 Air Temperature

Figure 7.1 presents typical average and extreme temperature ranges for the above two stations. Average and extreme temperatures of the more coastal Bustard Head tend to be slightly lower when compared to the more inland Gladstone Radar. Temperatures on the Island are likely to be somewhere between the ranges observed in the two stations above.



Notes: Solid bars = average maximum and minimum temperature range
Lines = maximum and minimum temperature recorded

Figure 7.1 – Average and extreme temperature range for Bustard Head Lighthouse (Stn. # 39018) & Gladstone Radar (Stn. #39123)

Average 3 hourly temperatures were calculated for the mid-season months (January, April, July and October) as these provide an indication of typical conditions experienced in each season.
Figure 7.2 shows the minimum, average and maximum conditions recorded, and the yellow highlight indicates the range of conditions expected for approximately 95% of the time (based on average ±2 standard deviations).

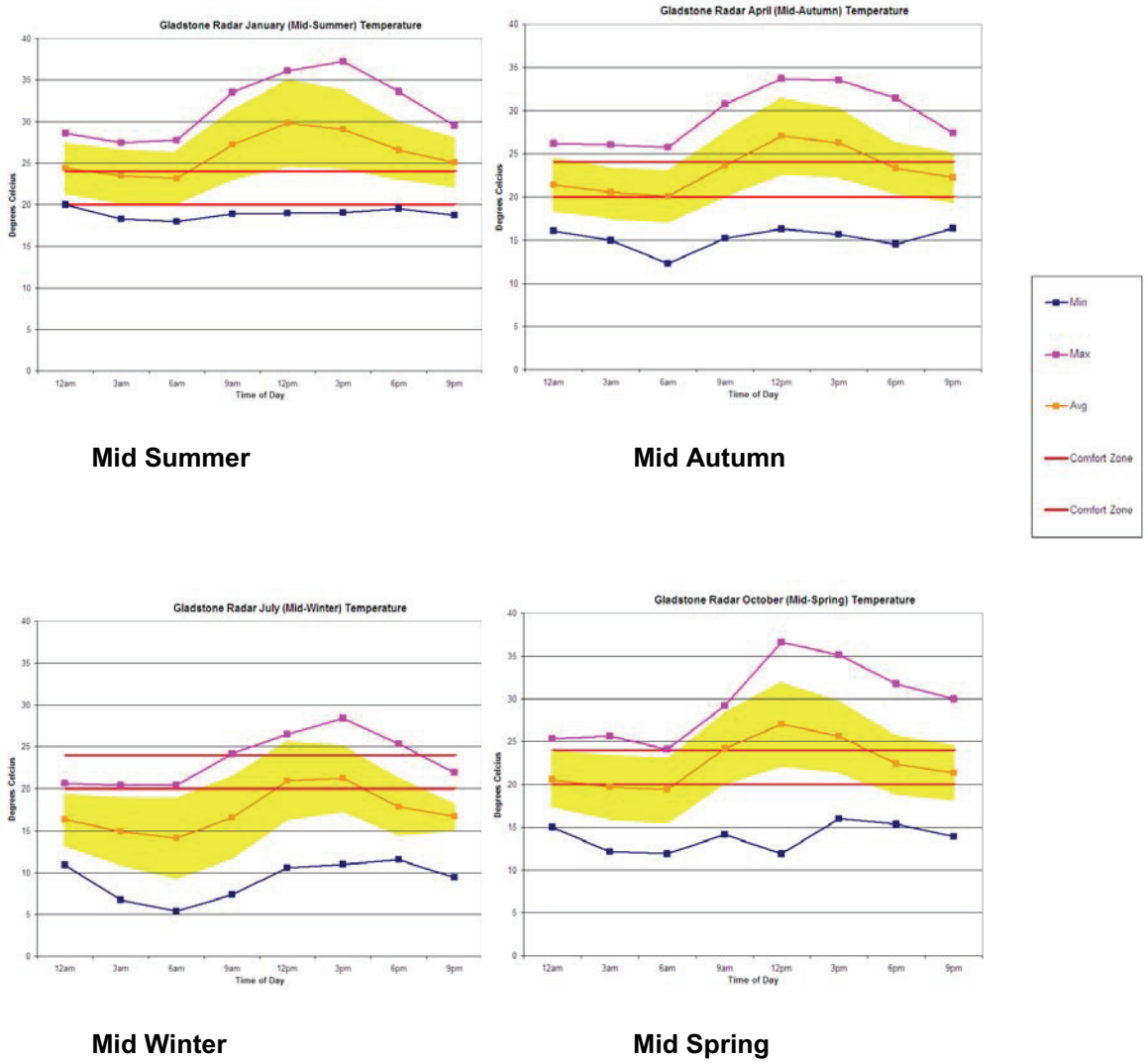


Figure 7.2 – 3 hourly average temperatures for the mid-season months (Gladstone Radar), with the 'comfort zone' identified as 20 to 24 degrees C

7.1.2 Relative Humidity

Average 3-hourly relative humidity levels for each mid-season month were analysed for Gladstone Radar being the only station to include RH records. These results are presented in Figure 7.3, including minimum, average and maximum conditions, along with yellow shading to indicate the expected range of conditions typical for 95% of the time (based on average ±2 standard deviations). People are typically comfortable if the Relative Humidity level is between 40% and 60%. This zone is identified on the following charts to provide an indication of the extent of time that the ambient conditions are within this zone.

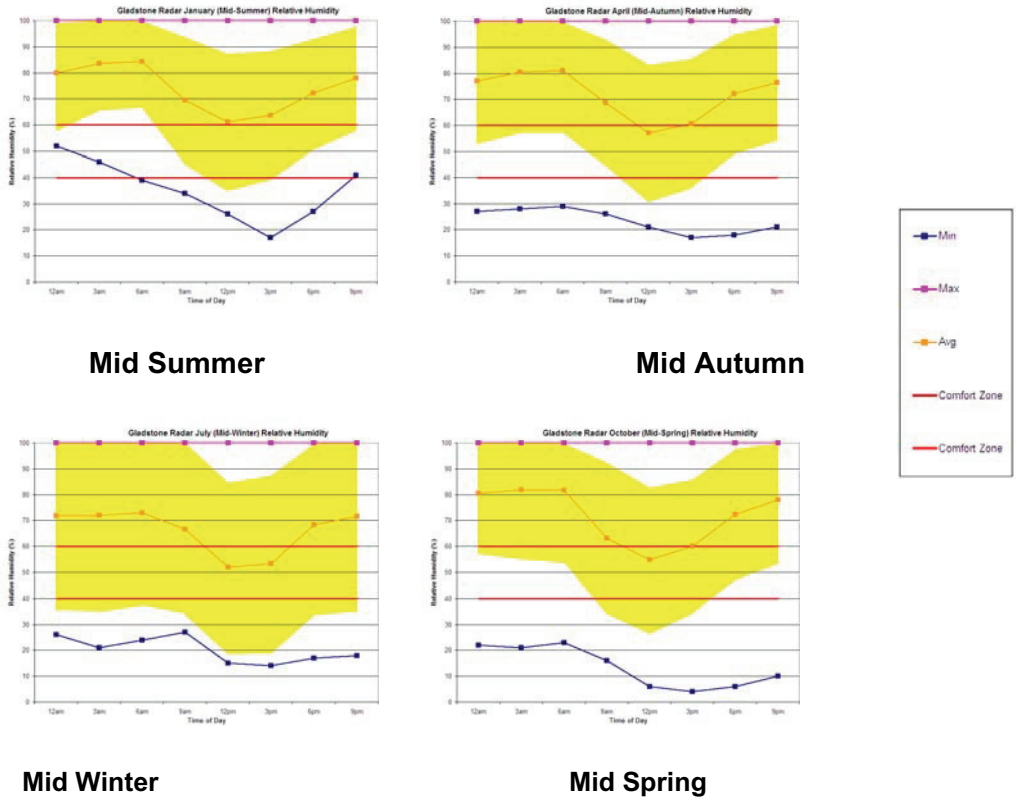


Figure 7.3 – 3 hourly relative humidity levels for the mid-season months (Gladstone Radar), with the 'comfort zone' identified as 40-60%

7.1.3 Evaporation

Evaporation rates (mm per month) at Gladstone Radar were analysed for each month of the year. Figure 7.4 shows the average evaporation rate for each of these months, the minimum and maximum recorded evaporation rates for each month and the typical range of conditions expected for 95% of the time (based on average ±2 standard deviations).

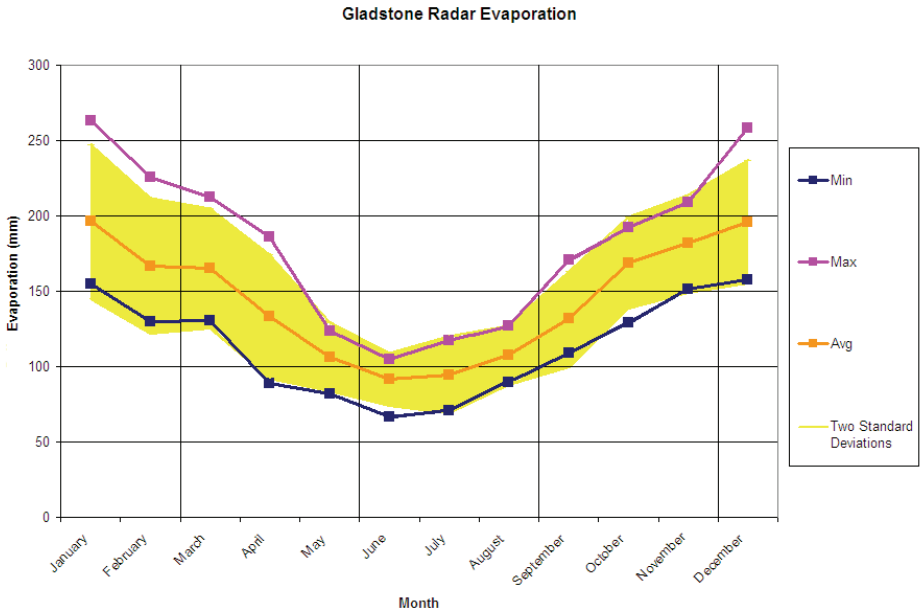


Figure 7.4 – Monthly evaporation rates (Gladstone Radar)

Figure 7.4 shows that at the Gladstone Radar site evaporation rate is highest in summer, and lowest in winter. For the majority of the year the minimum and maximum recorded values are similar to the range of conditions expected 95% of the time.

The Gladstone Radar evaporation data shows that 95% of the time the summer monthly evaporation rates will be between approximately 150 mm and 250 mm – approximately double the winter evaporation rates.

7.1.4 Rainfall

Rainfall data was analysed at a number of sites, due to the variability over relatively small distance. Mean annual rainfall is 723 mm per year for Gladstone airport and 1147 mm per year for Bustard Head lighthouse. Average rain days greater than 1 mm are 55 and 87 respectively. Rainfall data display a seasonal trend in line with the summer monsoon period (refer to Figure 7.1).

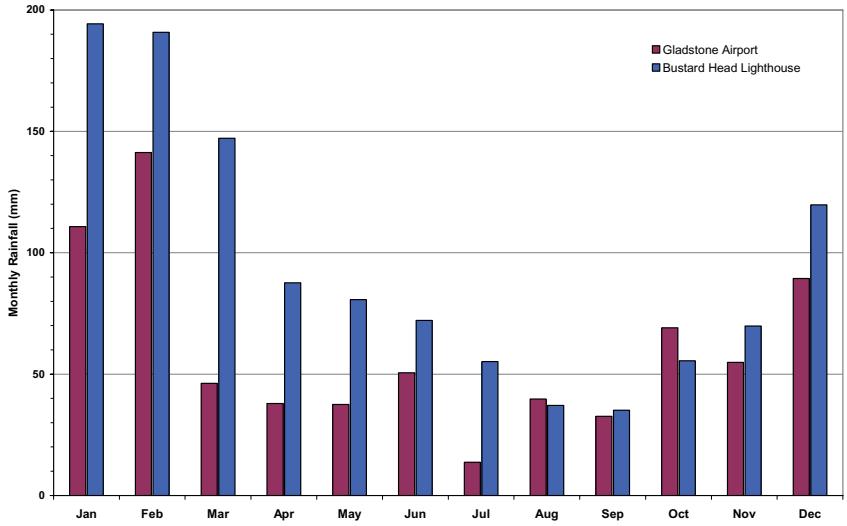
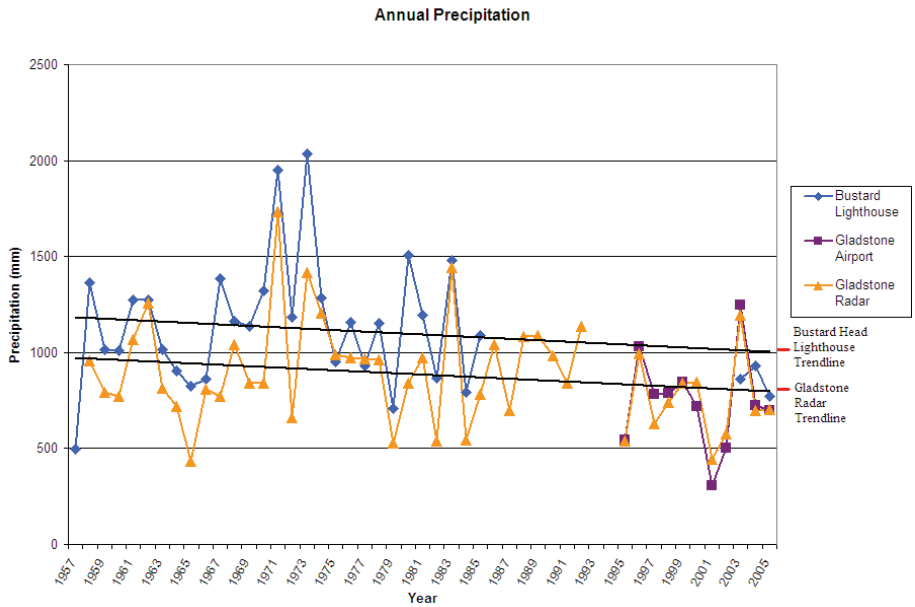


Figure 7.5 – Mean Monthly Rainfall for Gladstone Airport and Bustard Head Lighthouse

The following analysis includes data from the three sites nearest to Hummock Hill Island, Gladstone Radar, Gladstone Airport and Bustard Head Lighthouse.



Note: black trendlines (for Bustard Head Lighthouse and Gladstone Radar) have also been included.
No trendline was added for Gladstone Airport due to the short record period.

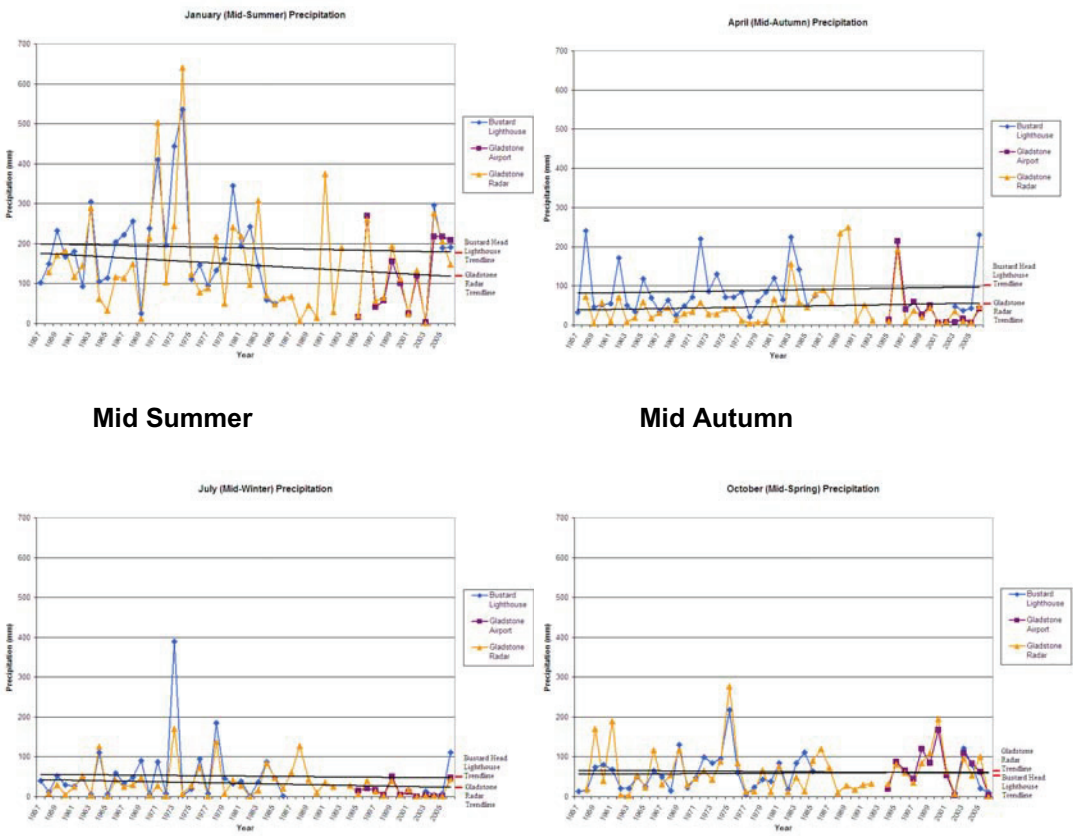
Figure 7.6 – Annual rainfall at Gladstone Radar, Gladstone Airport and Bustard Head Lighthouse

Although Bustard Head Lighthouse and Gladstone are reasonably close in location (approximately 55 kilometres apart) there is a noted difference in the rainfall at each location, with Bustard Head generally receiving 200 mm more rainfall than Gladstone Radar.

Long term data from both Gladstone Radar and Bustard Head Lighthouse show a reduction in annual rainfall of approximately 200 mm in the 50 years from 1957, equating to an average reduction of approximately 4mm per year during this period.

7.1.4.1 Seasonal Trends

Precipitation levels for the mid-season months were analysed and are shown on the following chart.



Note: The trendlines are for Bustard Head Lighthouse and Gladstone Radar. No trendline was added for Gladstone Airport due to the short record period.

Figure 7.7 – Mid-season rainfall at Gladstone Radar, Gladstone Airport and Bustard Head Lighthouse

The majority of rainfall appears to occur in Summer (100-200mm/month) and Autumn (~50-100 mm/month), with the winter and spring seasons being significantly dryer (~25-70mm/month). Observed data in Figure 7.7 suggest that despite the reduction in annual

rainfall seasonal trends show a slight increasing trend in Autumn with relatively constant Winter and Spring rainfall. The observed annual rainfall reduction appears to be the result of summer rainfall reductions.

As discussed in Section 3 the proposed development will be self sufficient in water with reliance on rainfall for rainwater tank usage only. The decreasing trends in rainfall are not considered to significantly impact the proposed development.

7.1.4.2 Site Variability

Figure 7.8 shows the variability in rainfall for each month of the year at Bustard Head Lighthouse, Gladstone Airport and Gladstone Radar.

Average rainfall patterns are similar across the year at all three sites. Despite there being less than 60km between the three sites (and less than 5km between Gladstone Airport and Gladstone Radar), there is significant difference between the maximum rainfall events – with more significant winter rainfall events at Bustard Head Lighthouse.

Figure 7.6 shows the annual precipitation recorded at Bustard Head Lighthouse, Gladstone Airport and Gladstone Radar.

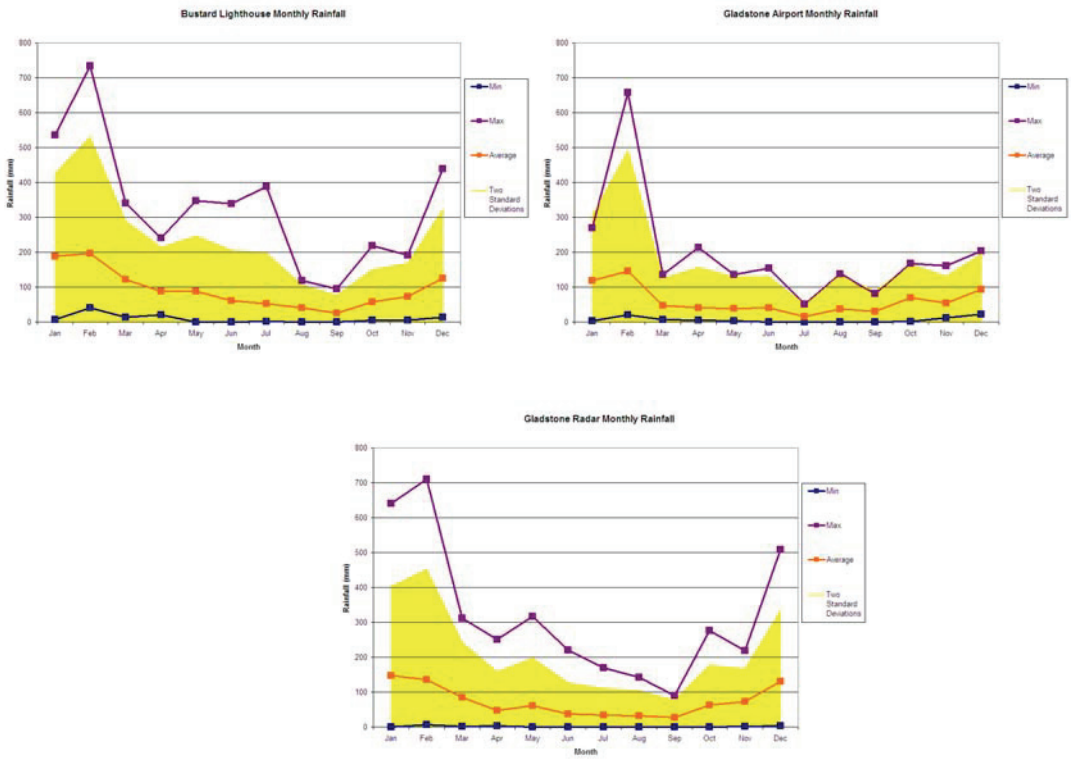


Figure 7.8 – Monthly rainfall - Bustard Head Lighthouse, Gladstone Airport and Gladstone Radar

Rainfall intensity, frequency and duration for Gladstone is presented in Figure 7.9 and shows that typically, rainfall intensity for a 30 minute storm ranges from 51 mm/hr for a 1 year ARI[1] to 150 mm/hr for a 100 year ARI. Again the intensity of rain is generally greater for more severe events, such as thunderstorms or cyclones.

