AQUIS RESORT AT THE GREAT BARRIER REEF PTY LTD

ENVIRONMENTAL IMPACT STATEMENT

VOLUME 12

APPENDIX T

SOLID WASTE

March 2014

SOLID WASTE MANAGEMENT ASSESSMENT REPORT

Aquis Resort at The Great Barrier Reef

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Executive Summary

Responsibility for solid waste management in Cairns is currently shared between Cairns Regional Council, who primarily handle household waste, and a range of commercial service providers that primarily handle wastes generated from non-household sources such as offices, various industries and medical facilities.

Both household wastes and non-household wastes generated in Cairns are generally managed through key regional waste management facilities that also service surrounding local government areas and commercial/mining facilities that extend from Weipa (800 km to the north) to Cardwell (200 km to the south).

Cairns Regional Council has estimated that household waste within its local government area will increase by approximately 50% from 120,000 tonnes per year in 2010 to 180,000 tonnes in 2030 as a result of projected population growth. As Cairns Regional Council no longer operates a landfill to service Cairns, it plans to manage this projected increase in household waste though the continued use of commercial service providers and ongoing upgrades to its waste recovery/recycling facility.

Discussions with Cairns Regional Council indicate that it would have limited capacity to accept waste material generated by the construction and operation of the Aquis Resort at The Great Barrier Reef through Council's existing arrangement and facilities. Council would, however, be interested in working with the development proponent to identify opportunities to support the development of new cost effective infrastructure and technologies that achieve the waste management hierarchy objectives of increased waste recovery/recycling and minimising waste disposal to landfill.

Commercial organisations that service the non-household waste requirements of Cairns and the surrounding region operate a range of existing licensed waste management infrastructure that include collection vehicles, waste transfer stations and landfills. It was not possible to quantify the overall waste disposal capacity of this infrastructure, however, it is noted that one existing general waste landfill that services the Cairns region has available capacity of 0.4 million m^3 and preliminary approval for a total of 6 million m^3 (note: landfill compaction rates are typically 0.7 m^3/tonne to 1 m^3/tonne). There are also three small construction and demolition waste landfills located in close proximity to the Aquis site.

Solid waste generation quantities during the construction phase of Stage 1 and Stage 2 are estimated to be between approximately 35,255 tonnes and 63,865 tonnes. Adopting the current construction industry waste reduction targets, the volume of waste requiring disposal to landfill during construction should be less than 16,000 tonnes. Adoption of best practice waste management systems during the planning, design and procurement of Aquis Resort at The Great Barrier Reef presents the opportunity to further reduce construction waste requiring disposal to landfill in the Cairns Region to less than 3,200 tonnes.

Solid waste generated during the operations phase of the combined Stage 1 and Stage 2 the Aquis Resort at The Great Barrier Reef is estimated to be in the order of 14,455 tonnes per year. Adoption of best practice waste management systems during the planning, design and operation of Aquis Resort at The Great Barrier Reef presents the opportunity to reduce ongoing waste disposal to landfill in the Cairns Region to approximately 1,885 tonnes per year.

The estimated amounts of both construction and ongoing operations waste generated within the Aquis Resort at The Great Barrier Reef is considered to be well within the capacity of existing commercial waste service providers and their waste management infrastructure that services the Cairns region.

In summary, adoption of best practice solid waste management systems for both the construction and operation of the Aquis at The Great Barrier Reef Resort will significantly reduce the amount of waste disposed of to landfill, with estimated quantities well within the existing capacity of commercial waste providers that service Cairns and the surrounding region. The Aquis Resort at The Great Barrier Reef should not impact upon the current and future waste management responsibilities of Cairns Regional Council, however, there are potential opportunities to work together to support the development of new cost effective waste management infrastructure and technologies.

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GLOSSARY, ACRONYMS, ABBREVIATIONS

Term	Meaning
AHD	Australian Height Datum
Aquis Resort	Aquis at The Great Barrier Reef Resort
ARI	Average Recurrence Interval
ARRT	Advanced Resource Recovery Technology
C&D	Construction and Demolition
C&I	Commercial and Industrial
CCRC	Cassowary Coast Regional Council
CRC	Cairns Regional Council
CSC	Cooktown Shire Council
DSC	Douglas Shire Council
EHP	Department of Environment and Heritage Protection
EIS	Environmental Impact Statement
EP Act	*Environmental Protection Act (1994)*
FCG	Flanagan Consulting Group
Golder	Golder Associates Pty Ltd
MeRF	Material Recovery Facility
MSC	Mareeba Shire Council
MSW	Municipal Solid Waste
SITA	SITA Australia Pty Ltd
SWMF	Springmount Waste Management Facility
TRC	Tablelands Regional Council
WRR Act	*Waste Reduction and Recycling (WRR) Act 2011*

1.0 INTRODUCTION

1.1 Background

Flanagan Consulting Group (FCG) has commissioned Golder Associates Pty Ltd (Golder Associates) to undertake a Solid Waste Management Assessment to support the preparation of an Environmental Impact Statement (EIS) for the Aquis Resort at The Great Barrier Reef Development Pty Ltd (Aquis Resort) project.

This assessment report addresses the solid waste management components of the Terms of Reference for the Aquis Resort Environmental Impact Statement (EIS) issued by the Queensland Co-ordinator General. The scope of works comprised the following:

- Desktop review and documentation of 'best practice' waste management sustainability principles that should be incorporated into the development.
- Desktop assessment and discussion of existing waste management capacity within the Cairns Region, considering both local government and private waste treatment and disposal infrastructure.
- Estimation of typical indicative volumes for the waste stream, with a discussion of opportunities for minimisation and on-site reuse, and minimising off-site disposal to landfill.
- Documentation of waste management strategies that could be adopted for each identified waste management stream.

This report has been prepared on the basis of the following key project environmental objectives to ensure the following:

- No environmental harm occurs.
- Levels of environmental protection are consistent with relevant legislation, policy and guidelines.
- Best practices are adopted in the design, construction and operation of the project.
- A consistent and uniform management approach is undertaken to achieve the levels of environmental protection throughout the life of the development.