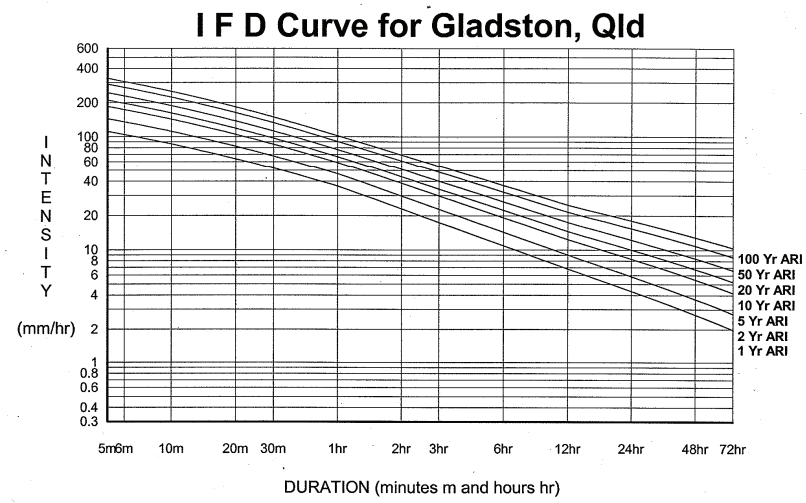


Figure 7.9 – Intensity, Frequency, Duration Curve for Gladstone (Source: AUSIFD V. 2.0)

Rainfall intensity requires consideration in the design of stormwater drainage and erosion and sediment control measures as discussed in Section 3 and Section 5. Current rainfall intensity/duration design parameters for the Gladstone region are considered suitable for these purposes.

7.1.5 Wind Regime

Wind roses for Gladstone radar are presented in Figure 7.12 show how wind changes over a day/year. Each wind rose diagram shows the direction and strength of wind at 3 hourly intervals for each month of the year.

Figure 7.12 diagrammatically demonstrates the frequency of wind speed from each direction. As shown by the prevalence of the red line on each chart, the wind speed is typically (15-20% of the time) between 11 and 20 km per hour, and generally from a south-easterly to north-easterly direction.

[1] ARI = Annual return Interval – the probability time interval in which a storm is likely to occur.

Wind direction appears to be relatively similar for each specific time of the day, rather than the relevant season. The following is a summary of the prevalent wind direction throughout the day, and is generally correct for each month of the year:

Period	Time	Prevalent Wind Direction
Before Sunrise	12am, 3am and 6am	South to south-easterly
Morning	9am, 12pm	Easterly
Afternoon	3pm, 6pm	Easterly to north-easterly
Evening	9pm	South-east to north-easterly

Seasonal Wind Speeds

Figure 7.10 show the minimum, average and maximum recorded wind speed for each 3 hour period at Gladstone Radar (1957-2006) for the middle month of each season, with the range of conditions expected to occur for 95% of the time highlighted in yellow (based on average ± two standard deviations).

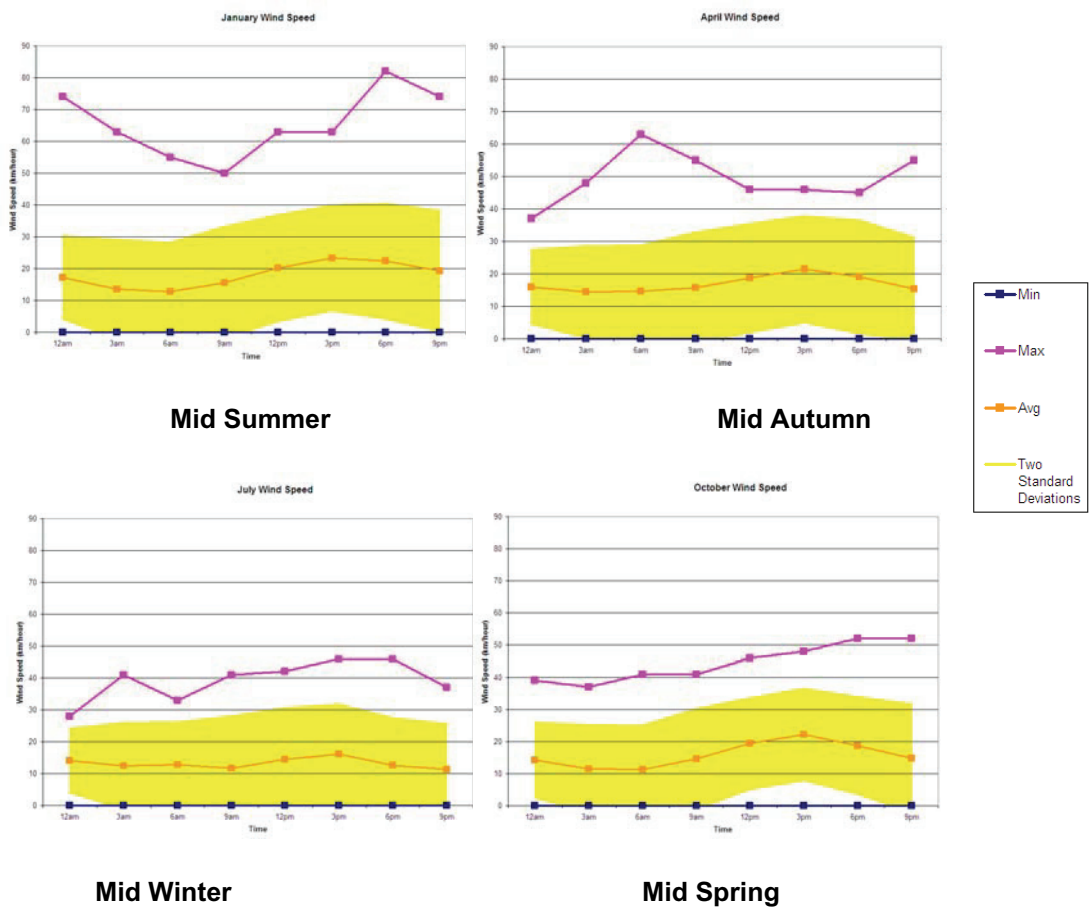


Figure 7.10 – Gladstone Radar 3 hourly wind speed for the mid-season months (Stn. #39123)

Figure 7.10 suggest there is minimal difference between wind speed across the seasons, with average wind speeds between 10 and 20 km/h, and a typical range of 0 to 30 km/h. As is typical in most locations, wind speed generally increases during daylight hours, and decreases once the sun sets.

Maximum Wind Speeds

Maximum wind speed is significantly higher than the range of winds expected to occur for 95% of the time (as per the shaded area on the charts). The following figure shows the maximum wind speed recorded at Gladstone Radar in each year between 1958 and 2005, together with trend line.

Figure 7.11 suggests maximum recorded wind speeds in excess 80km/hour have been recorded at Gladstone. However, maximum wind speeds appear to have been decreasing over the 50 year record period.

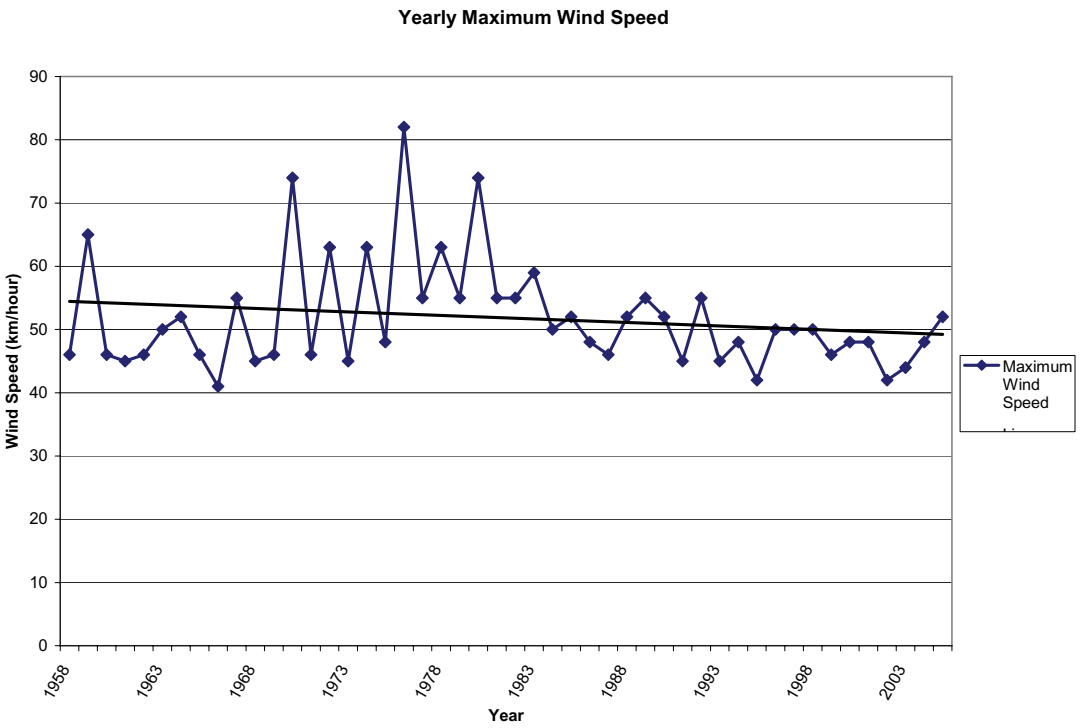
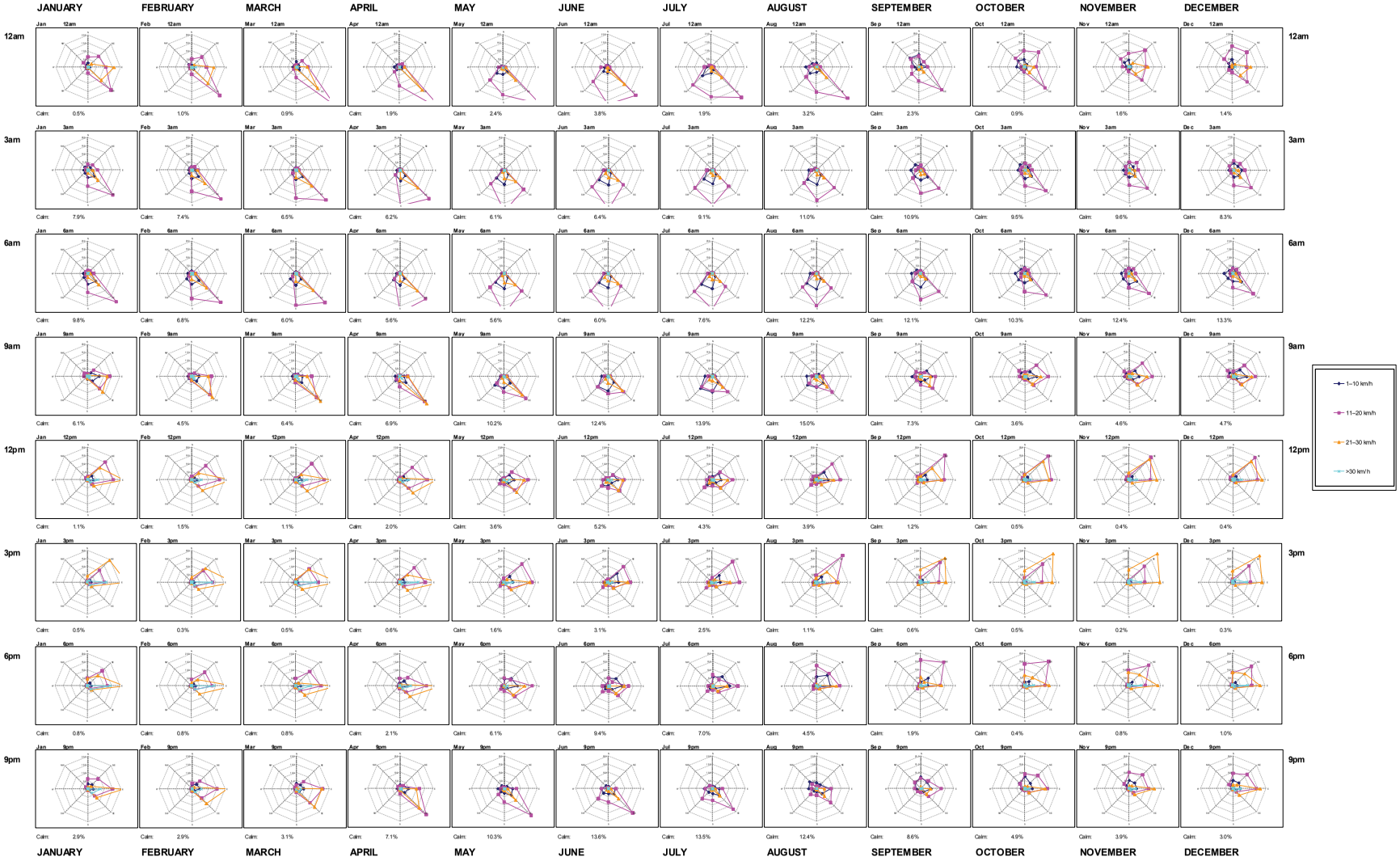


Figure 7.11 – Maximum wind speed (Gladstone)

Figure 7.12 - Averaged 3 Hourly Wind Roses for each Month (Source: Sustainable Fx, 2007)



7.1.6 Severe Weather Conditions

Cyclonic activity in the region of the Island occurs predominantly between January and March, although the cyclone season encompasses all months between November to April inclusive. Reference was made to the Bureau of Meteorology records for cyclone activity between 1969 and 1999 to assess cyclone activity. Records show that the annual average number of tropical cyclones in the Gladstone region is 0.2, or 1 cyclone every 5 years. Variation due to El Nino/Southern Oscillation events does occur with an increase in cyclone occurrence during La Nina events, when annual average cyclone occurrence increases to 0.4, or 1 every 2.5 years (EIS 1993). Extreme weather conditions associated with cyclones are:

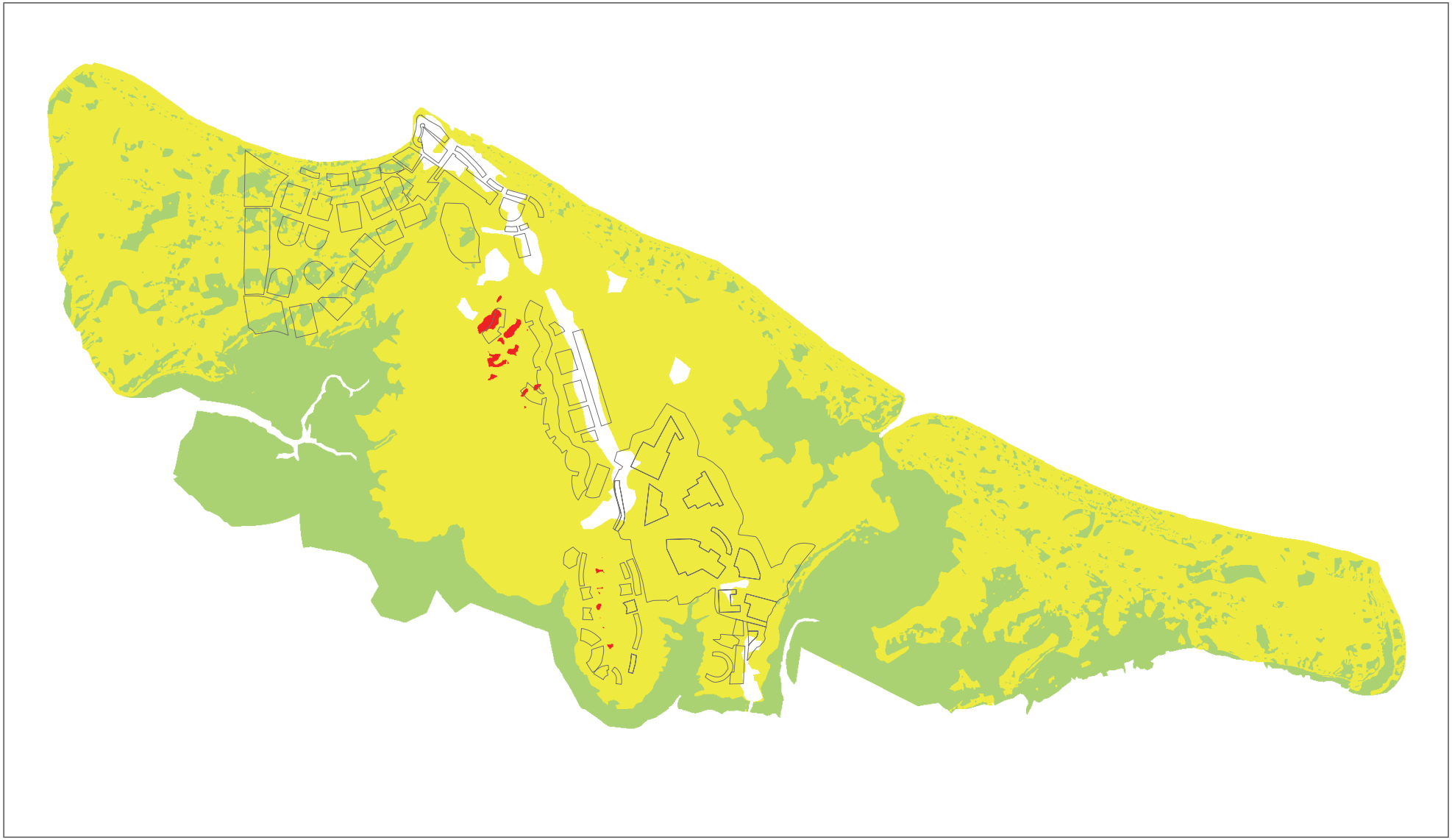
- Severe wind velocities - the highest wind velocity recorded at Gladstone is 155 km/hr (GHD, 2006);
- Extreme rainfall events - the highest daily rainfall recorded at Gladstone is 229 mm and at Bustard Head is 379 mm. Severe flooding is not likely to be a concern on Hummock Hill Island due to the limited size of catchments on the island (GHD, 2006); and
- Increased tidal effects (storm surge) - storm surge has been estimated to be 3.3 to 3.6 m AHD (100 year average recurrence) (Coastal Engineering Solutions (CES), 2005). Existing erosion prone areas are considered to be sufficient to protect against a 100 year storm surge event. Storm surge associated with cyclones is discussed further in Section 8.

Major flood inundation from rivers and creeks is considered minimal on the Island due to the limited size of catchments on Hummock Hill Island and is discussed further in Section 7. Master planning for the proposed development has considered of potential severe weather risks such as storm surge (Refer to Section 9) and does not impinge on erosion prone areas.

7.1.6.1 Bushfire Hazards

Historical evidence indicates that the Island has been cleared for pastoral activities, control of lantana and sourcing timber. As such, control of under storey growth by controlled burns will have been conducted over the pastoral lease period to control regrowth on the Island. No detailed records of controlled burning have been found during this investigation.

Figure 7.13 presents the potential fire hazard rating for regional ecosystems mapped on Hummock Hill Island, based on the risk assessment process outlined in SPP 1/03 Mitigating the Impacts of Flood, Bushfire and Landslide – Guideline (2003).



LEGEND

Bush Fire Hazard

- Precinct Plan
- Low
- Medium
- High

This figure must be read in conjunction with the data disclaimers located at the front of this report . The data acquired for this project is known to be of low spatial resolution and as such no representation or warranties about its accuracy, reliability or suitability are given. Assumptions and conclusions made from this figure and the associated data must be made with full understanding of the data limitations. SKM accepts no liability or responsibility whatsoever for or in respect of any use of or reliance upon the figure and the associated data

Figure 7.13 - Fire Hazard of Mapped Regional Ecosystems on Hummock Hill Island

0 0.5 1 2 Km

N W E S

Hummock Hill

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7.1.7 Climate Change

7.1.7.1 Historical Climate Change

Climate is a dynamic system that changes considerably over the geological timescale. Historically, on a geological timescale, climate has been warming since the end of the last ice age, around 18,000 years ago when average global temperature was just over 4° C below that of today. On average, global temperature rose between 18,000 BP to 6,000 years BP when average global temperature was around 1° C higher than today (Figure 7.14). This period was called the Holocene Maximum, a period in Australia when average sea-levels are thought to have been around 1 m higher than today, the Mid-Holocene High Stand (MHHS).

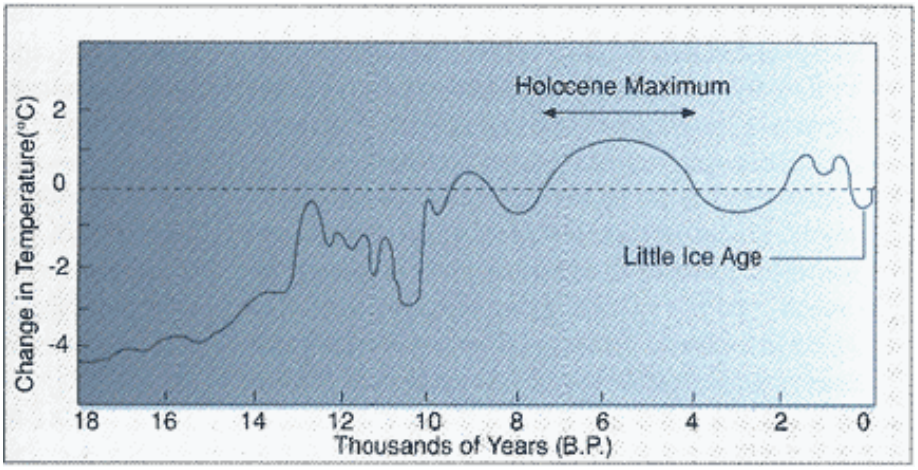
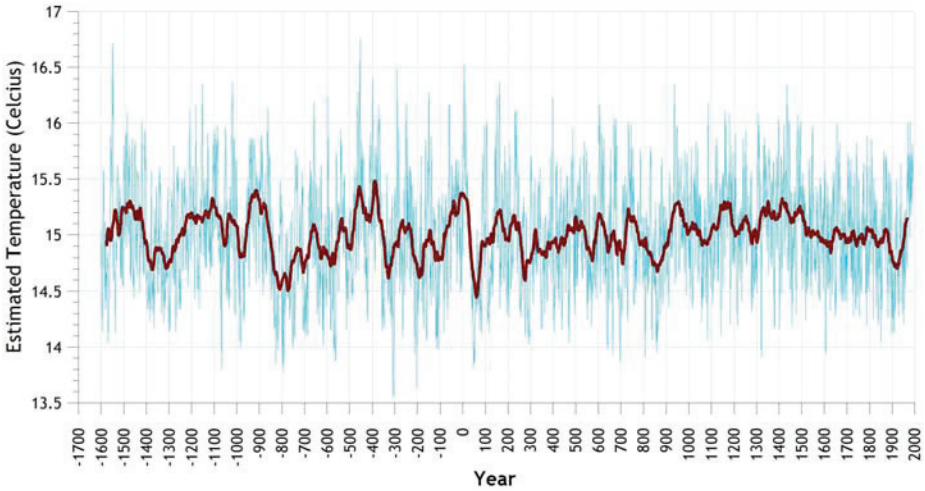


Figure 7.14 – Average Global Temperature Change Since the Last Glacial Maximum Based on Current Average Temperature (Source:[2])

Since the Holocene Maximum average global temperature has fluctuated around what is experienced today. Tree ring data derived from Huon Pine in Tasmania returns a more detailed view of temperature variability over the last 3,500 years roughly since the 18th Dynasty in Egypt (Figure 7.15). Figure 7.15 shows a highly variable yearly temperature, however the 50 year moving average shows the general trend more clearly. A sharp increasing trend in average temperature since the "little ice age" of the late 1800's can be seen in the data.

[2] Compiled by R.S. Bradley and J.A. Eddy based on J.T. Houghton et al., Climate Change: The IPCC Assessment, Cambridge University Press, Cambridge, 1990 and published in EarthQuest, vo. 1, 1991.



Note: the 50 Year moving average is also presented as the darker line to show general climatic trends

Figure 7.15 – 3,592 Year Warm Season (November-April) Temperature Reconstruction for Tasmania, Derived from Huon Pine on Mt. Read. – (Cook, E.R., D'Arrigo, R.D., and Buckley, B.M., 1998)

This observed trend reflects the current global warming trend seen in more recent data. How average annual temperature will change in the near future is subject to a number of model predictions. Current predictions of the Intergovernmental Panel on Climate Change (IPCC) are that average global temperature will increase by about 1-3ºC by 2100.

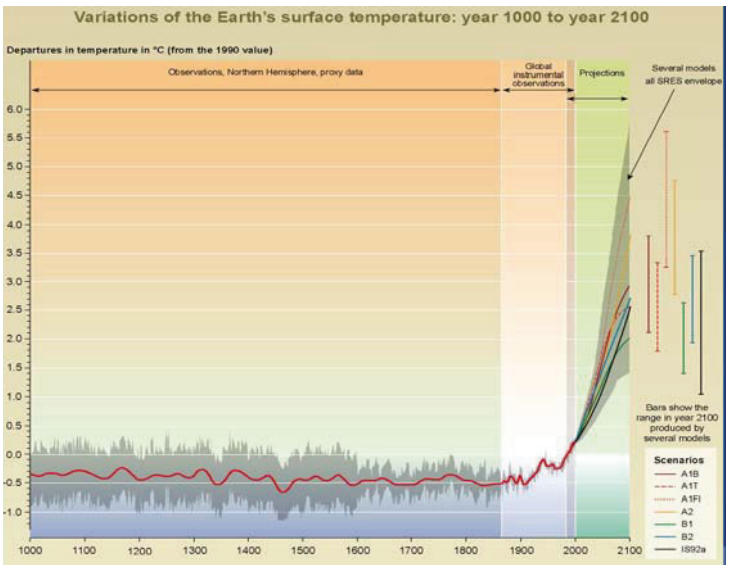


Figure 7.16 – Predicted Global Temperature Based IPCC modelling (IPCC, 2001)

7.1.7.2 Forecast Climate Change

The Intergovernmental Panel on Climate Change Fourth Assessment Report provides a range of forecast climatic scenarios from several models based on a range of emission scenarios from 600 ppm CO_2 (B1 Scenario) to 1,500 ppm CO_2 (AF1 Scenario). Forecast conditions based on these models are outlined in *Climate Change in Australia - Technical Report 2007* (CSIRO) and are summarised in Table 7.1.

Table 7.1 – Estimated Future changes in Key Climate Parameters B1 and AF1 Scenarios

Parameter	2030	2050/70 (B1 Scenario)	2050/70 (AF1 Scenario)
Temperature	Average = +1.0 °C Range = +0.6 to 1.5 °C	Average = 1.2 °C Range = 0.8 to 1.8 °C	Average = 3.4 °C Range = 2.2 to 5.0 °C
Rainfall	-10% to +5% (northern)	-15% to +7.5%	-20% to +10%
Solar Radiation	-1% to +2%	Larger range	Larger range
Relative Humidity	-2% to +0.5%	Larger range	Larger range
Potential Evapotranspriation	0 to +6%	+2% to+8%	+6% to +16%
Drought	Increased occurrence	Increased occurrence	Increased occurrence
Wind	-2.5% to +7.5%	Approx. -10%	Approx. +15%
Sea Level Rise[1]	+7 to +38 cm	+13 cm	+68 cm
Sea Surface Temperature	0.6 to 0.9 °C	1.2 to 1.5 °C	2.2 to 2.5 °C
Severe Weather	An estimated general decrease in total number and increase in individual intensity		

Source: Climate Change in Australia – Technical Report 2007
1 – Climate Change and the Great Barrier Reef: A vulnerability Assessment

The Australian Greenhouse Office (AGO, 2005) notes that the future sea-level is likely to rise due to thermal expansion of seawater, melting of land-based glaciers and melting of ice-sheets in Antarctica and Greenland. A rise may be from 3 to 17 cm by 2030 and 7 to 52 cm by 2070 according to the AGO, however they note that estimates in future regional variations from the global average rise are uncertain. Table 7.2 presents the current estimates of sea level rise for the various emissions scenarios.

Table 7.2 - Changes in global average surface warming and sea level rise at the end of the 21st century

	Temperature Range (°C relative at 2090-2099 relative to 1980-1999)		Sea Level Rise (m at 2090-2099 relative to 1980-1999)
Scenario	**Best Estimate**	**Likely Range**	**Model Based Range**
Constant year 200 concentrations	0.6	0.3-0.9	NA
B1 Scenario (600 ppm CO_2)	1.8	1.1-2.9	0.18-0.38
A1T Scenario (700 ppm CO_2)	2.4	1.4-3.8	0.20-0.45
B2 Scenario (800 ppm CO_2)	2.4	1.4-3.8	0.20-0.43
A1B Scenario (850 ppm CO_2)	2.8	1.7-4.4	0.21-0.48
A2 Scenario (1,250 ppm CO_2)	3.4	2.0-5.4	0.23-0.51
A1F1 Scenario (1,550 ppm CO_2)	4.0	2.4-6.4	0.26-0.59

Source – Contribution of Working group 1 to the Fourth Assessment Report on the Intergovernmental Panel on Climate Change: Summary for Policy Makers

7.2 Impacts and Mitigation

Changes in local weather patterns resulting from climate change have the potential to affect the operation of a project in the future. A climate change risk assessment has been undertaken for the design and operation of the proposed development.

CSIRO (2006) reports that southeast Queensland (including the Gladstone Area) is likely to become warmer, with more hot days and fewer cold nights. A decline in annual rainfall with higher evaporative demand would lead to a tendency for less runoff capture. Droughts are likely to become more frequent and more severe, with greater fire risk. Increases in extreme weather events are likely to lead to increased flash flooding, strains on sewerage and drainage systems, greater insurance losses, possible black-outs, and challenges for emergency services.

The climate change risk assessment is based on climate change scenarios for southeast Queensland in 2030. Two scenarios have been developed by CSIRO (2006) for purposes of risk assessment based on existing climate modelling studies:

- A low global warming scenario (0.54 °C by 2030); and
- A high global warming scenario (1.24 °C by 2030).

The two climate change scenarios present the percentage change and uncertainty in Table 7.3. The changes in average solar radiation, humidity, and extreme daily wind speed were found to be small and are not considered.

Table 7.3 – Change in climate for South-eastern Queensland by 2030, relative to 1990

	Low Global Warming Scenario		High Global Warming Scenario	
Feature	Estimate of Change	Uncertainty	Estimate of Change	Uncertainty
Annual average temperature	+0.6°C	±0.2°C	+1.3°C	±0.6°C
Average sea level	+3cm	±5%	+17cm	±11%
Annual average rainfall	-1.50%	±6.5%	-3.50%	±15%
Seasonal average rainfall				
▪ Summer	0%	±6.5%	0%	±15%
▪ Autumn	-3%	±6.5%	-7.50%	±15%
▪ Winter	-3%	±6.5%	-7.50%	±15%
▪ Spring	-3%	±1.9%	-7.50%	±4.4%
Annual average potential evaporation	+2.40%		+5.60%	NA
Annual average number of hot days (>35 °C)	0		+5 days	NA
Annual average number of cold nights (<0 °C)	0		-5 days	NA
Extreme daily rainfall intensity (1 in 20 year event)[1]	0%		+30%	NA
CO_2 concentration	+73 ppm		+102 ppm	NA

1 – These results are for 2040 as changes for 2030 were not available

Source: AGO (2006)

The Great Barrier Reef Climate Action Plan 2007 – 2012 (GBRMPA, 2007) states that '*two major factors will dictate the future health of the Reef: the rate and extent of climate change, and the resilience of the Reef ecosystem to climate change.*" It recognises that the bigger issue of climate change mitigation is a matter for international policy, the resilience of the reef is under the influence of local management strategies.

The GBR Climate Action Plan outlines a number of objectives and strategies that are aimed at maximising the resilience of the Reef to climate change. GBR Climate Action Plan strategies are outlined in Table 7.4. It is recognised that whilst the GBR Climate Action Plan was released in 2007, master planning for the proposed development has been and will be a continual process of adaptation since 2004. Many of the strategies address both contributions to climate change and recognise the value of the world heritage values of the Great Barrier Reef. Aspects of master planning relevant to the GBR Climate Action Plan and incorporated into the proposed development are outlined in Table 7.4.

Table 7.4 – Great Barrier Reef Climate Action Plan Strategies and Development master Planning

GBR Climate Action Plan Objective & Strategy	Master Planning Approach
Objective 1: Targeted Science Address critical knowledge gaps about climate change impacts on the GBR Identify thresholds, improve monitoring and predictions and evaluate strategies that identify thresholds beyond which climate change causes irreversible damage Translate information into active management responses	Detailed monitoring for the proposed development includes: ▪ inter-tidal vegetation monitoring (refer to Section 15.3); ▪ water quality in estuarine and coastal waters of sufficient detail to develop sub-regional guidelines (refer to Section 9.3); and ▪ monitoring of riparian vegetation within ephemeral watercourses (refer to Section 8.3). These studies will be conducted in co-operation with regional NRM bodies and catchment management groups to add to the existing data for GBR area. The development includes a centre of learning that can be used by research institutions and universities for research into sustainable housing/planning and the local environment.
Objective 2: A resilient Great Barrier Reef ecosystem Maximise resilience of the GBR ecosystem to climate change Adapt existing management to incorporate climate change considerations Minimise climate change impacts through local management actions	The proposed development does not directly impact intertidal vegetation outside a small area within the current access corridor, preserving these existing ecosystems' resilience to future climate change. Use of sustainable technologies minimises the requirement for non-renewable energy resources, minimising impact on the Reef from downstream effects. Detailed monitoring as part of the proposed development and future research from the centre of learning can be disseminated to the GBRMPA and agencies to further existing knowledge and maximise the resilience of the Reef.
Objective 3: Adaptation of industries and communities Identify factors that confer resilience to communities and industries in the context of climate change Maximise resilience of industries and communities to climate change	The Plan of Development encourages residents and owners to be aware of their energy demands and subsequent impacts to the environment. Building codes and development principles include allowances for reasonably predicted climate change factors such as increased winds, increased sea levels (refer to Section 9.3), increased rainfall (refer to Section 3.4 and

GBR Climate Action Plan Objective & Strategy	Master Planning Approach
	8.3).
Objective 4: Reduced Climate Footprints Increase knowledge and involvement of stakeholders in climate change responses Work with organisations and individuals to reduce their climate footprint	Master planning of the proposed development has incorporated housing design that maximises natural ventilation and minimises energy requirements. The proposed development incorporates features such as solar hot water, energy efficient lighting, maximum use of recycled water and an independent water supply to reduce reliance on non-renewable energy sources. The staged development allows for the future incorporation of new energy efficient technologies that will be developed in the future. The Plan of Development encourages residents to maximise use of energy efficient appliances and utilities reducing energy requirements and ecological footprint. Requirements of the Plan of Develop mandate that 50% of existing vegetation has to be maintained at the individual lot level reducing the areas of cleared vegetation and minimising loss of carbon sequestration (refer to Appendix A2). Offset vegetation of the equivalent size as that cleared will be acquired as required under the SE Qld Regional Vegetation management Code resulting in a no net loss of vegetation or loss of carbon sequestration (refer to section 14.3.1).

7.2.1 Construction Impacts and Mitigation

Potential construction impacts for the proposed development have been assessed and mitigation measures have been proposed, where appropriate, in Table 7.6. The proposed construction period is from 2008 to 2024 with major infrastructure occurring in the first 3 years of this period. Potential construction impacts due to climate change factors outlined in Table 7.3 are likely to be limited. Future development of tourism and residential precincts are likely to have limited clearing, however clearing for the proposed golf course in 2014 to 2015 may be influenced by potential climate change factors.

Potential construction impacts from changes in climate are considered as:

- An increase in erosion potential due to an increase rainfall intensity (increasing with time into the development period) recognising that long term records show a decrease in annual rainfall;
- A reduction in erosion control design capability due to increased rainfall intensity with reduced frequency;
- Increased bushfire hazard due to increased temperature, reduced rainfall and higher probability of drought periods; and
- Predicted increases in tropical cyclone intensity in Queensland have the potential to increase extreme daily rainfall, maximum wind velocity and storm surge.

Mitigation of potential construction impacts due to the two climate scenarios presented in Table 7.3 are presented in Table 7.5 below.

Table 7.5 – Potential Construction Impacts of Climate Change Scenarios on the Project and Proposed Mitigation Measures

Feature	Potential Impact	Mitigation measures (if required)
Increase in erosion potential	Potential increase in erosion during construction due to increased rainfall intensity	Erosion and sediment control plan will be developed and submitted for approval by MVSC with a 30% buffer on maximum design flows and basin sizes.
Reduction in erosion control design capability	Potential reduction in erosion & sediment control design capacity due to increase in rainfall intensity	Erosion and sediment control plan will be developed and submitted for approval by MVSC with a 30% buffer on maximum design flows and basin sizes.
Increased bushfire hazard	Average seasonal temperature increase increases potential bushfire hazard	Prior to commencement of construction a Bushfire Management Plan will be completed by a suitably qualified person in accordance with SPP 1/03. Master Planning will incorporate outcomes of the bushfire hazard assessment and incorporate natural road reserves, firebreaks such as the airstrip and golf course into the design for south easterly aspect areas. Appropriate buffer strip will be used in higher risk areas.
Increase in cyclone intensity	Increase in cyclone intensity increasing rainfall (see above), wind speed and storm surge (refer to Section 8).	No building will take place in erosion prone areas other than public beach access infrastructure. Building design will comply with relevant building codes for Central Queensland, taking maximum wind speeds into consideration.

Master planning for the proposed development has taken consideration of existing erosion prone areas and defined storm tide event (100 year event). No development is proposed within designated erosion prone areas except for public beach access infrastructure. Based on the absence of development within erosion prone areas and the lack of development below RL 3.6 m, the proposed development is not considered to require assessment under Section 2.2.4 of the SCMP and associated *Guideline - Mitigating the Adverse Impacts of Storm Tide Inundation* requirements. Floor levels of buildings and infrastructure will be located an additional 0.4 m above the existing DSTE of RL 3.6m (refer to Section 9.3)

Bushfire Fire Impacts & Mitigation

Bushfire risk impacts during construction are considered in Section 18 and include consideration of bushfire hazards.

It is proposed that fire management will be conducted in consultation with the local rural fire brigade and emergency services who will have a base on the Island within two years of initial construction. Details of bushfire impact during operation are outlined in Section 7.2.2.

7.2.2 Operational Impacts and Mitigation

Potential operational impacts for the proposed development on Lot 3 have been assessed and mitigation measures have been proposed, where appropriate, in Table 7.6. Potential impacts due to changes in climate are considered as:

- A potential increase in water demand as a result of higher temperatures and evaporation;
- An increase in demand for air-conditioning due to higher temperatures;
- A reduction in storm water design capability due to increased rainfall intensity with reduced frequency;
- Increased bushfire hazard due to increased temperature, reduced rainfall and higher probability of drought periods; and
- Predicted increases in tropical cyclone intensity in Queensland have the potential to increase extreme daily rainfall, maximum wind velocity and storm surge.

Mitigation of predicted potential impacts due to the two climate scenarios presented in Table 7.3 are presented in Table 7.6 below.

Table 7.6 – Potential Impacts of Climate Change Scenarios on the Project and Proposed Mitigation Measures

Feature	Potential Impact	Mitigation measures (if required)
Increase in annual average temperature	Potential increase in water demand within the development under both scenarios	Maintenance of sustainable water supply from a combination of rooftop capture, storm water harvesting and desalination
	Average temperature increase is unlikely to affect reliability of infrastructure or equipment (e.g. pumps)	N/A
	Average temperature increase may increase demand for air conditioning, increasing power demands	Maximising use of site aspect, architecture and natural ventilation reduces air conditioning demand and subsequent power demand and contributions to global warming
Increase in annual average potential evaporation	Increased evaporation due to higher temperature scenarios	Use of underground modular water storage and desalination reduces impacts from increased evaporation
Decrease in seasonal average rainfall	Potential to reduce the yield from rooftop and storm water capture. However, the predicted uncertainty is greater than the predicted decrease.	Maintenance of sustainable water supply from a combination of rooftop capture, storm water harvesting, recycled water and desalination
Reduction in storm water controls capacity	Increased rainfall intensity for reduced storm frequency may exceed the storm water systems capacity and lead to minor flooding	Storm water infrastructure design to include a 30% increase in design capacity to allow for potential climate change scenarios Increased storm water capacity achieves Specific Outcomes 1, 2, 3 and 5 in SPP 1/03[3]
Increase in bushfire hazard risk	Increase in annual temperature with greater drought occurrence may lead to increased bushfire hazard in areas mapped as high and moderate in the MVSC Draft Planning Scheme Map 4.42.1	The proposed development incorporates firebreaks such as the proposed airstrip, and golf course fairways down wind in areas of medium and high risk. Individual lot development will incorporate safety buffers of appropriate size for the associated vegetation type hazard score. Development design to incorporate measures to meet Specific Outcomes 6 and 7 in SPP 1/03

[3] Specific Outcome 4 (hazardous materials) does not apply as no hazardous materials will be manufactured or stored in bulk within the proposed development.

Feature	Potential Impact	Mitigation measures (if required)
Increase in average sea level	Predicted sea level rise for the high global warming scenario is between 0.18 and 0.59 m.	Existing assessment of storm surge risks for Hummock Hill Island found to include adequate climate change factor (refer to Section 9.3). Climate change factor is included in current storm-surge scenarios, and an additional 0.4 m above existing DSTE (refer to Section 9.3)
Annual average number of cold nights (<0 °C)	No Impact	N/A
Increase in CO_2 concentration	Small increase in acidity due to greater diffusion of CO_2. The expected increase in acidity of water is not expected to affect water quality significantly	Water quality sampling at nominated monitoring points will track long term changes in pH (refer to Section9.3).

Bushfire Hazards

Bushfire hazards are considered to be greater on vegetated slopes facing typically hot and dry winds, particularly from the north east. The central ridgeline of Hummock Hill Island trends from the south south-east to north north-west. A preliminary bushfire hazard assessment on development areas conducted with reference to SPP1/03 provides bushfire hazard scores for the central ridgeline and Hummock Hill.