1.2 Development Proposal

The Aquis Resort includes the following key features, distributed over three precincts:

- Resort Complex precinct (73 ha including 33 ha lake).
- Sports and Recreation precinct (155 ha).
- Environment Conservation and Management precinct (113 ha).

The main proposed land use elements (refer to Appendix A – Master Plan) are summarised in Table 1.

Table 1: Aquis Resort Land Use Elements

Master Planning Element	Number	Gross Floor Area (m^2)
Hotel rooms/suites configured in 8 towers	7500	625,000
Casinos	2	40,000
Convention and exposition	1	23,000
Theatres	2	5,000
Retail		10,000
Aquarium	1	2,250
Rainforest		2500
Circulation/shared space/back of house/services		350,000
Guest/staff parking	1400	80,000
Landscaping/lagoons/pools/entry water feature		110,000

Construction of the resort is to occur in two stages, with the first stage of the resort commencing operation before completion of construction of the second stage:

- Stage 1:
  - Approximately 4,000 hotel rooms
  - International class casino
  - Convention and exposition
  - Theatre
  - Aquarium
  - Restaurants, bars and food and beverage outlets
  - Championship golf course during, including driving range and club house
- Stage 2:
  - Approximately 3,500 hotel rooms
  - International class casino
  - Restaurants, bars and food and beverage outlets
  - Reconfigured golf course
  - Theatre
- Ancillary facilities including access roads, water supply mains, sewage pump stations and electrical, communications services infrastructure, administration and maintenance facilities.
- Upgrade of external local and state controlled road networks to cater for the anticipated traffic generation and transport needs.
- The proposal does not include any permanent residential elements.

The resort complex will be constructed over a basement level which will incorporate back-of-house support facilities including:

- Kitchens
- Staff facilities
- Stores
- Laundry
- Refuse collection
- Security
- Maintenance facilities
- Staff and guest parking facilities

2.0 SOLID WASTE MANAGEMENT IN CAIRNS

2.1 Statutory Framework

The management of waste in Queensland is currently regulated under the following statutory framework:

- *Environmental Protection (EP) Act 1994*
  - Environmental Protection Regulation 2008
  - Environmental Protection (Waste) Policy 2000
  - Environmental Protection (Waste Management) Regulation 2000.
- *Waste Reduction and Recycling (WRR) Act 2011*
  - Waste Reduction and Recycling Regulation 2011

Key elements of the statutory framework include:

- Local government administration of waste management activities.
- Approval and control of waste management and disposal facilities
- Waste management hierarchy to minimise, reuse, recycle various waste streams to limit disposal to landfill.
- Design standards for selected waste management infrastructure.

The Environmental Protection (Waste Management) Regulation 2000 is due to expire on 1 September 2014 and is currently subject to review by the Department of Environment and Heritage Protection (EHP).

2.2 Service Provision

Cairns Regional Council (CRC) is responsible for the management of most solid waste generated in the region through the operation of a curb-side household and commercial collection program and network of public waste transfer stations.

In addition, Cairns and surrounding areas are also generally well serviced by a broad range of commercial waste companies that operate both under contract to CRC and directly to commercial and industrial clients.

2.3 Waste Management Strategy

CRC has prepared a Waste Management Strategy that sets out the principles, objectives, targets, programme areas and action plans for managing municipal solid waste (MSW) for the five year period between 2010 and 2015.

The 2010 to 2015 Cairns Waste Management Strategy was developed based upon the following key information that was available at the time of preparation:

- Increase in MSW from approximately 87 000 tonnes in 2003/04 to 120,000 tonnes in 2008/09.
- Underlying annual municipal waste growth of 5.1% between 2003/04 and 2008/09.
- Annual average waste generation of 857 kg per capita and 2,080 kg per household.
- Diversion of approximately 64% of MSW away from landfill disposal in 2008/09.
- Approximately 78 000 tonnes of MSW processed by an Advanced Resource Recovery Technology (ARRT) facility in Cairns annually between in 2007/08 to 2008/09.
- Projected increase in households from 60,000 in 2010 to 75,000 in 2020.
- Projected population growth from 160,000 in 2010 to 220,000 in 2030.

Five scenarios used by CRC to estimate future domestic MSW growth are summarised in Figure 1. Scenarios 3 to 5 indicate that annual total waste managed by CRC will increase from approximately 120,000 tonnes in 2010 to a range between 180,000 tonnes and 210,000 tonnes in 2030.