Table 7.7 – Bushfire Hazard Assessment of Ridge-top Housing (after SPP 1/03 Guideline)

Ridge Aspect	Vegetation Hazard Score	Slope Hazard Score	Aspect Hazard Score	Total Hazard Score
North West Slopes	5	5	3	13 (High)*
West Slopes and Ridge top	5	4	2	11 (Medium)
South East Slope and Ridge top	5	3	0	9 (Medium)

* - limited to areas of slope greater than 30% (refer to Figure 7.13)

Based on the above hazard assessment, ridge top housing with a westerly aspect may be considered to be in a medium risk bushfire hazard area, due to the vegetated hillside down slope and the westerly aspect of the slope face of the area. Reference to wind roses in Section 7.1.5 reveals a less than 5% occurrence of north-easterly winds in the location that mitigates the potential fire risk to a degree. Proposed mitigation for bushfire hazard will be in accordance with SPP1/03 will be included for all housing in medium and high risk area.

Housing located on the easterly aspect of the ridge returns a medium bushfire hazard score based on a slightly reduced slope hazard and significantly low aspect hazard. This is due to the predominantly moist south easterly and easterly winds prevalent on the Island. Additional mitigation is available from existing fire breaks associated with the airstrip runway and proposed golf course fairways down wind of the development.

A small area of the proposed development falls within a high bushfire hazard area on the north eastern slope of Hummock Hill. Mitigation of this area will include relocation of houses to lower gradient slopes and incorporation of suitable bushfire buffers in accordance with SPP1/03.

Climate change factors have been considered as part of planning for the proposed development. Infrastructure and buildings will be designed with sensitivity to both the existing climate and also with consideration to potential climate change factors (refer to Section 3). Temporary and permanent stormwater controls will be designed with consideration of increasing rainfall intensity and include suitable allowances for such increases (refer to Section 3 and Section 8).

7.3 Conclusions

Climate factors and risks associated with the region have been incorporated into the Master Plan of the proposed development. Buildings will be designed in sympathy with current and anticipated climate changes as noted in Section 3. Aspects of the Great Barrier Reef Climate Action Plan have also been incorporated into the proposed development to reduce the ecological footprint and maintain the resilience of the surrounding ecosystems of the Island to climate change.

Risks to infrastructure from storm surge increases associated with climate change are discussed in Section 9.3, current erosion prone areas being considered sufficient with an allowance for climate change factors. Building pad levels and public infrastructure will be located above the Q100 storm surge level reducing potential risks from this source. Risks associated with increased temperature and storm intensity are incorporated into infrastructure and development design minimising potential risks from these sources.

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8. Water Resources

8.1 Environmental Values Assessment

The *Water Act 2000* (Qld) states that a "*Watercourse means a river, creek or stream in which water flows permanently or intermittently—*

(a) in a natural channel, whether artificially improved or not; or

(b) in an artificial channel that has changed the course of the watercourse;"

Beds and banks of a water course are deemed to be "*…land over which the water of the watercourse or lake normally flows or that is normally covered by the water, whether permanently or intermittently; but does not include land adjoining or adjacent to the bed or banks that is from time to time covered by floodwater.*" (*Water Act 2000* (Qld)).

The *Environmental Protection (Water) Policy 1997* (EPP (Water)) applies to all Queensland waters and provides a framework for:

- identifying Environmental Values (EVs) for Queensland waters, and deciding the Water Quality Objectives (WQO) to enhance and protect those EVs; and
- including the identified EVs and WQO under Schedule 1 of the EPP (Water).

The EPP (Water) also ensures that identified EVs for water are protected through the use of a measurable indicator such as pH, conductivity, nitrogen concentration etc. Site specific documents are the preferred source of identifying measurable indicators for EVs under the EPP (Water), where these are regional documents such as the Queensland Water Quality Guidelines (2006) are preferred followed by the National ANZECC (2000) Water Quality Guidelines. These are discussed further in Section 8.2.1.5.

Ephemeral watercourses on Hummock Hill Island or the surrounding estuarine and marine receiving waters are not listed in Schedule 1 of the EPP (Water). The EPP (Water) does state that for waters not listed in Schedule 1 the EVs to be enhanced or protected are the:

- biological integrity of a pristine or modified aquatic ecosystem;
- suitability for recreational use;
- suitability for minimal treatment before supply as drinking water;
- suitability for agricultural use; and
- suitability for industrial use.

A series of default EVs that may be used for assessment are also provided by the Qld EPA Guideline (2003) and the QWG (2006), and expand on those identified in the EPP (Water). These include:

- Aquatic ecosystems;
  - High conservation value (HCV);
  - Slightly to moderately disturbed systems (SMD);
  - Highly disturbed systems (HDS);
- Primary industries;
  - Irrigation;
  - Water for farm use;
  - Stock watering;
  - Aquaculture;
  - Human consumption of wild or stocked fish or crustaceans;
- Recreation and aesthetics;
  - Primary recreation (swimming);
  - Secondary recreation (boating, fishing);
  - Visual appreciation;
- Drinking water;
- Industrial uses; and
- Cultural and spiritual values.

Reference to the Qld EPA Guideline – *Establishing Draft Environmental Values and Water Quality Objectives* (2005) outlines the process for the establishment of site (catchment) specific draft EVs and associated draft WQO. This process takes into consideration the current waterway condition, identification of reaches with "*high ecological values*", current and future human uses of the waterway and consultation with the community on the above aspects of the catchment. This process is designed primarily for water quality managers, local government and natural resource management bodies however, the process is considered here in identifying draft EVs for watercourses on and around the Island.

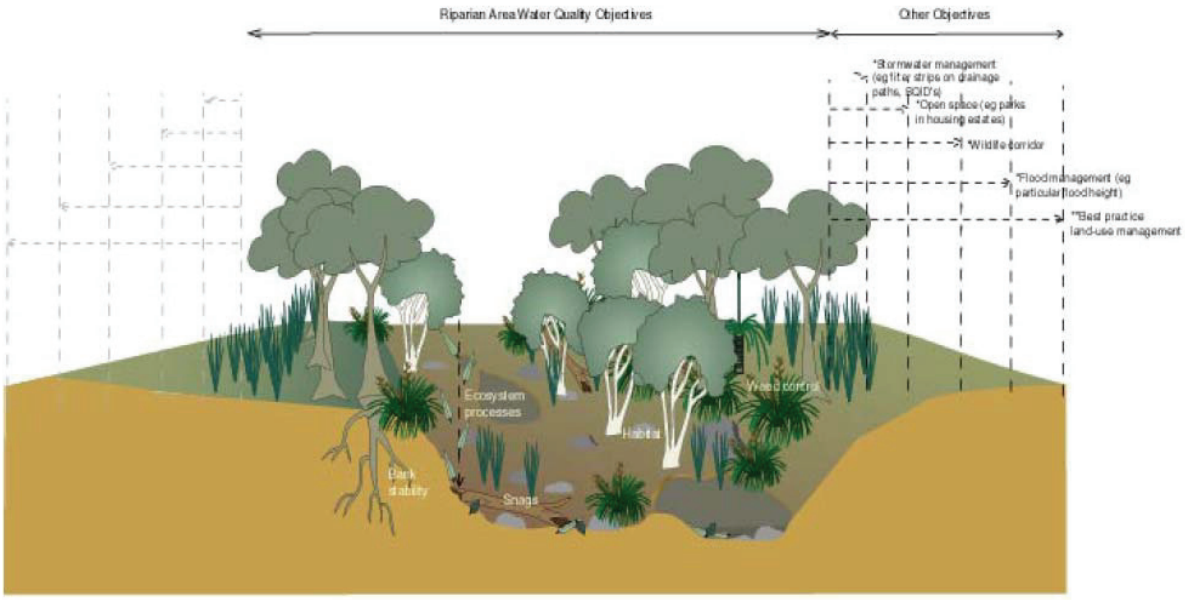
Consideration is also given to World Heritage Values (WHV) of the Great Barrier Reef (GBR), as the Island is located in the Great Barrier Reef World Heritage Area. These values are outlined in Appendix A3. Whilst the majority of the GBR WHV relate to aspects of the marine environment, some WHV of the GBR under Criterion II, such as terrestrial fauna and flora, remnant vegetation, migratory bird feeding grounds; Criterion III, rare and superlative natural phenomena and Criterion IV, such as habitats for species of conservation significance do require consideration in assessing potential EVs for watercourses on the Island.

Identified draft EVs for freshwaters and estuarine and marine receiving waters (refer to Section 9) are based on assessment of the physical nature and condition of existing watercourses and waters and current human uses either observed or through community consultation (refer to Appendix A5). Based on this assessment a series of EVs are provided in Section 8.2.1.4.

8.2 Existing Environment

8.2.1 Surface Watercourses

No perennial (permanent) freshwater watercourses are located on the Island. The Tod Group (1993) investigation also noted that no permanent freshwater watercourses were observed on the Island. Freshwater drainage on the Island typically consists of ephemeral watercourses (flowing only during and immediately after rainfall events) and gullies. Figure 8.1 presents the typical features of an ephemeral watercourse.



Source: Moreton Bay Waterways and Catchments Partnership (MBWCP),SEQRWQMS, Volume 1.

Figure 8.1 - Conceptual Model for an ephemeral freshwater stream

Most watercourses and gullies on the Island drain from the central granodiorite ridge line, radiating outwards to the adjacent colluvial or sand plains. Channel widths within these ephemeral watercourses are typically very small being less than 2 m wide and of first and second order[1]. Channels are poorly defined, such as those shown in Figure 8.3, and do not contain areas of standing water outside periods of flow during and following rainfall events. Many of the eastern watercourses draining the central ridge discharge as sheet flow either at the break of slope or within 200 m, and are not directly connected to adjacent receiving estuarine waters (refer to Figure 8.2).

1 Stream order is determined by the number of tributaries that have merged together to form the watercourse, e.g. a single watercourse will be a first order watercourse. When two first order watercourses merge they become a second order watercourse, when two second order watercourses merge they become third order and so on.

Figure 8.2 - Freshwater Drainage Systems and Water Quality Sampling Locations On Hummock Hill Island

LEGEND

- Proposed Sampling Locations
- Existing Sampling Locations
- Discharge Points
- Index Contour (5m)
- Intermediate Contour (1m)
- Drainage Line

This figure must be read in conjunction with the data disclaimers located at the front of this report . The data acquired for this project is known to be of low spatial resolution and as such no representation or warranties about its accuracy, reliability or suitability are given. Assumptions and conclusions made from this figure and the associated data must be made with full understanding of the data limitations. SKM accepts no liability or responsibility whatsoever for or in respect of any use of or reliance upon the figure and the associated data

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8.2.1.1 Riparian Habitat and Ecological Value

Riparian specific habitat is generally absent from watercourses draining the central ridgeline and also in channels crossing the colluvial plains. Vegetation associated with these watercourses consists of the same vegetation types as surrounding land, i.e. grasses and tree re-growth (refer to Figure 8.3). The lack of riparian habitat can be attributed to the small catchment size leading to watercourses with quick response times (refer to Section 8.2.1.2) leading to short bursts of water flow. The general low rainfall of the area and underlying geology does not encourage the storage of groundwater and as such base-flow that can supply water to a watercourse is absent. As such watercourses do not retain sufficient water to encourage the growth of typical riparian vegetation such as emergent macrophytes etc.

Figure 8.3 – Typical Ephemeral Watercourses Draining from the Central Granodiorite Ridge

An assessment of ecological value for watercourses draining the central granodiorite ridge and colluvial plains, based on assessment criteria outlined in *Guidelines for Protecting Australian Waterways* (Bennett et al, 2002), is presented in Table 8.1. Based on the preliminary assessment conducted in Table 8.1, watercourses draining the central granodiorite ridge and colluvial plain return a low ecological value.

Table 8.1 – Ecological Value Assessment of Ephemeral Watercourses on Granodiorite and Colluvium

Criteria	Question	Y/N/U	Rating
Naturalness	Is the watercourse free from (or signs of): Cattle disturbance Rubbish Poor water quality Clearing of natural vegetation Presence of weeds Erosion Dams or weirs Channel modification	 Y N U N N N N Y	Low
Representativeness	In comparison with similar watercourses in the area is the watercourse a good example of: Flow patterns Water quality Native vegetation in the watercourse and on the banks Aquatic wildlife Channel features	 U U Y N N	Medium
Diversity	Does the area support a large number of native species Does the area have a range of in-stream habitats Are there a variety of native birds commonly seen/heard in the area Are there a variety of streamside plants found in the area	N N Y N	Low
Rarity	Does the area (watercourse) support a rare, threatened or vulnerable species or those known locally or regionally as being significant Does the site have unusual natural features	N N	Low
Special Features	Are there any features present in the watercourse that makes it special	N	Low

Two ephemeral watercourses are also present in each of the relict beach ridge systems east and west of the Northern Headland (Figure 8.4). Channel definition in the ephemeral watercourse east of the northern headland is limited to a sandy and muddy reach below the headland extending east for approximately 300 m. This reach contains mangrove vegetation and pools of standing water. Whilst no distinct connection was observed with adjacent marine waters it is thought that this reach receives marine water during large spring tides with storms, either as swash over or seepage through the adjacent dune.

Further east this watercourse displays little distinct channel characteristics, such as a distinct bank and bed, forming a swale at the transition between the colluvial plain and relict beach ridge system (refer to Figure 8.4). No areas of standing water were observed during inspection of this reach of the watercourse, however melaleuca spp were observed of the sides of the swale.

Figure 8.4 – Two Reaches of the Watercourse East of the Northern Headland

A second ephemeral watercourse is found in the relict beach ridge system west of the headland (refer to Figure 8.2). The watercourse originates at the break of slope below the headland and approximately 100 m from the shoreline, where the granodiorite of the headland meets the relict beach ridge sands. A small dam is located at the head of the watercourse and did not contain water during at the time of inspection. Downstream of this dam the watercourse forms a broad swale (approx 50 m wide) with no distinct channel definition. Low shrub vegetation such as seablite (*S. australis)* and bead weed (*S. quinqueflora*) as shown in Figure 8.4, plants typically found in saltmarsh, are found in this swale. Further west, the swale narrows without discharging to the ocean (refer to Figure 8.5). No standing water was observed in this ephemeral watercourse/swale during site inspections by SKM during the 2005 to 2007 period. Areas of moist ground were observed in depressions within this system. Based on the current status of this system, with lack of cross sectional channel form, the above vegetation and lack of standing water this area is considered to be more representative of a wetland.

Inspection of historical aerial photography reveals this watercourse was once connected to the ocean and subject to tidal flooding up until the 1980s. Accumulation of sand since the 1990's has disconnected this watercourse from tidal waters and sealed the entrance.

Figure 8.5 – Two Reaches of the Watercourse West of the Northern Headland

An assessment of ecological value for ephemeral watercourses/swales in the relict beach ridges, based on assessment criteria outlined in Guidelines for Protecting Australian Waterways (Bennett *et al.*, 2002), is presented in Table 8.2. Based on the preliminary assessment conducted in Table 8.2, ephemeral watercourses in the relict beach ridge system return a medium ecological value.

Table 8.2 – Ecological Value Assessment of Ephemeral Watercourses/Swales in Relict Beach Ridges

Criteria	Question	Y/N/U	Rating
Naturalness	Is the watercourse free from (or signs of): Cattle disturbance Rubbish Poor water quality Clearing of natural vegetation Presence of weeds Erosion Dams or weirs Channel modification	 Y N U Y N Y N Y	Medium
Representativeness	In comparison with similar watercourses in the area is the watercourse a good example of: Flow patterns Water quality Native vegetation in the watercourse and on the banks Aquatic wildlife Channel features	 U U Y N N	Medium
Diversity	Does the area support a large number of native species Does the area have a range of in-stream habitats Are there a variety of native birds commonly seen/heard in the area Are there a variety of streamside plants found in the area	N N Y Y	Medium
Rarity	Does the area (watercourse) support a rare, threatened or vulnerable species or those known locally or regionally as being significant	Y	Medium

Criteria	Question	Y/N/U	Rating
	Does the site have unusual natural features	N	
Special Features	Are there any features present in the watercourse that makes it special	N	Low

A number of small man-made dams containing freshwater have been constructed within ephemeral watercourses and gullies to supply drinking water for cattle during use of the Island for pastoral activities. The larger of these dams and the ones currently containing water are located in catchments draining the central granodiorite ridge and colluvial plains (refer to Figure 8.2). The largest of these dams, located in a break in the central ridgeline does contain emergent riparian vegetation. It is not known to contain fish, though a distinct ephemeral watercourse does exist downstream, connecting to the adjacent estuarine waters of Boyne Creek. A second dam located adjacent the Boyne Apartments precinct receives drainage from the southern most section of the Island and is located at the head of a tidal inlet. Connectivity with adjacent marine waters is only likely during extreme high tides and storm flows.

8.2.1.2 Hydraulic characteristics

No physical investigations of ephemeral watercourse hydraulics have been conducted due to their ephemeral nature and the lack of water to assess flow conditions. Water flow in small ephemeral creeks typically responds quickly to storm events due to their small area and small distance for overland flow to travel to the channel. Water levels typically rise quickly and fall equally as rapidly.

Whilst the lack of water in watercourses has precluded investigation of flows, watercourses within the lease area have been modelled as part of Water Sensitive Urban Design (WSUD) for the proposed stormwater drainage system (refer to Appendix A7.2). Individual ephemeral watercourse catchment areas are less than 100 ha. Modelling for the purpose of assessing stormwater flows has amalgamated small sub-catchments to derive the drainage zones in Table 8.3 (refer to Figure 3.14).

Table 8.3 – MUSIC Modelling of 100 Year Peak Flows within the Development Area

	Area (ha)	Rainfall Intensity, I_{100} (mm)	Time of Conc., t_c (min)	Peak Flow (m^3/s)
Lagoon	98.29	67	20	39.79
Bay	8.18			3.31
Town	26.45			10.71
Headland	22.79			9.23
Hummock Hill	31.19			12.63
Boyne Hill	24.51			9.92
Boyne East	34.70			14.05
Boyne West	25.13			10.17

As seen in Table 8.3 peak flows for a 1 in 100 year storm (a major storm event) are relatively small, reflecting the small size of the catchments.

Changes in climate attributed to global warming effects are uncertain for Queensland as a whole. Rainfall in Queensland has exhibited both increasing and decreasing trends. However, the *Queensland Greenhouse Strategy* (2006) notes that the Gladstone region has recorded the greatest decreases in annual rainfall (more than 7 mm per decade). Rainfall intensity is predicted to increase leading to increases in intermittent flows in ephemeral watercourses and a subsequent greater increase in sediment transport capacity of existing ephemeral watercourses on the Island.

8.2.1.3 Current surface fresh water uses

No industrial, agricultural or potable use of surface water is conducted on Hummock Hill Island. Ecological function forms the primary use of existing ephemeral watercourses though this is limited for watercourses draining the central ridgeline. Two man made dams contain water and have some ecological processes associated with them.

No water allocations currently exist on Hummock Hill Island due to the predominantly dry ephemeral nature of creeks on Hummock Hill Island and lack of water flow reliability for abstraction.

8.2.1.4 Surface Watercourse Environmental Values

Based on the existing condition, preliminary assessment of ecological value and current human uses of identified watercourses draft EVs are outlined in Table 8.4.

Table 8.4 - Draft EVs for Ephemeral Watercourses

Watercourse Type	SMD Aquatic Ecosystems	Visual Appreciation	Cultural & Spiritual
Granodiorite & Colluvial Plain Watercourses	✔	✔	
Relict Beach Ridge Watercourses	✔	✔	✔
Man Made Dams	✔	✔	

The Island is also located in the Great Barrier Reef World Heritage Area (GBRWHA) and the World Heritage Values (WHV) are also considered in establishing draft EVs. Many of these relate to marine species or environments directly and are dealt with in Section 9. Some WHV are broadly considered in the ecological values assessment in Table 8.1 and Table 8.2 such as rarity and special features criteria. These criteria incorporate WHV of the GBRWHA and are subsequently included in the consideration of ecological value of ephemeral fresh watercourses. Consideration of downstream receiving environments is included in setting WQO at the discharge point and is discussed in Section 9.

8.2.1.5 Water Quality Objectives

Water Quality Objectives for freshwaters on the Island are required to protect the identified EVs in Table 8.4. As freshwaters on the Island are not listed in Schedule 1 of the EPP (Water), the WQO will be the "*the set of water quality guidelines for all indicators that will protect all EVs for the water*".

In the absence of site specific data the Queensland Water Quality Guidelines (2006), and ANZECC (2000) are used for fresh waters on the Island. Under the current Island conditions these guidelines apply to water in dams only as identified ephemeral watercourses do not contain water. Application of WQO to ephemeral watercourses is difficult due to the lack of water outside rainfall events. As such reference is made to the South-East region guidelines for riparian areas outlined in Table 8.5. Maintenance of riparian vegetation is effective at reducing contaminants such as suspended solids, nutrients etc and the use of buffer zones assists in maintaining water quality downstream of these watercourses.

The *Regional Vegetation Management Code for South East Queensland (2006)* (RVMC) provides the following Performance Requirement (PR S.3) relating to ephemeral watercourses[2] in the Island:

- To regulate the clearing of vegetation in a way that does not cause land degradation, prevents the loss of biodiversity and maintains ecological processes – maintain the current extent of assessable vegetation associated with any watercourse to provide –
  - bank stability by protecting against bank erosion; and
  - water quality by filtering sediments, nutrients and other pollutants; and
  - aquatic habitat; and
  - terrestrial habitat.

The acceptable solution for the above performance requirement (AS S.3) requires the maintenance of a 10 m distance from "*each high bank of each watercourse with a stream order 1 or 2.*" This performance requirement is consistent with the principle guideline identified in Table 8.5 and is included as an objective for ephemeral watercourses.

The 10 m riparian buffer outlined as a guideline for ephemeral watercourses is also considered to comply with the requirements of the *Fisheries Guidelines for Fish Habitat Buffer-Zones* (FHG 003), considering that the Colosseum Fish Habitat Area (FHA) is the ultimate receiving water of ephemeral watercourses on the Island. As such, a 10 – 15 m buffer is considered appropriate guideline.

Table 8.5 – Modified South-east Queensland Guidelines for Ephemeral Creeks & Gullies

Water Type	Riparian Function		
	Ecological Processes	Habitat	Bank & Bank Stability
Ephemeral	Maintain or restore vegetation to achieve 70% canopy shade in streams less than 10m wide. This will achieve: ▪ moderation of temperature and dissolved oxygen	Eradicate weeds and maintain or restore: ▪ in-stream large woody debris for fish and invertebrates; ▪ native trees, shrubs and ground cover on the	Maintain or restore bed and bank vegetation to minimise erosion during wet weather flows. Manage cattle access to maintain or restore bank stability and bank vegetation

[2] As defined on the most recent 1:100 000 Geoscience Australia topographic map.

Water Type	Riparian Function Ecological Processes	Habitat	Bank & Bank Stability
	extremes; ▪ organic cycling of leaf litter for nutrients and energy; and ▪ transformation of diffuse nitrogen inputs. ▪ Maintain 10 – 15 m buffer from each bank (AS S.3)	banks; and ▪ tree roots to provide stable under-cut banks. This also assists in maintaining biodiversity.	
Gullies	Not Applicable Maintain 10 - 15 m buffer from each bank (AS S.3)	Not Applicable Maintain 10 – 15 m buffer from each bank (AS S.3)	Maintain low vegetation to minimise erosion during wet weather flows

Consideration is also required of the Reef Water Quality Protection Plan (RWQPP) issued by the Great Barrier Marine Parks Authority (GBRMPA). Key objectives of the RWQPP are:

- reduce the load of pollutants from diffuse sources in water entering the Reef; and
- rehabilitating and conserving areas of the reef catchment that have a role in removing water borne pollutants.

Whilst these objectives are not quantitative and are difficult to incorporate as a specific management target they can be incorporated into the overall design philosophy for the proposed development. Draft Interim Marine Water Quality Guidelines have been compiled by GBRMPA but have not yet been released for public comment. Whilst they cannot be incorporated into the development of WQO at this stage their incorporation can be reviewed once fully released to assist in setting WQO consistent with the RWQPP.

Whilst recognising that ephemeral watercourses on the Island are generally dry, water flows do occur during storm events that could transport suspended sediment, nutrients and other potential contaminants from the proposed development to downstream waters such as dams, estuaries and coastal waters. The WQO for estuaries and coastal waters are derived in Section 9, however they require consideration in setting performance objectives for proposed mitigation measures utilising water sensitive urban design (WSUD) treatments as discussed in Section **Error! Reference source not found.**.

While specifying Qld WQG values as WQO at the discharge point of ephemeral watercourses would guarantee that acceptable estuarine concentrations are obtained, such an approach is highly conservative and unrealistic if it is not possible to demonstrate that the objectives can be achieved, even with the latest modelling software and treatment technology (refer to Appendix A7.2).

The Queensland Water Quality Guidelines (2006) state that *'a very important point to note is that although guidelines provide technical input to the development of WQOs or targets,* ***they are not necessarily the same values as the finally adopted WQOs****. The final WQOs take into account social, economic and current condition factors. These may dictate that achieving the actual guideline value is economically or technically unacceptable and that therefore the WQO should be set at some*

less stringent value. Hence the WQOs ultimately adopted might be the same as, or different from, the technical guideline values, depending on community and economic considerations.'

Healthy Waterways utilise load-based objectives recently in their document *WSUD: Developing Design Objectives for Water Sensitive Urban Design in Southeast Queensland* (2006). These require achievement of following objectives when compared to unmitigated urban development:

- an 80% reduction in annual suspended solid loads;
- a 60% reduction in annual Total Phosphorus loads;
- a 45% reduction in annual Total Nitrogen loads, and
- a 90% reduction in annual gross pollutant loads.

Ephemeral watercourses on the Island discharge to estuarine waters of Colosseum Inlet and Boyne Creek that contain a range of EVs and habitat for species of national environmental significance such as dugong (*Dugong dugon*) and green turtle (*Chelonia mydas*) that use seagrass meadows for foraging (refer to Section 14.2). These downstream EVs have been identified as having a high ecological value (HEV) as discussed in Section 9.2. Due to the linkage between Island SMD ecosystems and the downstream estuarine and marine HEV systems, WQO for ephemeral watercourses have the objective of maintaining identified ecological values and resources of estuarine and marine waters in their current condition.

In recognising the importance of minimising impacts from stormwater discharges to HEV estuarine and marine waters WSUD treatments during the design stage will also require the following objectives to be achieved at the point of discharge:

- no increase in export of contaminants compared to existing conditions; and
- the preservation of existing, natural nutrient loads as far as possible.

These objectives are considered to be consistent in protecting the existing conditions in estuarine and marine waters that are protective of identified EVs and world heritage values of these systems. These objectives are also considered to be consistent with the intent of the two RWQPP objectives of reducing pollutant loads from the GBR catchment and conserving areas that have a role in removing waterborne pollutants, i.e. riparian vegetation and intertidal wetlands.

Following initial approval, further refinement of the above WQO in line with the Qld WQG (2006) to establish site specific WQO will be incorporated in future water quality planning. These WQO will be established from the proposed water quality monitoring program and based on the 20th and 80th percentile for each contaminant of concern as outlined in Appendix D of the Qld WQG (2006).

The ongoing development of site specific WQO in conjunction with best practice management measures in mitigation measures is considered to protect the World Heritage Values of the Great Barrier Reef and achieve the objectives of the RWQPP.

8.2.1.6 Existing Water Quality

Previous investigations (Tod Group, 1993) recorded field parameters such as pH and electrical conductivity (EC) for waters from the relict beach ridge system and freshwater dams adjacent the former airstrip at the eastern base of the granodiorite ridge.

Conductivity of water in the ephemeral watercourse west of Northern Headland was recorded by the Tod Group (1993) as 13,650 µS/cm, about one quarter that of seawater and exceeding the WQO. However as this watercourse contains mangrove species it is considered to be more representative of marine or transitional conditions. Such a high conductivity would be appropriate for such waters. A pH value of 7.3 was also recorded for the same area. It was noted by the Tod Group (1993) that the tidal lagoon/creek east of the Northern headland would yield similar conductivities depending on the level of tidal flushing. Physico-chemical water quality of an ephemeral freshwater dam located at the base of the central granodiorite ridge yielded an EC of 120 µS/cm and pH of 5.6. No water quality samples were collected for chemical parameters during the 1993 investigation.

Physico-chemical water quality was assessed by SKM in September and November, 2005. Freshwater was found in only one dam within the lease area, located in an ephemeral watercourse located in a shallow valley dissecting the central granodiorite ridge (W3). Sample location W10 is located in the ephemeral semi-tidal/storm flushed watercourse located in the relict beach ridge system located east of the Northern Headland and sample location W11 is located in an ephemeral dam south at the south of the Island (refer to Figure 8.2). Results of freshwater water quality sampling are presented in Table 8.6.

Table 8.6 – Physico-chemical Water Quality for the Freshwater Dam Sample Location W3

Site	Parameter Unit	Temp. Celsius	Turbidity NTU	ORP mV	pH pH	Clark DO mg/L	Conductivity µS/cm	Salinity PPK
W3	Sept 05	28.9	9.6	-	-	6	149.0	0.08
W3	Nov 05	30.8	2.6	139.3	7.2	4.5	597.7	0.35
WQO		-	20	-	6.5	-	970	-

In general existing dam water complies with WQO outlined in Section 8.2.1.5.

MUSIC modelling was undertaken on the undeveloped and developed cases for contaminant loads in stormwater runoff from the Island (refer to Appendix A7.2). Modelled total discharge loads for key contaminants from ephemeral watercourses on the Island, for the undeveloped case, are presented in Table 8.7.

Table 8.7 – Results of existing WQ condition based on MUSIC Model (Cardno, 2007)

	MUSIC Model Result (mg/l)	QWQG[1] Fresh[2] (mg/l)	QWGG Estuarine[3] (mg/l)	QWQG Marine[4] (mg/l)
Total Suspended Solids	7.67 – 7.98	10	20	10
Phosphorous	0.033 – 0.034	0.05	0.025	0.02
Nitrogen	0.723 – 0.725	0.5	0.3	0.14

[1]Queensland Water Quality Guidelines 2006
[2] Central Coast Queensland Region – Lowland Streams
[3] Central Coast Queensland Region – Mid-Estuarine
[4] Central Coast Queensland Region – Open Coastal

Modelled concentrations of the above contaminants in MUSIC exceed the three QWQG derived WQO. It should be noted that this is a product of the MUSIC model software where previous versions of the MUSIC modelling software were able to achieve the QWQG through the use of a suitably sized treatment train. However, following a software update in 2005 to correct an error in the modelling of bio-retention basins, the new 'background' concentrations used in Version 3.01 of the software are higher than the published water quality objectives. No matter how efficient the modelled treatment train employed, or the number of devices employed, because the lowest input parameters are above current QWQG, modelled outputs will also be above the QWQG.

However, resulting annual loads of nutrients to estuarine and marine waters around the Island estimated by Cardno (2007) are outlined in Table 8.8.

Table 8.8 – MUSIC and SedNet Results for pre-development Conditions for the Island

Potential Pollutant	Undeveloped (existing) case	SedNet (Undeveloped)[1]
Total Suspended Solids	270,000 kg/yr	3,800,000 kg/yr
Total Phosphorous	249 kg/yr	2,200 kg/yr
Total Nitrogen	3,010 kg/yr	8,480 kg/yr

[1]SedNet Results are for Colosseum Inlet only and do not include Boyne Creek, Sandfly Creek or Seven Mile Creek

Existing Contamination Sources

As discussed in Section 1 and indicated in the ecological value assessment, clearing and selective logging carried out for cattle grazing and sleeper logging has changed vegetation on the Island in a number of ways that will affect water quality. Clearing for cattle grazing has consisted of a regular fire regime that reduced new under-storey growth, allowing grasses to dominate. Such clearing can increase the generation of surface sediment during storm events, potentially increasing total suspended sediment (TSS) in ephemeral creek/gully systems draining the central granodiorite ridge. Evidence of continuing erosion on the Islands colluvial plains suggests that land clearing is still creating some erosion issues, however, these watercourses do not always reach adjacent estuarine or marine receiving waters.

Logging carried out in ironbark *E. populnea* areas again thins vegetation potentially which can increase the generation of surface sediment during rainfall events leading to a subsequent increase in TSS as evidenced in some minor erosion and outwash fans.

Potential contamination sources associated with former fuel storage and cattle dip activities exist in the former homestead and cattle yard area. No evidence of contaminant impact in the form of stressed vegetation or surface staining was observed during site inspections conducted by SKM between 2005 and 2007. The relative risk of contamination from these sources to ephemeral watercourse system is considered low due to the covered storage area for fuel and cover over the cattle dip reducing direct contact of rainfall and subsequent surface flow contamination. The low solubility in water and high K_{OC} of DDT and Ethion found in cattle dip soils and residual dip water (refer to Section 5) means the transport of these compounds will be by attachment of fine soil particles. No evidence of soil erosion or mobilisation has been observed in these areas and as such the probability of impact to down gradient receiving waters is considered low.

8.2.2 Groundwater

AGC Woodward Clyde (1993) and Soil Surveys (1983) undertook wide-ranging hydrogeological assessments at the Island as part of previous investigations into potable groundwater supply options for previous development proposals. The only notable groundwater resource identified on the Island was associated with the unconsolidated quartzose dunal sands and marine sediments located in the eastern and western sections of the Island. In both areas aquifer conditions were unconfined with a saturated thickness of less than 10m (typically 1 – 4 m).

As discussed in Section 5, some groundwater dependant ecosystems are present at the break of slope of low hills in the southern areas of the Island. These areas are generally indicated by melaleuca spp. and have been mapped in Section 5. Some groundwater dependant melaleuca spp. have also been observed it the juncture of the colluvial plains and relict beach ridge systems as discussed in Section 8.2.1. No other groundwater dependant ecosystems have been identified during survey of the site (refer to Section 14).

8.2.2.1 Aquifer characteristics

AGC Woodward Clyde (1993) encountered unconfined groundwater approximately 0.5 to 5 m below surface on the eastern and western flanks of the island. Groundwater movement was found to be generally toward the coastline with the water table generally representing a subdued expression of topography. Groundwater recharge occurs primarily through rainfall infiltration with losses likely to be attributable mainly to beach face seepage and evapo-transpiration by vegetation.

The flanks of the central and eastern ridgeline are underlain by residual sandy-clayey soils derived from the underlying Miriam Vale Granodiorite batholith. Whilst no near-surface groundwater resource was associated with these materials there has been no investigation undertaken to-date regarding the aquifer potential of the deeper granodioritic material. Whilst the basement materials may host some groundwater in structural defects (joints, fractures etc) this stratum will not be disturbed as part of the current proposal and further investigation is not considered necessary.

8.2.2.2 Existing uses of groundwater

No abstraction of groundwater is currently carried out on the Island. Current uses of groundwater are considered to be related to maintenance of natural ecosystems and ecological function of groundwater dependant ecosystems and receiving waters of groundwater discharge (where encountered).

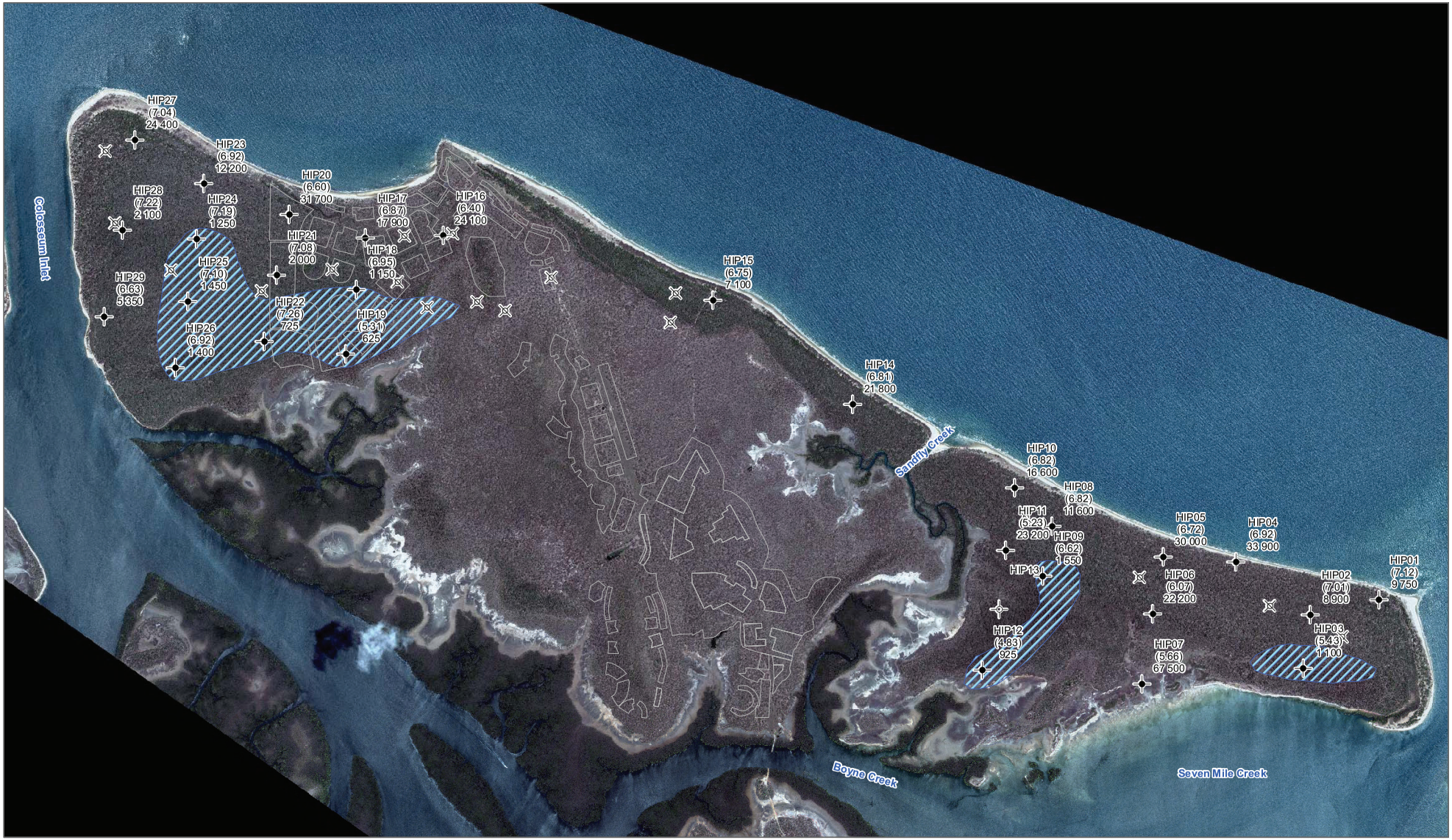
8.2.2.3 Groundwater Environmental Values

Based on the EPP (Water), the EV for groundwater will be reflective of the use of the groundwater at its point of discharge, whether by seepage as base flow to a creek or as abstracted by a well or bore. As such, on the basis that no current water extraction[3] is conducted, groundwater EVs for the Island will be consistent with the surface water to which it reports, such as seepage to beaches and subsequent discharge to marine waters.

8.2.2.4 Groundwater Quality and WQO

Isolated areas of fresh groundwater (<1,500 µS/cm) were encountered by Soils Surveys (1983) Woodward Clyde (1993) within sand areas of the Island; elsewhere on the eastern and western flanks of the Island, groundwater was typically brackish to saline at depth with a slight decrease in salinity noted to occur near-surface due to density stratification. The location of groundwater monitoring bores installed during the above surveys on the Island together with the inferred location of areas hosting fresh groundwater is shown in Figure 8.6.

3 It is noted that groundwater was historically abstracted from the north east beach sand aquifer to a small dam, however the infrastructure associated with this abstraction is now derelict and the dam dry.



LEGEND

- Exploration Bore (previous groundwater resources assessment programme)
- Exploration Bore (with installed piezometer)
- Exploration Bore (with no installed piezometer)
- Indicated Areas of Potable Quality Groundwater (boundaries approx.)-(<u1500 s/cm) Refined from AGC WWC & SS&E data (AGC WWC, 1993)
- Precinct Plan
- (6.63) = pH
- 5350 = Electrical Conductivity

This figure must be read in conjunction with the data disclaimers located at the front of this report . The data acquired for this project is known to be of low spatial resolution and as such no representation or warranties about its accuracy, reliability or suitability are given. Assumptions and conclusions made from this figure and the associated data must be made with full understanding of the data limitations. SKM accepts no liability or responsibility whatsoever for or in respect of any use of or reliance upon the figure and the associated data

Figure 8.6 - Inferred Regions of Fresh Groundwater (<1,500µ S/cm) on Hummock Hill Island

0 0.5 1 2 Km

N W E S

Hummock Hill

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8.3 Surface Water Impacts and Mitigation

8.3.1 Impact Identification – Surface Water

Surface waters on the Island consist of a small number of small man made dams fed by ephemeral watercourses. Only two dams currently contain water. Ephemeral Creeks on the Island consist of dry gullies and small first and second order creeks draining the steep central ridgeline and low lying watercourses located in relict beach ridge swales.

Environmental values of these ephemeral watercourse systems have been identified in Section 8.2.1.4 as being slightly to moderately disturbed (SMD) aquatic ecosystems, visual appreciation values and cultural and spiritual values. World Heritage Values of the GBRMP are also considered for these systems these being limited to rarity and special features.

Ephemeral watercourses on the Island discharge to estuarine waters of Colosseum Inlet and Boyne Creek that contains a range of EVs that provide habitat for species of national environmental significance such as dugong (*Dugong dugon*) and green turtle (*Chelonia mydas*) that use seagrass meadows for foraging (refer to Section 14.2). These downstream EVs have been identified as having a high ecological value (HEV) as discussed in Section 9.2. Due to the linkage between Island SMD ecosystems and the downstream estuarine and marine HEV systems, WQO for ephemeral watercourses have the objective of

Assessment of potential impact has considered the downstream effects of ephemeral watercourse discharges to estuarine and EVs from water quality changes. These EVs

Potential impacts to identified ephemeral watercourses and dams from the proposed development are discussed in the following Sections followed by a summary of potential impacts to riparian habitat, ephemeral watercourses and dams from construction activities and operational activities. These potential impacts will be used to drive subsequent mitigation measures discussed in Section 8.3.2.

8.3.1.1 Riparian Habitat Disturbance

Existing riparian habitat of ephemeral watercourse draining the granodiorite ridgeline and colluvial plains is not representative of water dependant riparian vegetation. Ephemeral watercourses in the relict beach ridge systems of the lease area contain primarily salt marsh habitat. It is noted that whilst the southern most ephemeral watercourse in the relict beach ridge system does contain both marine and limited freshwater riparian vegetation, this area is outside the development footprint and direct habitat disturbance will not occur.

Potential indirect impacts from changes in water flows or chemistry can impact the limited riparian vegetation located within the relict dune systems. Additional inputs of fresh stormwater can impact salt marsh communities located in the western relict beach ridge ephemeral watercourse, changing the community structure. Whilst it is noted that plant communities within this system are representative of saltmarsh conditions, no saltwater input or connection is currently known or observed. Current water inputs to this system are freshwater runoff derived from the headland catchments and northern slopes of Hummock Hill.