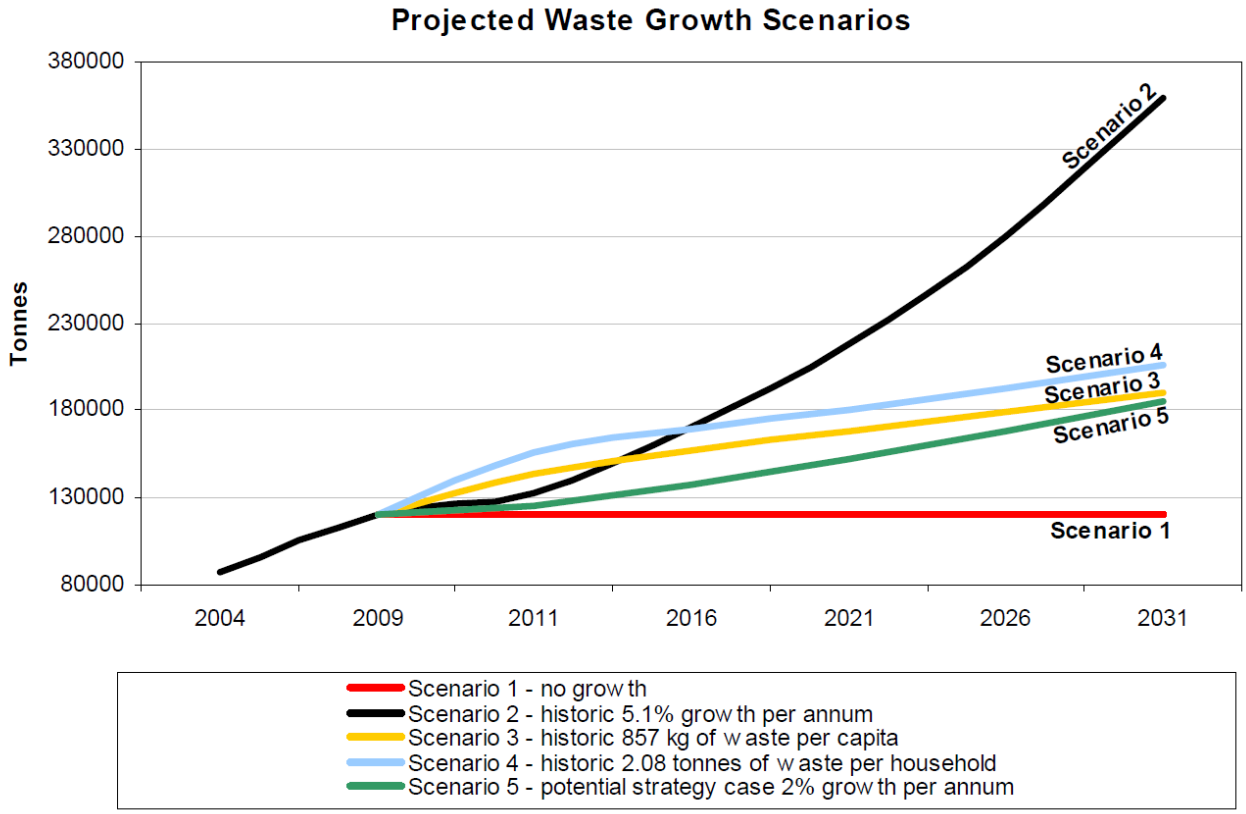


Figure 1: CRC Waste Growth Scenarios

CRC adopted the following policy drivers and principles in the formulation of its 2010 to 2015 Waste Management Strategy:

- Recognising waste as a material resource not a disposal problem.
- Waste management hierarchy (refer to Figure 2).
- Proximity principal of identifying and using local markets and solutions for recovered resources as close as possible to the source of generation.
- User pays to ensure that those who generate the waste pay an appropriate price for managing and disposing of it.
- Support and participation in product stewardship programs.
- Sustainable balance of economic, environmental and social considerations.
- Explore possibilities for strategic partnerships and collaboration with other stakeholders.

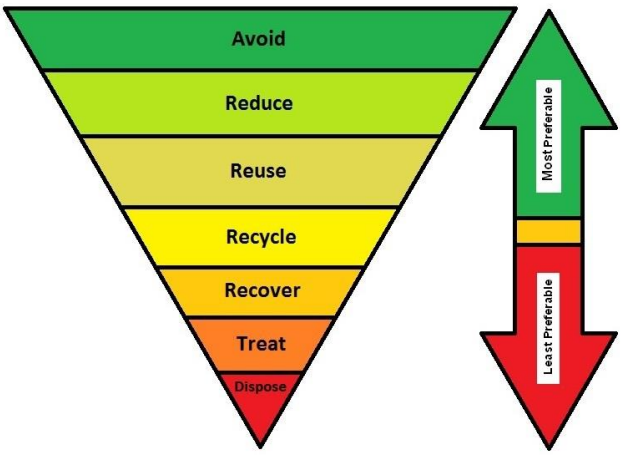


Figure 2: Waste Management Hierarchy

High level targets adopted by CRC for the 2010 to 2015 Waste Management Strategy comprise:

- Restrict growth in MSW generation to 2% per annum by 2015.
- Achieve a kerbside dry recycling rate of at least 60% by 2015.
- Achieve an overall diversion from landfill rate of at least 70% by 2015.
- Flexibility for residual MSW treatment options and recovery.
- Efficient recycling services with increased local markets and demand for recovered resources.
- Show leadership and coordination in regards to MSW management in the region and provide best value services.

2.4 Existing Waste Management Infrastructure

2.4.1 General

Figure 3 shows the location of key waste management infrastructure in Cairns and the surrounding region.

A brief description of the identified infrastructure is presented in the sections below.

2.4.2 Cairns Regional Council Facilities

Existing key waste management facilities operated by CRC are summarised in Table 2.

Table 2: Summary of CRC Waste Management Facilities

Facility	Waste Types	Distance from Aquis	Processed 2008/09	Total Capacity
Waste Transfer Stations				
■ Smithfield ■ Portsmith	■ All Domestic wastes ■ Commercial – Greenwaste only	< 2 km 20 km	40,000 tonnes across all CRC facilities	Unknown
Material Recovery				
■ Portsmith	■ Domestic recyclable waste (plastics, paper/cardboard, glass, aluminium, steel)	20 km	10,000 tonnes	10,000 tonnes

Residual inert waste material collected by CRC at the Smithfield and Portsmith Transfer Stations and the Portsmith Material Recovery Facility (MERF) is disposed of at commercial inert waste landfill sites located in Cairns (refer to Section 2.4.6).

Killaloe Landfill located near Port Douglas became the responsibility of Douglas Shire Council (DSC) following de-amalgamation on 1 January 2014.

CRC (pers comm August 2013) has indicated that its existing waste management facilities are unlikely to be able to accept commercial waste from a major integrated development. There may, however, be opportunities for organisations that generate or manage large volumes of commercial waste to partner with CRC as its plans for, and implements, new infrastructure to manage an estimated 2% annual domestic waste volume increase resulting from projected future population growth.