Stormwater flows derived from the proposed development following construction are designed to minimise any change from existing conditions as noted in Section 8.3.1.1. Freshwater inputs to the ephemeral watercourse/swale will not change significantly from present conditions. Subsequent changes in the present saltmarsh vegetation communities are not anticipated due to the lack of significant changes in freshwater inflows to this area.

Master planning of the proposed development has recognised the presence of first and second order ephemeral watercourses[4] and has maintained a 10m buffer from each bank as required by AS S.3, S.3.1 outlined in the *Regional Vegetation Management Code: South East Queensland Bioregion*. As such direct disturbance of vegetation (outside culverts and crossings) within the riparian zone will not occur during construction. Maintenance of riparian buffer zones will also provide habitat corridors for terrestrial fauna on the Island as discussed in Section 14.1.2.

Changes to existing ephemeral watercourse alignments, including diversions, are not proposed as part of the proposed development. However, a stormwater outlet structure will be required to allow discharge to North Beach during large storm events (Cardno, 2007). Stormwater below this storm range will infiltrate as per current natural conditions (refer to Section 8.2.2.1). One way gates will be installed on such outlets to eliminate ingress of seawater during high tides.

Excavation within ephemeral watercourses, outside that required for installation of crossings and culverts is not intended in any identified watercourse. Crossings and culverts will be required as part of the proposed development to provide safe access across ephemeral watercourses and drainage lines. Relevant permits (refer to Section 2) will be sought (if required) for construction activities associated with crossings and culverts of first and second order ephemeral watercourses. Proposed watercourse crossings will be designed by a suitably qualified person in accordance with the *Road Drainage Design Manual (Qld Department of Main Roads, 2002)*.

As part of the design process terrestrial fauna passage will be included in all culverts where considered appropriate to allow movement down watercourses and maintain fauna passage along riparian corridors. Inclusion of fish passage features is not considered a requirement for proposed culverts and crossings on Hummock Hill Island for the following reasons:

- Ephemeral watercourses draining the south eastern side of the central ridge have no connectivity with permanent or semi-permanent water. As such suitable habitat or refuge for fish species will not be required; and
- The hydrodynamics of ephemeral watercourses are such that water flows are very short in duration, typical channel length being less than 1 km, with very rapid flushing of water from the system. Again conditions not conducive to maintaining suitable fish habitat.

[4] As defined on the most recent 1:100 Geoscience Australia topographic map.

Two ephemeral watercourses currently cross Clarks Road and have existing culverts to allow drainage. These crossings will be upgraded in accordance with Queensland Transport requirements as part of initial infrastructure works.

Riparian habitat is noted to be important in the attenuation of potential pollutants derived from diffuse sources such as fertilisers and pesticides and also in attenuating and transforming contaminants. Their role is important in protecting downstream EVs and WHV of the estuaries and GBR WHA (refer to Section 9.2). Maintenance of riparian vegetation will assist in removing potential contaminants from surface water runoff, reducing contaminant loads reaching the watercourse as required under the GBR WQPP. For example emergent macrophytes (such as Baumea spp. and Juncus spp) can uptake heavy metal compounds within their structure, in stream bacteria and biota can transform and breakdown organic contaminants such as hydrocarbons and some pesticides. Proposed mitigation measures and associated performance targets to minimise potential impacts are outlined in Section 8.3.2.

8.3.1.2 Hydraulic Characteristics Disturbance

Construction of the proposed development will involve the staged clearing of vegetation. Clearing of vegetation during construction reduces the amount of vegetation that intercepts rainfall. Tall vegetation intercepts raindrops and reduces the erosion potential from rainfall impact. Lower vegetation such as grasses and shrubs also impedes water flow travelling across the soil surface slowing down flows and reducing potential erosion. Clearing of vegetation during construction can increase raindrop impact on soils, generate greater quantities of stormwater, greater surface water velocities and subsequently a greater capacity to erode soils and transport this material to downstream reaches or receiving waters potentially impacting both EVs within watercourses and receiving waters if not mitigated.

Construction of watercourse crossings and culverts can also impact flows within watercourses. Water flowing through such structures can speed up leading to scouring and erosion downstream of the construction if not designed to maintain existing flow rates. In severe cases erosion can undermine the crossing structure leading to failure. Correct design of such structures is important to minimise changes to water velocity and flows and maintain water velocities below that which can erode the bed.

Potential changes to watercourse hydraulics and flows can lead to downstream water quality impacts within receiving waters such as Colosseum Inlet and Boyne Creek unless mitigated. Associated water quality impacts issues associated with increased stormwater flows are discussed further in Sections 8.3.1.3 and 8.3.1.4. The overall mechanism for potential impacts due to water quality changes is water velocity. Reducing water velocity both from surface runoff is key to also controlling downstream changes to water quality and subsequent potential impacts to identified EVs both within the watercourse and receiving waters.

Mitigation of stormwater flows during construction will be through the development and implementation of a site specific *Erosion and Sediment Control Plan* (ESCP). The ESCP will assess potential stormwater generation and associated erosion and sedimentation associated with the high medium and high risk soils outlined in Table 8.12 during proposed construction activities.

Implementation of the site specific ESCP will be in accordance with the *Soil Erosion and Sediment Control Guidelines – Engineering Guidelines for Queensland Construction Sites* (IEAust (Qld) 1996) and will designed around the following objectives:

- Minimisation of vegetation and soil disturbance during construction;
- Drainage control from cleared areas;
- Erosion control of exposed surfaces;
- Sediment control; and
- Revegetation of cleared areas to re-establish ground cover.

An additional objective of the site specific ESCP will be compliance with WQO and Guidelines for ephemeral watercourses noted in Section 8.2.1.5 and Table 8.5 and protection of identified EVs. Proposed ESCP objectives will also be required to provide control treatments and devices that reduce water quality impacts on downstream receiving estuarine and marine waters in particular maintaining water quality within current and future WQO for each contaminant of concern at proposed reference sites within the estuary as discussed further in Section 9.

As part of the Site Specific ESCP for proposed construction activities, assessment of stormwater generation will be conducted with the aim of minimising stormwater generation and subsequent flows above existing conditions. A range of construction stormwater generation treatments will be used to minimise and control stormwater generation in line with the ESCP objectives outlined above. Proposed treatments within the site specific ESCP will include but not be limited to:

- Mulching to reduce raindrop impact;
- Surface roughening to reduce overland flow velocities;
- Diversion drains to capture surface water before it concentrates and erodes soil; and
- Detention basins to capture and slowly release water to reduce changes in flows discharged to watercourses.

Incorporation of the above and additional best practice treatments during construction of the proposed development will be effective at minimising impacts to identified EVs of watercourses on the Island and to downstream receiving waters such as Boyne Creek. Specific estimates of such reductions are provided in the following Sections.

Subsequent monitoring in accordance with the ESCP and water quality monitoring plan will be conducted to assess the efficacy of proposed treatments in reducing flows and subsequent erosion and sedimentation within watercourses and receiving waters. Monitoring will conducted in accordance with both the ESCP and water quality monitoring component of the ESCP.

Following construction a range of impermeable surfaces ranging from roads, pavements, parking areas etc, will be introduced that will increase the generation of stormwater by between 28 and 56% (refer to Table 8.9). Storm water drainage from developed precincts will be directed to

current ephemeral watercourses (as per condition C381 of the SL). Initial water flow estimations from sub-catchments pre and post development are outlined in Table 8.9 below and present the unmitigated changes in peak flows post development.

Cardno (2007) predict Q_{100} flows for most existing catchments on the Island to increase by around 30%, and flows in the Town Centre precinct to increase by 56% (due to the greater area of impermeable surface coverage). If unmitigated such increased flows can lead to greater erosion and subsequent transport of greater quantities of suspended sediments and nutrients to downstream receiving estuarine and marine waters (refer to Section 9). Water quality issues are discussed in Section 8.3.1.3.

Table 8.9 – Modelled Stormwater Flows – Existing and Developed (Cardno, 2007)

Zone	Peak flow Q_{100} (m^3/s)		
	Pre Development	Post Development	Unmitigated % change in flow[a]
Lagoon	39.79	51.85	+30
Bay	3.31	4.26	+28
Town Centre	10.71	16.74	+56
Headland	9.23	12.5	+36
Hummock Hill	12.63	16.23	+29
Boyne E	14.05	18.55	+32
Boyne W	10.17	13.43	+32
Boyne Hill	9.92	12.76	+29

a - unmitigated % change

During operation mitigation of increased stormwater flows originating from all rainfall events of up to the 100-year recurrence interval will be attenuated close to the source, and released in a controlled manner which will resemble the natural drainage rates and pathways existing before development. Attenuation close to the source of watercourses means that stormwater systems can be installed in stages as the development progresses, reducing subsequent impacts to EVs.

Attenuation will be achieved by using treatment devices, including bioretention basins and swales and permeable pavements, will ensure that flows are mitigated in all storms of up to the three-month recurrence interval (in urban areas, the three-month flows account for approximately 90% of the mean annual runoff). A range of suitable stormwater control devices was assessed (refer Appendix A7.2) for the proposed development and assessed for efficacy in achieving desired WQO. Table 8.10 outlines preferred stormwater control techniques selected for the development as most appropriate for the proposed Hummock Hill Island Development, based on achievement of both quality and quantity targets.

Table 8.10 – Summary of Stormwater Drainage Control Methods (Cardno, 2007)

Device	Description	Function
Bioretention Devices	Combine a grass or vegetated swale with an infiltration trench. Usually on flatter ground, but can be incorporated into steeper areas using terracing or stepped systems. May be located within a retention basin.	Remove high proportion of sediment and nutrients from stormwater Mimic natural infiltration Slow down flow.
Swales (grassed or vegetated)	Broad drains lined with grass or other vegetation, typically along the edges of roads or following contours.	Slow and direct flow but also remove sediment and nutrients in lower rainfall events. Aesthetically pleasing compared to concrete drains. Grass cover avoids erosion of drainage lines. Effective on relatively flat slopes or when following contours.
Porous Pavements	Pervious surfaces which allow stormwater to penetrate may be underlain by storage zones or allow natural infiltration. Used under paved areas, footpaths, cycleways and lightly trafficked roads.	Effective in capturing stormwater from areas such as public spaces, footpaths, cycle ways, thus avoiding concentrated flows from these features. Allow collected stormwater to be treated before direction to surface flow systems.
Rainwater tanks	Household level and for hotels and commercial buildings.	Captured roof water counters the effects of decreased stormwater infiltration due to impermeable surfaces which otherwise tends to increase stormwater flows in developed areas. Integrates with water supply system (refer Section 3.4.1.4). Have some effect in reducing nitrogen levels in runoff.
Ponds and wetlands	Constructed pond and wetland systems located within the golf course (golf course ponds will also contain recycled water for irrigation).	Attenuate quantity of stormwater flow. Polish stormwater quality, removing sediment and nutrients. Store irrigation water for use across the site. Provide for public amenity and wildlife habitat.

As discussed in Section 3 and Appendix A7.2, proposed stormwater flow mitigation within development zones will utilise a range of potential treatments. These treatments will be incorporated to minimise changes to existing ephemeral creek hydrodynamics. Proposed treatment measures for development sub-areas are summarised in Table 8.11.

Table 8.11 – Proposed WSUD features for Hummock Hill Island

Zone	Area (ha)	Description Existing	Description Proposed	Drainage Existing	Drainage Proposed
Lagoon	98.29	North-western relict beach ridge system. Undulating low dunes and beach ridges with swale depressions. Sandy soils with high infiltration rates. Dense scrub, large emergent trees.	Low-density residential plots of 'Bushland', 'Eco Homesites' & 'Lakeside Villas', with an area of higher-density Town houses. Includes large lake/wetland, tourist park and camping ground.	Few defined drainage pathways due to very high infiltration rates and flat topography. Two lead eastwards towards Town zone, before joining head of ephemeral watercourse.	Treatment swales along roads feed to central ornamental lakes for storage. New outflow channel (in wider emergency spillway) leads north to join the stream at North Beach outlet.
Bay	8.18	Sandy soils with high infiltration rates	Beachfront Holiday Homes, positioned along a cul-de-sac located between the beach and the stream.	Defined drainage channel (dry on inspection), leads westwards to discharge via North Beach.	Central road treatment swale to discharge at head of stream, or at points along it. Storm storage contained within treatment swale construction.
Town	26.45	Dense scrub, large emergent trees	Dense focal point of development. Commercial Town Centre includes Resort Hotel, Conference Centre & Motel, and Education Centre.	Lagoon channel enters zone before turning north to discharge into North Beach Stream. Zone dished, lower in centre; falls towards beach to north.	North of zone to feed to new North Beach outlet. South of zone to be drained to new channel to connect with existing, leading SW to estuary. Storm storage in basins on site.
Headland	22.79	Central portion of Island formed on Miriam Vale Granodiorite. Steep hills along island spine have shallow rocky soils with rock outcrops and boulders. Surrounding areas more gently undulating, with sandy loams over sandy clays.	Mid-density residential area: Seaside Cottages, Beachfront Holiday Homes and a Resort Hotel	None surveyed. Drainage channel appears at NE base of steep slope, but is out of bounds. Zone slopes from headland crest SW towards town, and from southern knoll SW towards estuary.	North of zone to connect with town drainage and out to Rodds Bay. South area drains to proposed channel described above, out to estuary to south. Storm storage in basins in Town Zone. Emergency flows from Town and Headland routed to south.
Hummock Hill	31.19	Differing infiltration rates lead to seepage outflow zones on slopes, the presence of melaleuca stands, and a risk of erosion. Eucalypt	Low-density housing located along ridge-top road, and Hillside Terraces units along main island arterial road, opposite airstrip.	Many drainage pathways surveyed in steep valleys on western face of hill (leading direct to estuary), fewer on east (leading to level ground).	Two treatment swales along peak and airstrip roads to drain south to discharge in reservoir, which will also provide storm storage. Emergency storm drainage

Zone	Area (ha)	Description Existing	Description Proposed	Drainage Existing	Drainage Proposed
		woodland.		Reservoir to south.	routes exist direct down hill sides on both sides.
Boyne Hill	24.5	Differing infiltration rates lead to seepage outflow zones on slopes, the presence of melaleuca stands and risk of erosion	Low-density housing lots located on a road loop on the slopes of Boyne hill.	Hill forms promontory in estuary: drainage pathways appear on all sides, straight down steep slopes. Reservoir to north.	Flows via two treatment swales on each side of hill, leading north to reservoir (also for storm storage). Emergency spillways to match existing channels.
Boyne East and West	34.7 and 25.13	Eucalypt woodland	Apartments and low density homesites, located along the main island arterial road, serving the golf course to each side. Zone includes a village centre with marine services.	Zone positioned on 5 interlinking ridges. In north, established route leads south from western slopes to estuary. In south, several small streams fall from steep slopes of knoll.	Areas to supply adjacent golf course ponds; overflows to existing channels. Southern knoll drained direct to estuary with onsite detention.

The design requirements for proposed treatments outlined in Table 8.10 and Table 8.11 are conservative and include a safety factor that would incorporate any potential storm flow changes associated with climate change. Resulting flow rates after application of WSUD flow treatments results in no net change at the watercourse discharge points to adjacent estuarine waters. MUSIC modelling was also conducted on flows prior to entry into existing dams within southern watercourses. These dams will act as a further stage of stormwater retention and water quality treatment, prior to stormwater discharge to downstream receiving estuarine and marine waters.

As part of the proposed WSUD mitigation and to provide aesthetic water features a number of permanent stormwater basins are also proposed within the Lakeside Villas and Golf Course precincts. Stormwater basins will be designed to contain and/or ameliorate up to Q_{100} design flows from upstream catchments in accordance with design criteria specified in Section 3 and Appendix A7.2.

In the case of the Lagoon Villas (ref. 30 on Figure 3.3), storm flows will be combined and routed to supply the planned water feature in the centre of the zone (shown on the Master Plan as having an area in excess of 60,000 m2 and likely to be around 2 metres deep). The lagoon system will be supplied by lot runoff, but is not intended to be part of the WSUD treatment train: each lot will have its own devices to ensure adequate nutrient removal before release. This approach will also alleviate eutrophication problems in the lake. Each lot will attenuate flows in-situ for storm events

up to the three-month duration, but the lake will serve as storm storage for larger events up to the 100 years occurrence interval.

Storm water basins within the golf course will be used to collect flows within the golf course and from adjacent developed areas. Proposed storm water basins will be designed to contain up to a Q100 event and will release water with minimal changes to existing water flows within downstream ephemeral watercourses.

Design of the storm water basins will reference applicable design standards designated in *Healthy Water Sensitive Urban Design Technical Guidelines for South East Queensland* (2006) and any other relevant documents.

Application and incorporation of WSUD treatments within the proposed development will mitigate stormwater flows from the proposed development to slightly less than pre-construction conditions. Changes to the length of time ephemeral watercourses flow following a storm event are likely to be greater as retention basins discharge stored water. The management of stormwater flows from the site during both construction and operation has a cumulative benefit of reducing suspended sediments and reducing nutrients as discussed in the following sections.

8.3.1.3 Water Quality - Suspended Sediments

As discussed above, construction activities can impact the identified environmental values of ephemeral watercourses due to increased water flows from cleared lots or sealed areas unless mitigated. Increased water velocity both across land and in watercourses leads to greater erosion and subsequently suspended sediment within watercourses. Increased suspended sediment increases turbidity and reduces the amount of light available to aquatic plants within receiving waters such as the dams, estuarine and coastal receiving waters, impacting their growth and viability.

Ephemeral watercourses located within the proposed development areas on the Island discharge either to salt-flats and subsequently the mangrove fringe within Colosseum Inlet and Boyne Creek, or frontal sand beaches as shown in Figure 8.2. Existing high-volume water flows during storms transport and deposit sediment and organic matter to the adjacent saltpan, mangrove and estuarine fringe where they are part of the natural sediment and nutrient cycles.

Modelling of Colosseum Inlet by CSIRO (SedNet) derives an annual fine sediment load of 3,800 tonnes per annum or around 260 $mg/cm^2/day$, based on a water and intertidal flat area of 85.65 km^2 (derived from OzEstuaries Database). Sediment loads within estuaries are naturally positively correlated with local catchment rainfall and adjacent watercourse flows, and hence it is likely that the majority of annual sediment load will be delivered to the adjacent estuarine system during large storm events. This is a natural cycle and is important for the function of estuarine systems delivering sediment and nutrients and food to coastal ecosystems and the estuarine food web.

A number of soils identified in Section 5 are considered as having a moderate to high erosion risk. Where these soils occur within the development precincts they will require particular attention

during development of the site specific ESCP prior to construction activities commencing. These areas are identified in Table 8.12.

Table 8.12 – Medium and High Erosion Risk Soils and Relevant Precinct

Soil Type	Erosion Risk	Development Precinct
Pzm1	High erosion risk due to sandy hardsetting surface and sodic B horizon.	Cross Island Boulevard, Airstrip, Commercial and Social Hub, Headland residential
Pzm3	High erosion risk due to sandy hardsetting surface and sodic B horizon.	Golf Course and Golf Course Villas
Pzm4	Relatively stable surface but high erosion risk due to high slope.	Ridge top housing
Czs1	High erosion risk due to sandy hardsetting surface and sodic B horizon.	Waste Water and Treatment Plant
Czs2	High risk of gully erosion	Airstrip runway

Increased sedimentation can negatively impact EVs of ephemeral watercourses identified in Section 8.2.1.4 if not mitigated. The "*Prohibition on build-up of sediment in a gutter, drain or water*" (including beds and banks of ephemeral watercourses) is a requirement of Section 32 of the EPP (Water), this Policy recognising the need to protect waters from potential sedimentation effects associated with stormwater. Achievement of this requirement will be through the development of a site specific erosion and sediment control plan as discussed in Section 3 and Section 8.3.1.2.

Due to the phased nature of the development, large expanses of soil disturbance and land clearing at any single time will not occur. Initial construction works for infrastructure will be limited to infrastructure such as roads, bridge, gas, water and sewage reticulation. Clearing for such infrastructure will be limited to a relatively narrow corridor. Later stages of clearing will also be relatively small in scale and limited to building and landscaping footprints.

Subsequently the scale of any potential impacts from increased sediment loads associated with construction works will be relatively small, this together with the relatively low rainfall within the area of around 1000 mm per year also reduces the frequency that such events can occur. The seasonal nature of rainfall in the area increases erosion and sedimentation risk during the summer period when rainfall is greatest.

Mitigation of any potential impacts from increased suspended sediments will be through the implementation of a site specific ESCP for initial infrastructure phases and subsequent development phases. The proposed plan will be developed by a suitably qualified engineer in accordance with the *Soil Erosion and Sediment Control Engineering Guidelines for Queensland Construction Sites (IEAust, 1996)* or subsequent revisions. Design of temporary erosion and sediment control measures will be required to be of sufficient nature and capacity to achieve requirements of the EPP(Water) ephemeral watercourse WQO and WQO of receiving estuarine and marine waters (refer to Section 9).

The use of erosion and sediment control treatments outlined in Table 3.13 will be effective in reducing sediment loads within ephemeral watercourses both during construction and operation phases of the development. Due to the phased nature of the proposed development over the 15 year period both temporary and permanent mitigation measures will be occurring at the same time. Integration of both temporary ESCP and permanent treatments will be essential to minimise impacts from suspended sediments.