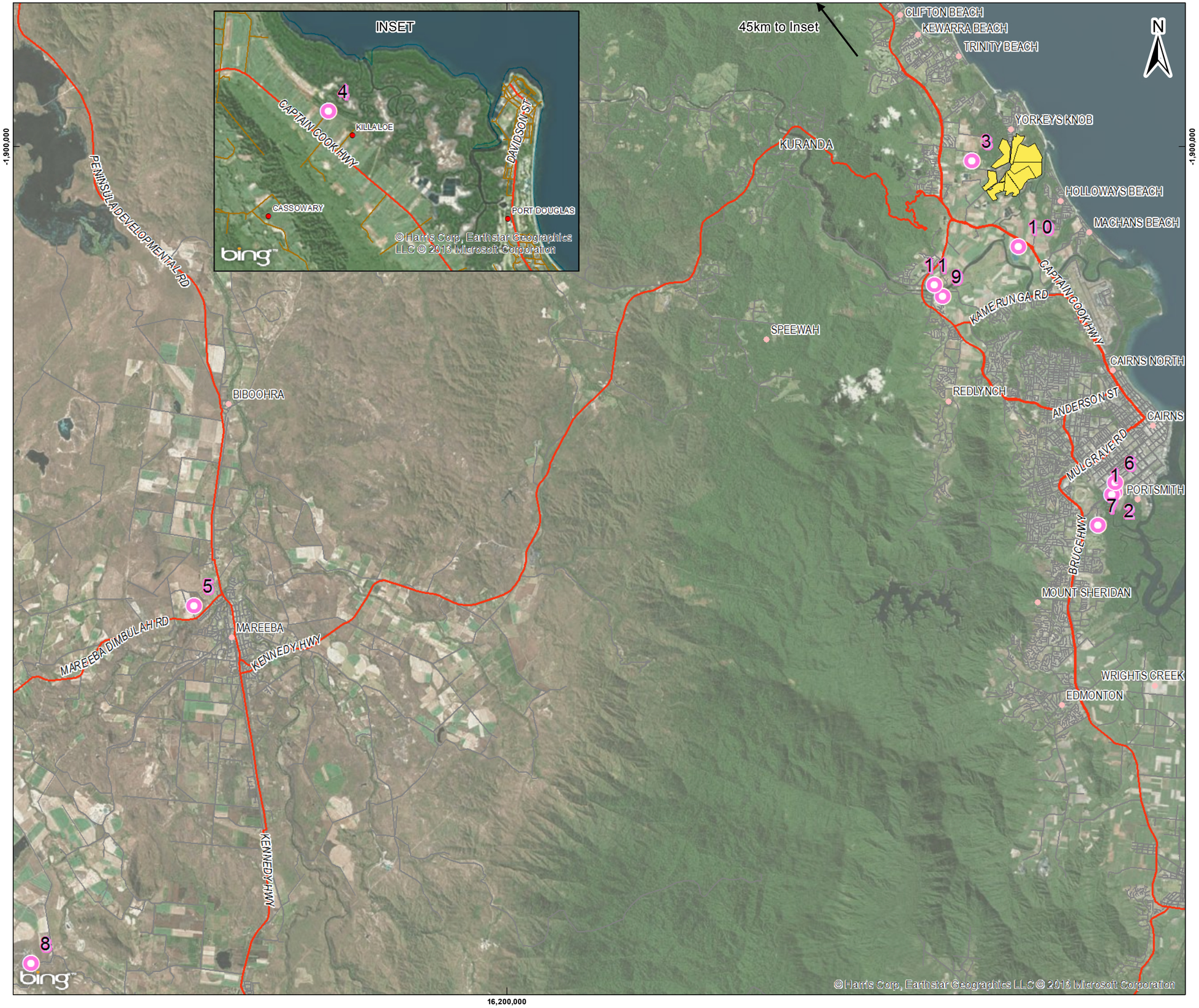
2.4.3 SITA Australia ARRT Facility

SITA Australia Pty Ltd (SITA) is part of an international waste management company that is contracted by CRC, DSC and Mareeba Shire Council (MSC) until 2026 to operate an Advanced Resource Recovery Technology (ARRT) to process MSW to produce commercial organic compost, with the relatively inert, less bulky residual waste sent to landfill. Bio-solids from CRC waste water treatment plants are added to increase moisture content and assist in the composting process.

AQUIS AT THE GREAT BARRIER REEF

FLANAGAN CONSULTING GROUP

CAIRNS REGION WASTE MANAGEMENT INFRASTRUCTURE



LEGEND

- Waste Management Facility
- Highway
- Aquis Development Site

MAP ID	
	Cairns Regional Council
1	Material Recycling Facility (MeRF)
2	Portsmith Waste Transfer Station
3	Smithfield Waste Transfer Station
4	Killaloe Landfill
	Tablelands Regional Council
5	Mareeba Landfill
	SITA Australia
6	Advanced Resource Recovery Facility
	Springmount Waste Management Facility
7	Woree Waste Transfer Station
8	Springmount Landfill
	Inert Landfills
9	Metalfield
10	Northern Sands
11	Sand Quarry

0 0.5 1 2 3 4 Kilometers

DATUM GDA 94, PROJECTION MGA Zone 55

PROJECT: **137633048-001-R-Rev0**
DATE: **27 AUG 2013**
DRAWN: **SB**
CHECKED: **JSB**

FIGURE 3

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The CRC Waste Management Strategy provides the following information for the SITA ARRT:

- Commenced operations in 2006.
- Capacity of approximately 90,000 tonnes per annum.
- Processed approximately 78,000 tonnes per annum in 2008/09.
- Produced approximately 20,000 tonnes of compost in 2008/09.

Commercial use of the produced compost is restricted by waste stream contaminants (primarily glass). It is understood that limited volumes of viable compost material is predominantly used by non-food agricultural properties in the area south of Cairns.

Residual waste from the ARRT is currently disposed of at Mareeba Landfill (refer to Section 2.4.5 below). During maintenance/breakdown periods unprocessed waste is also disposed of at Mareeba Landfill with limited use of Springmount Landfill (refer to Section 2.4.4 below).

SITA (per communication in August 2013) has indicated that the facility can accept suitable waste material on a commercial basis outside its contact with CRC. It was noted, however, that existing contracts with CRC give it first preference for use of the remaining capacity resulting from any growth in domestic waste quantities until 2026.

2.4.4 Springmount Waste Management Facility

Springmount Waste Management Facility (SWMF) is a Joint Venture between Remondis Pty Ltd, part of an international waste management company, and FGF Developments Pty Ltd, a Cairns based contactor and development company.

SWMF owns and operates a regional general waste commercial landfill l located in the Tablelands approximately 90 km west of Cairns. Springmount Landfill is a fully engineered landfill that commenced operations in 2004 with the following waste disposal airspace capacity:

- Constructed waste cells: Approximately 600,000 m^3.
- Preliminary regulatory approval: Approximately 4,000,000 m^3.

Springmount Landfill is currently approved to accept 75,000 tonnes to 100,000 tonnes of waste per annum, however, it also has preliminary approval to accept 100,000 to 200,000 tonnes.

SWMF operates independently of CRC and maintains a waste transfer station at Woree in Cairns to service a range of commercial clients from Cairns and the surrounding region.

Key sources of waste material managed at Springmount Landfill are summarised in Table 3.

Table 3: SWMF Key Waste Sources

Source	Primary Waste Types	Travel Distance
Cairns-based commercial waste companies	■ Construction and demolition waste ■ Commercial and industrial waste	90 km
Cassowary Coast Regional Council	■ Household and commercial kerbside collection (wet waste)	130 km
Cooktown Shire Council	■ Household and commercial kerbside collection	290 km
Tablelands Regional Council – Atherton only	■ Household and commercial kerbside collection	30 km
Townsville-base commercial waste companies	■ Treated industrial waste	380 km

2.4.5 Mareeba Shire Council

MSC owns and operates a general waste landfill at Mareeba, a fully engineered facility since 2006 located approximately 55 km west of Cairns.

Mareeba Landfill is approved to accept to accept 75,000 tonnes to 100,000 tonnes of waste per annum. Key sources of waste material managed at Mareeba Landfill are summarised in Table 4.

Table 4: SWMF Key Waste Sources

Source	Primary Waste Types	Travel Distance
SITA	■ Residual ARRT waste	55 km
Tablelands Council – Former Eacham Shire	■ Household and commercial kerbside collection	60 km
Mareeba-based commercial waste companies	■ Construction and demolition waste ■ Commercial and industrial waste	5 to 100 km

Domestic waste generated within the former Mareeba Shire Council area within TRC is sent to the SITA ARRT facility in Cairns for processing.

MSC (pers comm August 2013) indicated that at existing waste disposal rates Mareeba Landfill is expected to operate until approximately 2026.

2.4.6 Inert Waste Landfills

There are no operating private or Council operated general waste landfills located within the local government boundary of CRC. There are, however, three relatively small inert waste landfills located within with Barron River delta in relatively close proximity to the Aquis Resort. These are non-engineered facilities with defined inert materials such as construction and demolition waste placed into operating and former commercial sand pits.

3.0 AQUIS WASTE MANAGEMENT STRATEGY

3.1 General

This section describes Aquis Resort's waste management strategy with regards to the waste management hierarchy and how it will be applied to various waste streams. Furthermore, how indicators for monitoring waste management can be developed and environmental controls can be implemented are discussed.

3.2 Waste Management Hierarchy

The Waste Management Strategy for the Aquis Resort is based around the Waste Management Hierarchy promulgated within the Environmental Protection (Waste) Policy 2000 which describes the order of priority in which waste materials are to be managed. The Waste Management Hierarchy, in order of most to least preferred option, is presented in Figure 2 above.

The primary objectives of the proposed Aquis Resort Waste Management Strategy are as follows:

- Adopt the principles of the Queensland Waste Management Hierarchy and align with the CRC waste management strategy where possible.
- The measures adopted for waste management will meet current best practice, be in proportion to the potential environmental and health impacts the waste being managed and be cost effective.
- Minimise waste and negotiate supply of goods with minimal packaging.
- Securely contain waste in bins and skips for the shortest period of time possible.
- Ensure responsible management and disposal through considering waste streams as a whole and the final destination before sending waste off-site.
- Comply with statutory requirements.
- Ensure that waste management options do not place unreasonable burden on existing CRC infrastructure.
- Consult with CRC and commercial waste contractors to identify opportunities for introduction of new best practice waste management services that will benefit the Cairns region.

While there are no current co-generation opportunities for power that have been identified with the development, Aquis Resort is also committed to exploring any opportunities that may be identified during the detailed project planning and design stages.

3.3 Environmental Management

3.3.1 Performance indicators

Environmental performance indicators adopted for the Aquis Resort waste management strategy comprise:

- Minimise excessive volumes of non-reusable or recyclable waste generated.
- Waste to be segregated and separated at the source point wherever possible.
- Waste to be managed and disposed of in accordance with statutory requirements.
- All litter generated to be collected and managed appropriately at least daily.
- No introduction of pest and vermin issues at waste management facilities.
- No odour issues at waste management facilities.
- Avoid complaints and incidents relating to waste management, and respond appropriately to any that may occur.
- Appropriate training and awareness in waste management for relevant managers and employees.

The following sections describe the various environmental waste management controls, training and awareness, complaints response and management and reporting.

3.3.2 Litter Management

Litter generation will be managed through the following measures:

- All waste and bulk bins will be covered.
- Public waste bins will be emptied at least daily.
- Back of house and bulk bin waste storage areas will be inspected daily for spills and litter by assigned personnel.
- Any large items that cannot be stored in back of house or bulk bins will be removed off-site transported to the appropriate facility as soon as is practical.

3.3.3 Pest and Vermin Management

The attraction of pests and vermin by waste will be managed by adoption of the following measures:

- All waste bins and bulk bins will be covered and organic waste bins enclosed.
- All public bins, back of house bins and bulk bins, particularly those holding organic waste bins, will be inspected daily and cleaned to remove any spillages/leakages.
- Bulk bin storage areas will be evaluated for the need to use of pest control measures.
- All relevant personnel will be trained in the site's waste management procedures.