MUSIC modelling by Cardno (2007) demonstrate that proposed permanent stormwater treatment controls reduce the annual suspended solids loads from ephemeral watercourses by 14% prior to discharge to receiving estuarine and marine waters (refer to Table 8.13). An important assumption in this modelling is the exclusion of existing dams in modelling. As such further reductions in TSS loads will be likely prior to discharge to estuarine and marine waters. A discussion of potential impacts and mitigation on marine waters is provided in Section 9.

Table 8.13 – MUSIC Results for pre-development and post-development TSS

Potential Pollutant	Undeveloped (existing) case	Developed case	Reduced by
Total Suspended Solids	270,000 kg/yr	231,850 kg/yr	-38,150 kg/yr (-14.1%)

Mitigation of suspended sediment loads utilising WSUD features will minimise potential impacts to identified EVs within ephemeral watercourses and will also minimise any change to downstream receiving waters and their EVs. Proposed WQO for WSUD treatments are calculated prior to be achieved prior to entry into estuarine and marine receiving waters.

8.3.1.4 Water Quality - Nutrients

Watercourses transport nutrients in a number of forms:

- As free dissolved ions such as ammonium (NH_4^+), nitrate (NO_3^-) and phosphate (PO_4^{3-});
- As part of dissolved organic compounds; and/or
- In suspended particulate matter such as soils and detritus (after Furnas, 2003).

Nutrients, in both particulate and dissolved forms, are essential for the maintenance of aquatic ecosystems around Hummock Hill Island. Potential nutrient release during construction activities can be in the form of both dissolved and particulate nitrogen (N) and phosphorus (P). Primary sources of particulate N and P can be derived from cleared vegetation and soils that is transported to ephemeral watercourses during rain events and eventually to the estuary and marine environment. Some of this particulate material may be biologically available following rapid mineralization within the water column of estuarine and marine waters.

Current nutrient loads from terrestrial runoff to Colosseum Inlet are estimated by SedNet[5] as:

- Dissolved Phosphorous = 0.20 tonnes/year;
- Fine Sediment Phosphorous = 2.00 tonnes/year;
- Dissolved Nitrogen = 4.28 tonnes/year; and
- Fine Sediment Nitrogen = 4.20 tonnes/year.

These inputs are likely to be associated primarily with periods of high runoff and discharge from watercourses. MUSIC modelling conducted by Cardno (2007) estimates current annual nutrient loads from the Island[6] to be:

- Total Phosphorous = 0.249 tonnes/year (11% of total SedNet total); and
- Total Nitrogen = 3.01 tonnes/year (35.5% of SedNet total).

Potential impacts to identified EVs of ephemeral watercourses from uncontrolled nutrient inputs can be excessive riparian plant growth that clogs the watercourse, reducing the efficiency of the channel to transport water. Where ephemeral waters discharge to permanent water such as downstream dams, increased nutrients can lead to excessive algal growth and eutrophication issues. Where nutrients in stormwater from ephemeral creeks discharge to estuarine and marine disruption of the normal nutrient dynamics of these systems can be impacted and also the identified EVs (refer to Section 9).

Potential uncontrolled nutrient inputs during construction and operational activities for the proposed development are likely to include:

- Particulate nutrients associated with eroded sediments, mulch and detritus;
- Artificial nutrients from establishment of public areas in both dissolved and particulate form;
- Emergency discharges associated with the proposed waste water treatment plant; and
- Domestic animal waste.

The phased construction of the proposed development over a 15 year period will entail limited clearing of vegetation or exposure of erodible soils that may transport nutrients at any particular time. For example the lagoon zone has an area of 98 ha and consists of 13 blocks of housing (refer to Section 3.3.3). The area of these blocks will range from approximately 4 ha to 12 ha, however, clearing of vegetation and disturbance of soils will be limited to 50% of each lot (as a requirement of the Plan of Development (refer to Appendix A2)). Consequently large areas of soil disturbance at

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[5] SedNet is a CSIRO modelling package that estimates sediment and nutrient loads within GBRMP catchments.

[6] Note that SedNet data is for Colosseum Inlet only. Music modelling is for the entire Island.

any particular time will not occur. Such a phased development will minimise the scale of potential impacts from stormwater nutrient impacts on identified ephemeral watercourse and receiving water EVs and associated WHV..

Particulate Nutrients

Erosion and sediment control measures required to control suspended sediments will also be effective at removing nutrients associated with particulate nutrients associated with sediments and vegetation. The proposed site specific ESCP will use treatments, as described in Section 8.3.1.3, that will reduce initial sediment generation and associated particulate nutrients, control nutrient transport and reduce nutrient loads within stormwater prior to release to existing watercourses, downstream dams and receiving estuarine and marine waters.

Proposed mitigation measures for each ephemeral watercourse catchment within the proposed development are provided in Table 3.14 and will include features such as permeable paving, grassed swales, bioretention basins and detention basins. MUSIC modelling conducted as part of WSUD (Cardno, 2007) has estimated an overall reduction to be between -3.6% for total phosphorous and -0.6% for total nitrogen in discharged stormwater (refer to Table 8.15). These reductions are predicted prior to entry into existing dams for catchments draining the southern section of the development. Further reductions will occur within these “natural” detention basins prior to release to estuarine receiving waters in Boyne Creek.

Incorporation of the proposed treatment trains and resulting loads of phosphorous and nitrates are designed to achieve minimal change to existing conditions within estuarine and marine receiving waters. Whilst a slight reduction in loads is predicted by MUSIC modelling, achievement of WQO for these waters can be achieved and EVs of estuarine and marine receiving waters achieved as noted in Section 9.

Dissolved Nutrients

Uncontrolled releases of nutrients to ephemeral watercourses and subsequently downstream estuarine and marine receiving waters may exceed the natural variation present in the Colosseum Inlet, Boyne Creek and Seven Mile Creek system. Such inputs can lead to changes to the natural nutrient dynamics of the estuarine system that can impact on identified EVs (refer to Section 9) as discussed above.

Landscaping, establishment of playing fields, parks and the wild golf course will require intermittent applications of supplementary fertiliser to aid turf growth particularly during establishment. Some nutrient input from recycled irrigation water will occur reducing the requirement for supplementary fertiliser application. Table 3.11 notes that typical nitrogen content of recycled water will be less than 4 mg/l and 0.2 mg/l for phosphorous. Being in a dissolved form these nutrients will be rapidly taken up by plants reducing subsequent loads to ephemeral watercourses on the Island.

Typically fertilisers contain organic nitrogen compounds (NOx and NH3), phosphorus and minerals such as potassium which boost turf growth. The AGSCA[7] (2001) notes that nutrients in surface runoff is a potential transport mechanism of nutrients from managed turf areas such as golf courses. Trials by Douglas et al, (1995) on a turfed sloping site (9-11% slope) with a nitrogen application rate of 4 kg/N/m2/year and subject to an irrigation rate of 150 mm/hr revealed little or no movement of nitrogen in stormwater.

Mitigation of potential nutrient inputs from surface runoff and nutrient sources will be achieved utilising WSUD principles such as grassed swales, bioretention swales, bioretention basins and sedimentation basins. Table 8.14 presents typical contaminant removal efficiencies of WSUD features as reported in the *Draft Water Sensitive Urban Design Engineering Guidelines: Stormwater (Healthy Waterways, 2006)*.

Table 8.14 – WSUD Contaminant Removal Performance (after BCC, 2005)

WSUD Feature	Suspended Solids	Total Phosphorous	Total Nitrogen
Grassed Swales	90 %	60 %	15 %
Bioretention Swales	90 %	80 %	50 %
Sedimentation Basins	NA	NA	NA
Bioretention Basins	90 %	50 %	80 %
Constructed Wetland	70 %	60 %	35 %

NA= no removal performance figure available
Note: removal performance is based on WSUD feature surface area being 3 % of catchment area

Stormwater control features outlined in Table 8.14 are proposed to be used in sequence (treatment trains) to provide an integrated approach to stormwater treatment tailored for each precinct within the proposed development. Greater efficiencies of contaminant removal may be achieved by using treatment trains as outlined in Appendix A7.2.

Within these proposed treatment trains uptake of dissolved nutrients will occur firstly in grassed swales used as part of both construction ESCP and WSUD treatments. Further nutrient removal will occur in bioretention basins, reducing loads in stormwater and subsequent downstream discharges to dams and/or estuarine and marine receiving waters. Table 8.15 presents the modelled nutrient loads in stormwater discharged to dam, estuarine and marine receiving waters before and after development.

Table 8.15 – MUSIC Results for pre-development and post-development Stormwater Quality

Potential Pollutant	Undeveloped (existing) case	Developed case	Reduced by
Total Phosphorous	249 kg/yr	240 kg/yr	-9 kg/yr (-3.6%)
Total Nitrogen	3,010 kg/yr	2,992 kg/yr	-18 kg/yr (0.6%)

[7] Australian Golf Course Superintendents Association

Whilst proposed WSUD treatments will reduce nutrient loads as modelled, source control will also be used for nutrient management. The correct management and application of nutrients to turfed areas during the construction of the proposed development will be essential to minimise impacts to EVs of ephemeral watercourses and estuarine and marine receiving waters.

The development of a Golf Course/Turf Management Plan in line with the AGCSA (2001) will incorporate management principles such as:

- Design of the course to include bioretention basins to "process" stormwater nutrient loads prior to release to existing drainage lines and ephemeral watercourses;
- The use of in ground sensors to assess soil moisture and nutrients to manage recycled water application rates;
- Management of fertiliser use, limiting fertiliser applications, use of slow release natural organic fertilisers, application of fertiliser during forecast dry weather only; and
- Management of the course as a "wild" course retaining and utilising native vegetation to the maximum extent, limiting recycled water application to that available.

Incorporation of the above management principles together with developing practices on similar courses within the GBRWHA will control potential nutrient inputs at the source and provide in-stream treatment/mitigation measures to ensure that receiving water WQO are achieved and potential impacts to identified EVs minimised.

WWTP Emergency Discharge Nutrients

As discussed in Section 3.4.1 the proposed sewage treatment plant will be sized to cater for an ADWF of 1.0 ML/d (includes a 20% additional safety factor) with additional storage provided to handle up to 3 times ADWF. Flows greater than 3 times ADWF (3 days storage) will require an emergency outlet. The emergency outlet is located in an ephemeral watercourse that discharges to Colosseum Inlet via intertidal wetlands and mangroves.

Release of untreated sewage can introduce nutrients to the ephemeral watercourse below the outlet and subsequently to estuarine and marine receiving waters where impacts to the receiving environment can occur. Such releases can cause sudden algal blooms, reduce dissolved oxygen content and produce eutrophication in receiving waters impacting identified EVs. Further discussion of these potential impacts may be found in Section 9. Potential impacts to ephemeral watercourses can be degradation in scenic and aesthetic amenity due to the presence of untreated sewage and excessive plant riparian and in-stream plant growth (where present).

Emergency outflows can occur due to:

- Plant failure due to mechanical breakdown; or
- Extreme weather events that increase ADWF above the design capacity.

Both these events occur very infrequently, less than once in every 5 to 10 years. The proposed treatment system will consist of two 500kL capacity stages. This reduces the risk of overflow from mechanical breakdown. In the event of a breakdown, wet weather storage will be used to store wastewater. The second treatment system will then continue to treat stored wastewater eliminating the requirement to use the emergency discharge. The duplicate plant will be able to "catch up" overnight when wastewater flows are lower.

In the unlikely event that both plants are malfunctioning or one plant is unavailable for an extended period of time, tanker trucks will remove untreated sewage from the wet weather storage for treatment and disposal at mainland facilities operated by Calliope Shire Council or Gladstone City Council. As such use of the emergency release due to mechanical breakdown will be minimised.

Extreme weather events such as large storms can introduce additional fresh water into the sewer system and subsequently exceed the design capacity of the system. Typically such events are associated with large cyclones, which are relatively rare in the Gladstone region (refer to Section 7) and tend to occur over a short duration.

The proposed treatment system incorporates a 3 day storage to store untreated sewage in such events, reducing the requirement for use of the emergency overflow. In the event that overflows do occur during such large events further mitigation/amelioration will occur through dilution within the large flows that will occur within ephemeral watercourses. When introduced into the estuarine system under such storm conditions the resulting overflow will be further diluted and rapidly dispersed to the ocean from tidal flushing and large water flows through the estuary from larger watercourses from the mainland.

Subsequent impacts to identified EVs from emergency overflows in such conditions will be of a short duration and ameliorated intensity and provide a small contribution of nutrient loads to estuarine and marine waters when combined with river flows under such conditions.

Nutrients – Domestic Animals

Nutrient inputs from domestic pet waste and particularly dogs are recognised as a potential nutrient source within watercourse catchments. A small feral dog (or dingo) population currently exists on the Island (refer to Section 14). It is anticipated that visitors and residents of the proposed development will own dogs. The release of nutrients from the decay of pet waste can promote weed and algae growth, limiting light penetration in receiving waters and the growth of aquatic vegetation. This in turn can reduce oxygen levels in stormwater, affecting fish and other aquatic organisms.

Whilst such sources of nutrients from are relatively minor mitigation can be achieved through the following measures:

- Awareness and education signage to alert residents to the proper disposal techniques for pet droppings;
- Establishment of off-leash areas for dogs in public spaces, parks or portions of parks with provisions for proper disposal of dog faeces; and

- Siting and design of these areas to address stormwater runoff to minimise transport to ephemeral watercourses.

Incorporation of these mitigation measures will be effective in minimising potential nutrient impacts to identified EVs of ephemeral watercourses, dams, estuarine and coastal receiving waters.

8.3.1.5 Water Quality - Litter

During initial construction of the proposed development a peak workforce of around 350 people will be present on the Island. This will reduce as initial construction of infrastructure is completed and subsequent phased development takes place for tourist infrastructure and community facilities over the 15 year development period (refer to Section 3).

Potentially litter from construction activities including mobile litter such as paper and plastic food and drink wrappers and less mobile containers and off-cuts such as lumber may find their way into the ephemeral watercourses. Whilst paper and plastic may not have a direct chemical impact on organisms, the presence of litter within ephemeral watercourses and subsequently Colosseum Inlet and Boyne Creek will degrade the visual amenity, aesthetic values and potentially ecological EVs of if not mitigated.

Proposed site specific ESCP and WSUD treatments during the phased development will capture and eliminate litter transported via ephemeral watercourses. Music modelling of proposed WSUD treatments proposed for the Island as outlined in Table 8.10 effectively reduces litter (Gross Pollutants) loads to 0. Potential impacts from litter in ephemeral watercourses being transported to estuarine and marine receiving waters and their EVs are minimised. Despite such treatments public education signage will also be incorporated into the phased development together with new treatment concepts to further reduce the potential for impacts.

8.3.1.6 Water Quality – Road Runoff

Stormwater from roads and pavements can carry contaminants such as hydrocarbons and metals from vehicles, to receiving waters. Generally the majority of these contaminants are transported in the “first flush”, the initial discharge of water that picks up detritus and sediment from the roads and transports it in the initial road runoff water. Contaminants are generally in particulate form from deposited exhaust fumes, tyre wear and hydrocarbons.

Investigations of road stormwater toxicity in the US (Kayhanian et. al., 2007) found that 90% of the toxicity of road runoff was encountered in the first 30% of the storm duration. They found that toxicity within the first flush was primarily caused by copper and zinc. When transported downstream in first flush waters, these contaminants can affect receiving waters such as the dams and estuaries of the Island. Contaminants can be deposited into sediments where they can impact bottom dwelling fauna or move into solution and impact fish or be taken up by plants potentially impacting these EVs.

As contaminants are generally bound to sediments, WSUD treatments that control suspended solids, such as bioretention basins and detention basins are also effective at reducing sediment bound

contaminants as well. Proposed WSUD treatments for the Island will reduce the potential impacts of road runoff contaminants bound to sediment and minimise impacts to downstream EVs, such as estuarine waters and associated fauna and flora.

8.3.1.7 Water Quality - Pesticides and Herbicides

During the construction of public parkland, playing fields and the golf course it is likely that pesticides and herbicides will be required to control pest insects and weeds. Incorrect application of such compounds may impact adjacent water bodies from leaching and transportation either in the dissolved form (for soluble compounds) or attached to sediment particles (for insoluble compounds). Once transported to the downstream marine environment pesticide and herbicide compounds may affect marine fauna and flora in a number of ways depending on the mode of action of the particular chemical.

Pesticides and herbicides that may be used during construction and operation (to a greater extent) of the proposed development include:

- Weed control of public open space, sports fields and golf course;
- Pest control of public open space, sports fields and golf course;
- Pest (termite) control for pre-construction (slab-on-ground) and post construction (perimeter treatment) applications; and
- Council-declared weed control programs.

Haynes et al. (2001) identify a number of pesticides and herbicides typically used within catchments of the GBRMP. Table 8.16 outlines typical properties of some common pesticides and herbicides that may be used for control of pest and weed control on the Island based on current DNRW and Department of Main Roads practices.

Table 8.16 – Physical Properties and Estimated Half-lives of Common Pesticides and Herbicides (after Radcliffe, 2002)

Type	Name	Water Solubility mg/l	Log K_{OW}[8]	Half Life-water	Half Life-Soil
Herbicides	2,4-D	900	2.8	1 week	7 days
	Glyphosate	7000	low	12 days -10 weeks	47 days
	Metsulfuron methyl	213	0.02	-	1 – 5 weeks
	Atrazine	33	2.3	1.6 – 2.2 days	30 – 100 days
Insecticides	Chlorpyrifos	1.4	4.7	3 – 20 days	60 – 120 days
	Diazinon	60	3.3	6 months	2 weeks – 6 months
Fungicides	Chlorothalonil	0.6	4.4	<10 weeks	1 – 3 months

[8] The octanol/water partition coefficient (Kow)1 is defined as the ratio of a chemical's concentration in the octanol phase to its concentration in the aqueous phase of a two-phase octanol/water system

Type	Name	Water Solubility mg/l	Log K_{OW}[8]	Half Life-water	Half Life-Soil
	Captan	3.3	2.8	1 – 2 days	1 – 10 days

Whilst Table 8.16 provides some indication of potential chemicals used in pest and weed control programs, others may be used based on best practice guidelines of regulatory agencies such as Qld DPIF and AGCSA[9]. Pesticide persistence in the environment varies considerably and is dependant on a range of factors, including the structure of the chemical, microbial activity within the receiving environment, affinity to adsorb to organic carbon, affinity to adsorb to minerals, propensity to breakdown in sunlight etc (refer to Table 8.17).

The toxicity of potential herbicides, pesticides and fungicides will vary depending on the receptor, i.e. mammal, fish or crustaceans. Typical acute toxicities for chemicals outlined in Table 8.16 are presented in Table 8.17 below. The relative toxicity varies considerably between species, with mammals and birds generally being more resistant to toxic effects than fish and crustaceans. Toxicity associated with aquatic plants varies over a range of compounds presented in Table 8.17.

Table 8.17 – Toxicity Ranges for Common Herbicides, Pesticides and Fungicides (after Radcliffe, 2002)

Type	Name	Mammals Acute LD50	Birds Acute LD50	Fish 48-96h LC50	Crustaceans 48-96h LC50	Aquatic plants LC50
Herbicides	2,4-D	<320 - 1,000	270 – 1,000	0.0014 – 4.8	0.0016 – 0.144	0.104 – 0.485
	Glyphosate	750 – 5,600	>3,800	0.011 - 9.217	0.003 – 0.062	>380
	Metsulfuron methyl	>5,000	>5,000	>150	>150	1.56
	Atrazine	750 – 3,090	>2,000	0.5 - 71	5.7 - 540	0.021 – 0.377
Insecticides	Chlorpyrifos	32 – 1,000	8 - 112	1.3 - 542	0.00006 - 0.001	0.01 – 0.33
	Diazinon	300 - 400	3 - 41	0.022 - 24	0.0002 – 0.14	2.5 - 20
Fungicides	Chlorothalonil	>6,000	5,000	0.25 – 0.43	0.07 – 1,000	0.17 – 0.27
	Captan	250 - 15,000	2,000 - 5,000	0.056 - 0.072	7 - 10	1 - 74

Notes

Toxicity for mammals, birds and bees = acute toxicity (mg/kg)

Toxicity for fish, crustaceans, and aquatic plants = acute toxicity (µg/L

[9] Australian Golf Course Superintendents Association

Diffusive transport of pesticides, herbicides and fungicides, following application, to downstream waters via stormwater runoff can occur through two primary modes:

- Transport in stormwater by attachment to sediments and particulate matter – generally low solubility compounds such as chlorpyrifos and captan;
- Transport in stormwater as a dissolved compound – generally high solubility compounds such as glyphosate and 2,4-D.

Pesticide transport to ephemeral watercourses during construction and operation of the proposed development can cause a range of potential toxicological responses within the various plants and animals present within ephemeral watercourses, dams and downstream estuarine and marine waters if not mitigated and managed. Riparian vegetation in many of the Islands watercourses is generally absent, consisting of terrestrial species, bar the saltmarsh species located in the relict dune system watercourse. Downstream EVs such as intertidal wetlands, mangroves, seagrass meadows, marine mammals, marine fish and invertebrate communities can be impacted from uncontrolled pesticide residues associated transported by uncontrolled stormwater flows (refer to Section 9).

Management of pesticide application within the proposed development and particularly associated with golf course maintenance will be through the development of an Integrated Pest Management Plans (IPMP) as recommended by the *Improving the Eco-efficiency of Golf Courses in Queensland (AGCSA, 2001)*. Components of the IPMP can include:

- Understanding course conditions and characteristics;
- Surveying pest species on the course;
- Defining pest management intervention thresholds;
- Development of a monitoring and record keeping program; and
- Development and implementation of pest control strategies.