3.3.4 Odour Management

Odour generation will be minimised through the following measures:

- All bins holding organic waste material will be enclosed and cleared daily.
- Bulk storage of organic waste will be located in enclosed buildings.
- Any on-site processing/composting of food waste material will be located in enclosed buildings, designed and commissioned with controls for air emissions.
- All relevant personnel will be trained in the site's waste management procedures.

3.3.5 Surface Water Management

Contamination of surface water bodies' stormwater run-off will be avoided through the following measures:

- Waste will be stored in a safe and secure way to prevent land and stormwater contamination.
- Chemical spills will be cleaned up in accordance with Material Safety Data Sheets (MSDS).
- Oils, fuels and chemical wastes will be stored in designated storage areas within hard-stand surfaces, with appropriate bunding around the perimeter.
- All litter will be collected and managed appropriately at least daily.
- Gross pollutant traps will be installed at key stormwater run-off collection points throughout the Aquis Resort.

3.3.6 Training and Awareness

Training of relevant managers and employees will be undertaken for both the construction and operational stages and include:

- Relevant legislative requirements.
- Identification of potential environmental impacts of litter and waste spills.
- Correct procedures for identifying and separating nominated waste types.
- Correct procedures for handling, storing and managing or disposing of each waste type.
- Procedures for auditing waste management, undertaking incident response and handling complaints.

3.3.7 Complaints and Incidents Response

Complaints received related to waste and the actions taken by Aquis Resort to manage or mitigate the cause of the impact will be recorded in a Complaints and Incidents Response Register. The register may be separated for each building/facility and will be maintained by an assigned manager.

Management of complaints will involve the following:

- Manager of any establishment within the resort is to co-ordinate complaints relevant to waste.
- All received complaints are to be directed to an establishment's manager.
- The manager will investigate the issue.
- The manager will record the following information in the Complaints and Incidents Response Register:
  - Complainants name and contact details (if provided)
  - The nature of their complaint
  - The time and date of their observation
  - Weather conditions and wind direction at the time the issue was observed, if relevant.
- The manager will report this complaint to senior management of the resort.
- Where the cause(s) of the issue are identified, the manager will liaise with employees, contractors and subcontractors to establish and apply controls to mitigate the potential for it to reoccur.

The manager will contact the complainant and inform them of the outcomes of their enquiries and the actions taken by Aquis Resort to mitigate the potential reoccurrence of the issue. This will be recorded in the Complaints and Incidents Response Register.

3.4 Monitoring and Reporting

A detailed waste management and auditing program will be developed during the detailed planning and design stage of the project that will incorporate the following:

- Monitor and report internally on waste volumes generated at the site.
- Site employees must report incidents and non-conformances with established standards or procedures to the assigned manager.

The following records will be maintained:

- Waste volume records
- Regulated/Hazardous Waste Transport Records
- Complaints and Incidents Response Register (refer to Section 3.3.6).

EHP has made available worksheets on their website that can be utilised to track the quantities of various waste streams generated. There are also a number of commercial software systems that record and track waste materials and volumes and associated Carbon units in use throughout Queensland.

4.0 CONSTRUCTION PHASE WASTE MANAGEMENT

4.1 General

This section presents the predicted volumes of various waste streams to be generated during construction of Aquis Resort and systems for managing these wastes.

4.2 Waste Streams

Organic wastes

The Aquis Resort construction is predicted to generate the following organic wastes:

- Food waste.
- Green waste such as vegetation.

The preferred measure is for organic waste bins to be provided in each construction area. Signage will be provided on bins for the types of materials that may be composted.

Waste from these bins should either be composted on-site, if practical to have commissioned by commencement of construction, or alternatively taken off-site to general waste disposal facilities.

Where possible, green waste generated during construction, such as leaves, grass and plant and tree clippings will be collected at temporary on-site green waste composting facility.

Recyclable wastes

Recyclable wastes that will be generated during construction will include construction and packaging materials and other materials such as newspaper, office paper, cardboard, paperboard milk cartons, glass, recyclable metal cans (steel and aluminium), recyclable plastics, scrap metal, plasterboard, oils, textiles and hydraulic fluids.

Co-mingled recycling bins will be provided in each construction area from which waste will be consolidated in bulk bins. Signage will be provided on bins for the types of materials that may be recycled.

Recyclable materials will be stored in bulk bins located in specified storage areas around the site, the contents of which will be collected and taken to various materials recovery facilities.

Regulated wastes

Construction of the various infrastructures will result in regulated waste materials such as paints, oil and unused pesticides being generated. Other regulated wastes include materials such as household chemicals, cleaning chemicals, car batteries and other domestic waste materials prohibited from landfill. Personnel at the resort will be trained in correct procedures for the disposal of these materials to Private or Council-run collection facilities.

General wastes

General wastes include materials such as non-recyclable packaging, personal sanitary items, non-recyclable plastics, small broken items such as crockery, non-compostable food waste (meat, cheese) and bulky items such as broken appliances, pieces of furniture not in repairable condition, and large items from maintenance or repair of buildings.

General waste bins will be provided in each construction area from which waste will be consolidated in bulk bins.

General waste will be stored in bulk bins located in specified storage areas around the resort, the contents of which will be collected and taken to a landfill. Disposal of larger items will be managed by maintenance staff, and where such items cannot be stored in bulk bins, disposal will be arranged to occur as soon as is practical.

4.3 Construction Waste Quantities

Quantity estimates of materials expected to be used in the construction of the resort were provided by FCG to Golder Associates for the following developments:

- Stage 1:
  - four towers with approximately 4,000 hotel rooms
  - a casino approximately 18,800 m^2 in area
  - an expo with four junior ballrooms and three main halls, approximately 22,800 m^2 in area.
  - a theatre approximately 2,400 m^2 in area
  - retails shops approximately 6,100 m^2 in area
  - an aquarium approximately 2,250 m^2 in area.
- Stage 2:
  - four towers with approximately 3,500 hotel rooms
  - a casino approximately 20,550 m^2 in area
  - a theatre approximately 2,400 m^2 in area
  - retails shops approximately 3,850 m^2 in area
  - a rainforest approximately 2,350 m^2 in area.

The anticipated construction materials provided by FCG included the following:

- concrete
- reinforcement
- steel
- quarry materials
- asphalt
- glass
- timber
- plasterboard
- precast pipes.

Uncertainty factors were supplied by FCG for the volume of each material from which minimum and maximum volumes of material and waste were derived.

The percentages of waste that may be generated from the total ordered volumes of materials were assumed to be 3 %. This is considered to be at the lower end of published ranges of proportion of construction materials becoming waste on the basis that that waste minimisation methods discussed in Section 5.4 will be utilised and that Aquis Resort will utilise best practice procurement systems.

The volumes of additional waste materials including plastics, non-ferrous metals, organics and paper not included in the estimates provided by FCG were calculated based on their proportions in construction and demolition activities, sourced from the Australian Bureau of Statistics (2006).

The estimate of the waste volumes for each stage of construction is presented in Table 5.

Table 5: Estimated Construction Waste Quantities

Waste Material	Uncertainty Factor (%)	Estimated Construction Waste Quantities	
		Minimum (tonnes)	Maximum (tonnes)
Stage 1			
Asphalt	20%	600	900
Concrete	25%	11,540	19,240
Glass	30%	65	120
Miscellaneous	100%	0	3,000
Plasterboard	30%	235	440
Precast pipes	*Unknown*	190	190
Quarry materials	25%	9,450	15,750
Reinforcement	25%	1,145	1,910
Steel (ferrous)	50%	90	270
Timber	50%	55	160
Plastics	N/A	5	5
Non-ferrous metals	N/A	180	180
Organics	N/A	25	25
Paper	N/A	3	3
Other	N/A	160	160
	Total	**23,745**	**42,355**
Stage 2			
Asphalt	20%	145	215
Concrete	25%	7,695	12,825
Glass	30%	60	110
Miscellaneous	100%	0	2,400
Plasterboard	30%	190	352
Precast pipes	*Unknown*	15	15
Quarry materials	25%	2,205	3,675
Reinforcement	25%	830	1,385
Steel (ferrous)	50%	60	180
Timber	50%	35	110
Plastics	N/A	4	4
Non-ferrous metals	N/A	120	120
Organics	N/A	15	15
Paper	N/A	2	2
Other	N/A	105	105
	Total	**11,480**	**21,515**

Waste Material	Uncertainty Factor (%)	Estimated Construction Waste Quantities	
		Minimum (tonnes)	Maximum (tonnes)
Stages 1 & 2 Combined			
Asphalt	20%	745	1,115
Concrete	25%	19,240	32,065
Glass	30%	125	230
Miscellaneous	100%	65	5,400
Plasterboard	30%	425	790
Precast pipes	*Unknown*	205	3,865
Quarry materials	25%	11,655	19,425
Reinforcement	25%	1,975	3,295
Steel (ferrous)	50%	150	450
Timber	50%	90	270
Plastics	N/A	9	9
Non-ferrous metals	N/A	300	300
Organics	N/A	40	40
Paper	N/A	4	4
Other	N/A	270	270
	Total	**35,225**	**63,865**

The national average recycling rate for construction waste presented in the Environment Protection and Heritage Council's *National Waste Report 2010* is 58 per cent. The Green Building Council of Australia report *The Value of Green Star – a Decade of Environmental Benefits* (May 2013), presents project Green Star project examples with average recycling rates of construction and demolition waste of 96 per cent, which exceeded original commitments for an average of 75 per cent recycling rates.

Estimates of residual waste material requiring disposal to landfill based upon a range of recovery rate scenarios are provided in Table 6.

Table 6: Estimated Construction Residual Waste Disposal Quantities for both Stages

Scenario	Resource Recovery	Estimated Construction Waste Landfill Disposal Quantities	
		Minimum (tonnes)	Maximum (tonnes)
A – No resource recovery	0%	35,225	63,865
B – Normal Practice	50%	17,650	32,620
C – Green Star Standard	75%	8,825	16,310
D – Best Practice	95%	1,765	3,260

Existing commercial landfills located within the Cairns Region currently have the capacity to accept the estimated residual construction waste quantities for each of the resource recovery scenarios presented in Table 6. Scenario's A and B, with low or no resource recovery are likely to be outside the capacity of existing local inert landfills located within the Barron River flood plain area. Most residual waste would need to be transported to Springmount Landfill which would need to bring forward the final approval and installation of new waste storage capacity.

Adoption of best practice waste management systems could result in minimal impact upon the existing waste disposal infrastructure in the Cairns Region.

4.4 Construction Waste Management Strategy

The waste management strategy for Aquis Resort will target the minimum Green Star Standard of 75% resource recovery of construction wastes. During the planning, design and procurement processes, however, the Aquis Resort will seek opportunities to achieve a best practice target of 95% resource recovery of construction wastes.

The objectives of waste management strategy during the construction phase will be achieved through:

- Minimising waste generation.
- Maximising recovery, re-use, recycling of materials.
- Ensuring appropriate collection and storage of waste.