The pest management hierarchy under the IPMP includes non-chemical cultural methods as a preference followed by non-cultural methods utilising pesticides or biological control agents as a second tier management strategy. Cultural management strategies that control weeds without chemical use include:

- Selection of disease resistant turf species;
- Selection of low water requirement turf species;
- Turf management through:
  - Soil aeration;
  - Thatch control;
  - Irrigation management;
  - Increased mowing heights;
  - Minimal and appropriate use of organic fertiliser supplements;

- Development of a pest monitoring plan; and
- Removal of low density pests/weeds by hand;

Non-cultural methods will be triggered at a certain pest threshold and will use pesticides or biological controls. Pesticides will be used based on the following principles:

- Review of the location where the chemical will be used and proximity of any drainage, bioretention structures and ephemeral watercourses;
- Selection of the lowest toxicity chemical that will be effective for the intended purpose (preferably compounds that biodegrade rapidly to non-toxic products);
- Consideration of soil and thatch conditions within the area to be used;
- Review of weather conditions (no application if rain is forecast for 48 hrs);
- An application hierarchy of:
  - Direct (to leaf) application;
  - Spot spraying;
  - Treatment of the diseased area only;
  - Controlled broader spraying. and
- Conduct a monitoring program of site groundwater and receiving waters for pesticides and incorporate results into a quarterly summary report.

Use of such hierarchy and management options will minimise the use of chemicals within the proposed development and minimise potential impacts to ephemeral watercourse EVs and downstream waters such as dams and estuarine and marine waters.

The use of WSUD measures will also mitigate potential impacts of chemicals applied on the Island to downstream EVs. Proposed structures such as bioretention basins and detention basins reduce flows to downstream environments and increase the time that these chemicals can naturally degrade through sunlight or microbial action, reducing impacts to EVs. .

8.3.2 Impact Mitigation – Surface Waters

8.3.2.1 Riparian Habitat Disturbance

Mitigation of potential construction impacts to ephemeral creek riparian habitat are summarised in Table 8.18.

Table 8.18 – Proposed Mitigation Summary of Construction and Operation Impacts to Ephemeral Watercourse Riparian Habitat

Feature	Potential Impact	Mitigation measures (if required)
Riparian vegetation	Potential clearing of riparian vegetation during construction activities will expose soils to erosive forces.	Maintenance of required riparian vegetation buffer as per Acceptable Solution S.3.1-d in the Regional Vegetation Management Code. Riparian buffer zones will be marked as no clearing zones Culverts and crossings will be designed in accordance with *Queensland Urban Drainage Manual* (1994) with incorporation of fauna passages of appropriate height and including dry passage ways for fauna and maintain riparian movement corridors Culverts, crossing installations and stormwater outlets will require minor clearing of riparian vegetation and a permit under the IDAS.
Saltmarsh and mangrove vegetation in relict dune system swales/ephemeral watercourses	Changes in freshwater flows changing vegetation community type	ESCP treatment design to maintain freshwater flows within 10% of present conditions.* Conduct regular monitoring of vegetation communities in accordance with Qld Herbarium survey methods to detect changes associated with stormwater impacts.
Watercourse and riparian vegetation	Impacts from contaminants: nutrients, heavy metals and pesticides	Stormwater drainage will include WSUD treatments that will reduce sediment bound chemical loads and detain dissolved loads to allow degradation. Nutrient and chemical use will be based in best practice turf management as outlined in Section 8.3.1.4& and 8.3.1.6. Development of a Golf Course management Plan in accordance with AGCSA (2001) Guidelines, current and future best management practices. Quarterly water quality sampling of surface and ground waters will be conducted within receiving waters to develop sub-regional WQO in accordance with QWG (2006)

* note this target will be refined during detailed design and calibration of the MUSIC model with site data

8.3.2.2 Hydraulic Characteristics

Mitigation of potential construction impacts to ephemeral watercourse hydrodynamics are summarised in Table 8.19.

Table 8.19 – Potential Construction and Operational Impacts and Mitigation of Hydraulic Characteristics

Feature	Potential Impact	Mitigation measures (if required)
Construction		
Ephemeral watercourse flows	Clearing of riparian vegetation during construction activities increases surface water generation and flows	Maintenance of required riparian vegetation buffer as per Acceptable Solution S.3.1-d in the Regional Vegetation Management Code. Riparian buffer zones will be marked as no clearing zones.
Ephemeral watercourse hydraulics	Change to ephemeral watercourse hydraulics due to installation of culverts and crossings	Culverts and crossings will be designed in accordance with *Queensland Urban Drainage Manual* (1994) and updates with a climate change buffer in the relevant calculation of discharge (Q). Appropriate scour protection will be included in design if required. No erosion in bed or bank of watercourse due to culverts.
Fauna passage	Installation of culverts and crossings in ephemeral watercourses may reduce fauna pathways along ephemeral creeks	Culverts and crossings will be designed in accordance with *Queensland Urban Drainage Manual* (1994) and updates with incorporation of fauna passages of appropriate height and including dry passage ways for fauna
Ephemeral watercourse hydrodynamics	Reduced time of concentration (t_c) and increased peak discharge (Q_y) due to increased stormwater flow from cleared areas.	Design of an erosion and sediment control plan in accordance with Queensland Urban Drainage Manual (1994) and updates and WSUD Guidelines (2006) and Soil Erosion and Sediment Control Guidelines – Engineering Guidelines for Queensland Construction Sites (IEAust (Qld)1996)
Operation		
Ephemeral watercourses and receiving waters	Installation of storm water management devices and systems may change existing hydrodynamics Installation of erosion and sediment control measures and retention basins may alter flows to downstream environments.	Storm water controls will be designed in accordance with *WSUD Technical Guidelines* (Healthy Waterways, 2006). Maintenance of existing runoff conditions. Maintenance of existing peak flow rates. Preservation of existing drainage paths.
Fauna passage	Installation of culverts and crossings in ephemeral watercourses may reduce fauna pathways along riparian zones	Culverts and crossings will be designed in accordance with *Queensland Urban Drainage Manual* (1994) with incorporation of fauna passages of appropriate height and including dry passage ways for fauna

8.3.2.3 Water Quality

Mitigation of potential impacts to ephemeral creek hydrodynamics are summarised in Table 8.20.

Table 8.20 – Potential Construction and Operation Impacts and Mitigation of Ephemeral Creek Water Quality

Feature	Potential Impact	Mitigation measures (if required)
Construction		
Ephemeral watercourse suspended sediment loads Receiving waters – nutrient water quality	Stormwater - Suspended Sediment Loads Construction clearing works increasing overland flows and associated suspended sediment loads to ephemeral creeks resulting in changes to hydrodynamics and potential transport to downstream habitat and adjacent transitional estuarine EVs Stormwater Nutrient Loads Potential increases in sediment and dissolved phase nutrient being transported to dam, estuarine or coastal receiving water	Design of an erosion and sediment control plan in accordance with *Soil Erosion and Sediment Control Guidelines - Engineering Guidelines for Queensland Construction Sites* (IEAust (Qld)1996) or updated versions (refer to Section 3) Minimise size of cleared areas, minimise time soils are exposed, reduce and control surface flows and suspended sediment from cleared areas. Maintenance of 50% of vegetation on low density lots. Use of WSUD treatments to reduce suspended sediment loads by 80% from unmitigated modelled loads Conduct Quarterly WQ monitoring and develop sub-regional WQO and maintain WQ in dams, estuaries and coastal waters within the 20th and 80th percentile of background conditions.
Receiving water – litter	Stormwater Litter Construction activities may introduce litter from construction personnel and construction materials that may enter downstream transitional wetlands and waters.	Contractors will be required to meet WQO outlined in the construction EMP as part of their contract. Design of an erosion and sediment control plan in accordance with *Soil Erosion and Sediment Control Guidelines - Engineering Guidelines for Queensland Construction Sites* (IEAust (Qld)1996) Regular maintenance of ESCP features will be a performance target as part of the construction EMP
Receiving waters – chemical water quality	Plant maintenance and site activities may introduce chemicals to ephemeral watercourses during rain events and down stream receptors such as dams and transitional estuarine wetlands	Contractors will be required to meet WQO and performance criteria outlined in the construction EMP as part of their contract. Measures will include bunding on temporary chemical storage areas and spill response kits. Some mitigation will be obtained from water detention structures and existing dams that trap and recycle inflow water for reuse.
Receiving waters – chemical water quality	Weed control of newly established and rehabilitated areas may introduce organic chemicals to receiving waters such as dams and estuarine wetlands	Minimise area of disturbance and re-habilitation. Design of an erosion and sediment control plan in accordance with *Soil*

Feature	Potential Impact	Mitigation measures (if required)
		Erosion and Sediment Control Guidelines - Engineering Guidelines for Queensland Construction Sites (IEAust (Qld)1996) or updated versions Utilisation of ESCP of WSUD treatments that reduce sediment loads. Installation of detention basins to retain storm water flows for re-use during construction, e.g. dust suppression.
Operation		
Ephemeral watercourse - Suspended Sediment Loads Ephemeral watercourses & receiving waters - Nutrient water quality	Storm water drainage from developed areas may concentrate flows and encourage soil erosion with subsequent increases in suspended sediments that: ▪ degrade ephemeral watercourse environmental values; and ▪ are transported to adjacent estuaries and impact on marine EV ▪ Maintenance of public areas, parks, green space and Golf Course may introduce nutrients from fertiliser applications to maintain vegetation growth and also irrigation of grey water ▪ Emergency WWTP overflows ▪ Animal waste inputs	Storm water controls will be designed in accordance with *WSUD Technical Guidelines* (Healthy Waterways, 2006). Development and implementation of a Golf Course Management Plan that outlines recommended fertiliser formulations to be used within the development area, their storage, handling and application during construction. Use of WSUD such as retention basins utilising turf or sedges where possible will reduce flow velocities and minimise erosion and sedimentation impacts. Maintenance of existing sediment loads to receiving waters Maintenance of existing nutrient loads to receiving waters Conduct Quarterly WQ monitoring and develop sub-regional WQO and maintain WQ in dams, estuaries and coastal waters within the 20th and 80th percentile of background conditions. Minimise use of emergency outflow from WWTP. Incorporation of off-leash areas for dogs with waste facilities.
	▪ Golf course maintenance may introduce nutrients from turf management practices and grey water irrigation	Designed of the Golf Course as a "*wild course*" minimising turfed areas. Use of recycled water for irrigation of turf using in ground sensors to control application Manage fertilisation techniques in accordance with principles in *Improving the Eco-efficiency of Golf Courses in Queensland (AGCSA & Qld EPA, 2001)*
Ephemeral watercourse & receiving water - litter	Operational activities may introduce litter from populated areas and be transported to downstream transitional wetlands and estuarine waters impacting receptors and EVs of these waters.	Storm water controls will be designed in accordance with *WSUD Technical Guidelines* (Healthy Waterways, 2006). Include gross pollutant traps and trash baskets to capture litter entering permanent drainage system.

Feature	Potential Impact	Mitigation measures (if required)
		Regular maintenance of drainage structures by Council will maintain efficiency of litter and trash removal devices.
Ephemeral watercourses & receiving waters – particulate and dissolved metals and hydrocarbons	Surface runoff from roads may contain and transport heavy metals and hydrocarbons to adjacent ephemeral watercourses.	Storm water controls will be designed in accordance with *WSUD Technical Guidelines* (Healthy Waterways, 2006). Include WSUD structures such as grassed swales and retention basins that assist in reducing heavy metal loads to receiving waters.
Ephemeral watercourses & receiving waters – introduced chemicals such as pesticides	Maintenance of public areas can include wed control using pesticides that may be washed downstream during storm events to dam, estuarine and marine receiving waters	Storm water controls will be designed in accordance with *WSUD Technical Guidelines* (Healthy Waterways, 2006). Include buffer strips that will assist in biological breakdown of weed and pest control chemicals. Integrated pest management procedures will be incorporated in to public space management.
	Golf course maintenance can introduce weed and pest control chemicals to ephemeral watercourses during heavy rainfall events	Designed of the Golf Course as a "*wild course*" minimising turfed areas. Develop an integrated pest management plan for the management of weeds and pests in accordance with principles outlined in *Improving the Eco-efficiency of Golf Courses in Queensland (AGCSA & Qld EPA, 2001)*

8.3.3 Monitoring Requirements

Monitoring of surface water quality at ephemeral watercourse discharge points from the development or the final storage will be required during construction and operation to:

- assess the effectiveness of proposed mitigation measures;
- develop site specific WQO to replace default WQO outlined in Section 8.2.1.5; and
- provide triggers for actions outlined in the EMP.

A Water Quality Monitoring Plan will be developed prior to construction to establish sub-regional WQO in accordance with the QWQG (2006) and will consider the GBRMPA Draft Interim Marine Water Quality Guidelines (as yet unpublished). The WQMP will identify key contaminants of concern to be monitored during both construction and operation, proposed sampling locations, including reference sites. The WQMP will dictate the frequency of monitoring to ensure that sufficient data is obtained to establish the 20th and 80th percentile of each contaminant of concern in accordance with procedures outlined in QWQG (2006).

Monitoring of riparian vegetation (where present) will also be required to assess any potential impact to vegetation communities within ephemeral watercourses in the relict beach ridge system. This monitoring will be conducted in accordance with Qld Herbarium requirements.

8.4 Groundwater Impacts and Mitigation

8.4.1 Impact Identification – Groundwater

Groundwater resources on Hummock Hill Island are limited to sands within the relict beach ridge systems. Within Lot 3, groundwater is limited to areas within the relict beach ridge system in the Lagoon Villas precinct. Groundwater is not proposed to be used for water supplies or irrigation of the project. No current groundwater users are recorded on the Department of Natural Resources and Water database. Groundwater dependant ecosystems have been identified within the proposed golf course area and mitigation discussed in Section 5.2.2.

Potential for impacts to groundwater during project construction include:

- Minor dewatering potentially required to facilitate construction of the 2 m deep lake near the lagoon villas;
- Changes to the hydrogeological regime of groundwater dependant ecosystems. Development proposed near the potential GDE's or on the slopes of ridgelines which represent the likely recharge source for these areas and will require management and/or avoidance at the individual site scale. These are addressed in Section 5.2.2;
- Potential groundwater contamination from site construction activities, such as incidental fuel or chemical spills. The potential for spillages and associated impacts will be managed through the implementation of product/materials handling and storage procedures and the inclusion of physical preventative features (bunding, storage sheds) at the development;
- Changes to soil porosity and permeability in developed areas. The effect of hard-stand areas and changes in vegetation/soil type on groundwater recharge is anticipated to be negligible given the area of proposed development relative to the aquifer extent. Furthermore, development in upstream catchments will not be undertaken under the current proposal and surface water input from runoff is unlikely to change. Whilst local variations in recharge and discharge processes may occur these are not anticipated to be sufficient to result in any significant change to the overall hydrogeological regime for the sand aquifers; and
- Disturbance of potentially contaminated groundwater in the vicinity of the former cattle dip.

Potential groundwater impacts during development operation include:

- Potential changes to the hydrogeological regime from irrigation and creation of hardstand that can change the groundwater regime for groundwater dependant ecosystems;
- Potential impacts to groundwater quality in proposed irrigation zones on Qb3 and Pzm 1 soils and subsequent low level discharge at the interface between Island groundwater and marine waters; and
- Potential impacts to groundwater quality from routine activities conducted during the operation of the proposed development, such as application of fertiliser and pesticides.

8.4.2 Impact Mitigation

Proposed mitigation measures for the above construction impacts are presented in Table 8.21 below.

Table 8.21 – Potential Impacts and Mitigation of Groundwater during Project Construction

Feature	Potential Impact	Mitigation measures (if required)
Existing groundwater aquifers	Construction of a 2 m deep lined water storage may intercept a freshwater aquifer situated between 0.5 and 2 m bgl.	Perform lake construction during winter months when lower rainfall is likely to lower groundwater levels. Dewatering during lagoon will be artificially recharged to groundwater through perimeter recharge trenches or surface irrigation in the immediate vicinity. An acid sulphate soil investigation will be required to confirm the low probability of PASS occurrence currently considered for relict beach ridge sands based on 2003 groundwater data.
Existing groundwater aquifers	Construction activities in relict beach ridge system may introduce contaminants to the groundwater aquifer via fuel spills etc	Plant refuelling and field maintenance will be conducted in accordance with the construction Environmental Management Plan. Fuel and maintenance vehicles will carry spill kits as a standard requirement.
Groundwater dependant ecosystems	Clearing and earthmoving in groundwater recharge and discharge zones may impact shallow groundwater hydrology leading to increased surface salination and soil scalding	Clearing of vegetation of upslope recharge areas and slope break discharge areas and will be minimised with maximum maintenance of existing vegetation in low density lots and golf course buffer strips (refer to Section 5.2.2)
Soil permeability and porosity.	Construction activities such as earthmoving, compaction and filling may change soil permeability and/or porosity. Some small changes will be inevitable as part of the development.	Proposed soil disturbance, filling and compaction activities will be minimised to reduce potential changes to soil permeability and porosity.
Potentially contaminated groundwater in the vicinity of the former cattle dip	Construction activities around the former cattle dip may expose and mobilise potentially contaminated groundwater	Groundwater contamination will be assessed as part of a Contaminated Land Investigation. Any groundwater contamination discovered during contaminated land investigations will be remediated as part of proposed remediation works required to satisfy Qld EPA that the land is suitable for its intended use. Investigations and remediation will be conducted with reference to the Draft Guidelines for Assessment and Management of Contaminated Land in Queensland (1998).

Proposed mitigation measures for the above construction impacts are presented in Table 8.22 below.

Table 8.22 – Potential Operational Impact Mitigation of Groundwater

Feature	Potential Impact	Mitigation Measures (if required)
Soil hydrogeology	Development of hardstand areas, vegetation clearing, on-site effluent disposal and golf course irrigation could potentially alter the natural hydrological regime at the site and result in waterlogging and soil salinisation in some areas	Proposed hardstand areas and building footprints will be minimised to reduce potential changes to soil permeability and porosity. Where applicable such as in Qb3 areas permeable paving may be used for parking areas.
Groundwater quality	Potential for land disposal of effluent to impact groundwater quality and levels has been considered and quantified by Cardno (2006) using the MEDLI package. All effluent will be treated to a Class A+ standard prior to disposal with the MEDLI results suggesting a very slight increase in deep percolate volume (<0.5%) and nitrate loading (0.1kg/ha/yr) occurring post-development.	MEDLI modelling undertaken by Cardno (2006) recommends a sustainable irrigation rate of 14 kL/day in Pzm1 areas and 22 kL/day in Qb3 areas (refer to Appendix A7.1). These rates are considered to be the sustainable yield with minimal impacts to groundwater quality.
Groundwater quality	Routine activities undertaken during the operation phase of development have the potential to result in groundwater contamination, and consequently marine receiving waters (WHV) if inappropriately managed. Potential sources may include biocide and fertiliser application at the golf course, chemical and fuel storage/handling at the airstrip/boat ramp and chemical storage at water treatment plant	Development of an Integrated Pest Management Plan in accordance with AGCSA[10] requirements for the wild golf course will required prior to commission. Persistent chemical based pesticides will not be used on a wide scale during operation. Slow release organic fertilisers will be used as required by AGCSA. Chemical storages above trigger volumes will require construction to AS1940-2004 and will include appropriate sealed bunding or an approved containment system.

8.4.3 Monitoring Requirements

Specific details groundwater management measures and monitoring requirements to be adopted during construction phases of site development are outlined in the Environmental Management Plan (EMP). Groundwater monitoring requirements will be conducted as specified in the EMP. Specific groundwater monitoring points will include:

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- Groundwater monitoring will be undertaken during any dewatering activities during the lagoon construction to monitor recharge performance and potential changes in groundwater quality;
- Groundwater monitoring will be undertaken in the vicinity of proposed effluent disposal areas to ensure land irrigation of treated effluent does not result in mounding, salinisation or contamination;
- An investigation of existing groundwater contamination in the vicinity of the dip site should be undertaken. If groundwater contamination is identified opportunities for remediation as part of site development may improve groundwater quality and reduce potential risks to human health and the existing environment;
- In the vicinity of proposed effluent disposal areas to ensure land irrigation of treated effluent does not result in mounding or contamination; and
- Adjacent any proposed bulk chemical storages.

It is recommended that baseline groundwater monitoring will be undertaken on a quarterly basis in the vicinity of proposed effluent disposal areas prior to development and 6 monthly during operation. Data recovered during monitoring would serve to characterise existing quality and allow for the determination of potential groundwater impacts during the operational phase. Recommended analytical parameters are outlined in the Construction EMP.

8.5 Conclusions

8.5.1 Surface Water Conclusions

Surface water releases from the proposed development to both ephemeral watercourse and adjacent transitional estuarine and marine waters will comply with the requirements of the EPP (Water) as discussed. Compliance with these requirements (including WQO) will protect identified EVs both on the Island and within adjacent transitional estuarine and marine waters.

The use of erosion and sediment control plans to control identified impacts during the various construction phases and WSUD for permanent stormwater drainage will achieve the requirements of the EPP(Water) and in particular WQO at identified discharge points of ephemeral watercourses to transitional estuarine and marine receiving waters (discussed in Section 9.1).

8.5.2 Groundwater Conclusions

No groundwater in the Island is proposed to be used for any part of the development. The proponent has agreed with Qld DNRW not to exploit groundwater on the Island for any use. Potential impacts identified from proposed activities during both construction and operation will be mitigated and managed with minimal impacts to existing groundwater on the Island. Impacts to world heritage values and associated sensitive receptors are not anticipated to occur as the existing hydrogeological regime is unlikely to be altered as a result of the proposed development.

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