Controls that can be implemented during the construction phase include:

- Minimising volumes of materials purchased through:
  - Being as specific as possible in estimating volumes of materials to be used and avoiding over-estimating volumes.
  - Specifying waste management requirements to suppliers.
  - Having materials delivered intermittently throughout construction, only as needed.
  - Optimising the use of packaging materials when ordering materials in bulk.
- Identifying potential re-use and recycling opportunities as part of the procurement process. For example:
  - Using shredded polystyrene packaging as bulk filler in non-structural concrete.
  - Collecting and crushing excess concrete for re-use within structural concrete.
- Incorporating the use of recycled materials, such as sourcing recyclable packaging where practicable.
- Allocating and labelling correct bins for disposal and recycling, both communal and interim (various storeys of developments).
- Segregating waste streams at the source.
- Arranging a co-ordinated contractor/s for the handling transport, processing, recovery and disposal of waste.
- Implementing a comprehensive system to manage and document waste volumes sent to disposal and recycling services.
- Pursuing opportunities for recycling of plasterboard. It is unlikely that processing of waste plasterboard will be available to occur locally. Recycling facilities for plasterboard are established in Brisbane, the feasibility of consolidating waste plasterboard for transport to an appropriate recycling facility will be evaluated further prior to construction.

Table 7 presents the management of waste streams during the entirety of the construction phase of the Aquis Resort.

Table 7: Aquis Resort Construction Waste Management Summary

Waste Stream	Relevant Waste Materials	Waste storage	Waste Collection Method	Potential Waste Destinations
Organic waste	■ Food waste ■ Green waste	Dedicated organic waste bins in each construction area.	Maintenance staff will collect organic waste bins Weekly	In order of preference, potential waste destinations include: 1) Establish an in-vessel composting facility on-site. 2) Develop a commercial composting facility in collaboration with CRC or a commercial waste contractor. 3) Transport to landfill.
Recyclable wastes	■ Paper and cardboard (dry) ■ Plastic bottles ■ Asphalt ■ Concrete ■ Glass bottles ■ Steel ■ Non-ferrous metal ■ Plasterboard (potential to be evaluated)	■ Dedicated co-mingled recycling bins in each construction area. ■ Designated co-mingled recycling bulk bins for recyclables at each construction area.	■ Cleaners will collect co-mingled recycling bins daily. ■ Maintenance staff will manage bulk bins.	In order of preference, potential waste destinations include: 1) Transport to designated on-site or off-site recovery facilities. 2) In conjunction with CRC or a commercial waste contractor, establish or utilise a transfer station off-site.
Regulated wastes	■ Chemicals ■ Pesticides ■ Batteries ■ Oils and paints	All wastes will be stored in a hard-stand, bunded area.	Maintenance staff will collect on request.	Cleaning chemicals, pesticides, car batteries, oils and paints will be sent to private or Council-run collection facilities.
General wastes	■ Plasterboard (if recycling not feasible) ■ Plastic packaging ■ Paper and cardboard (wet) ■ Other	■ Dedicated general waste bins in each construction area. ■ Designated general waste bulk bins at each construction area.	■ Contractors will collect general waste bins daily. ■ Maintenance staff will manage bulk bins and transport to designated landfill.	In order of preference, potential waste destinations include: 1) Transfer from the resort directly to a commercial landfill. 2) In conjunction with CRC or a commercial waste contractor, establish or utilise a transfer station off-site.

5.0 OPERATIONAL PHASE WASTE MANAGEMENT

5.1 General

This section presents the predicted quantities of various waste streams to be generated during the ongoing operation of the Aquis Resort and systems for managing these wastes.

5.2 Waste Streams

This section outlines the management strategies proposed for each waste stream during the operation phase of the resort.

Organic wastes

The Aquis Resort is predicted to generate the following organic wastes:

- food waste
- garden waste
- grease trap waste.

Organic waste bins with clear signage will be provided in hotel suites, apartments, villas and restaurants. The feasibility of providing additional organic waste bins in public spaces and entertainment precincts will be assessed during the detailed planning and design stages.

Grease traps will be installed in all kitchens and food preparation areas, with centralised management responsible for maintenance.

Re-usable wastes

Re-useable wastes such as clothing, unwanted furniture, out-dated appliances (e-waste), and bulky items such as broken appliances, pieces of furniture not in repairable condition, will be collected upon request by maintenance personnel and stored in designated area. These materials will then be taken on a regular basis to resource recovery facilities such as:

- Local charities
- Commercial contactor operated recycling and recovery facilities.

Recyclable wastes

Recyclable wastes that will be generated during operation will include newspaper, office paper, cardboard, paperboard milk cartons, glass bottles and jars, recyclable metal cans (steel and aluminium), recyclable plastics.

Co-mingled recycling bins with clear signage will be provided in hotel suites, apartments and villas, as well as in kitchens and public spaces.

Recyclable materials will be stored in co-mingled recycling bulk bins located in specified storage areas around the resort.

Regulated wastes

Regulated wastes include materials such as household chemicals, unwanted medicines, syringes, car batteries, oils and other domestic waste materials prohibited from landfill. Regular maintenance of the various infrastructures will also result in waste materials such as cleaning chemicals, leftover paints and unused pesticides being generated. The volumes generated are likely to be less frequent relative to other wastes. Personnel at the resort will be trained in correct procedures for the collection and temporary on-site storage of these materials.

General wastes

General wastes include materials such as non-recyclable packaging, personal sanitary items, non-recyclable plastics, non-useable clothing, small broken items such as crockery, non-compostable food waste, diseased plant material non suitable for green recycling and non-recoverable items from maintenance or repair of buildings.

General waste bins with clear signage will be provided in hotel suites, apartments and villas, as well as in kitchens and public spaces.

General waste will be consolidated and stored in bulk bins around the resort, the contents of which will be collected and taken to a materials recovery facility. Disposal of larger items will be managed by maintenance staff, and where such items cannot be stored in bulk bins, disposal will be arranged to occur as soon as is practical.

5.3 Waste Generation

Quantities of waste quantities generated within the Aquis Resort have been estimated for the following key facilities:

- Stage 1:
  - Four towers with approximately 4,000 hotel rooms and 1.5 people per room
  - A casino with approximately 325 tables, 1,500 slot machines, an aquarium and food and beverage stores
  - An expo with four junior ballrooms and three main halls, approximately 22,800 m^2 in area.
  - A theatre with approximately 600 seats
  - Retails shops approximately 6,100 m^2 in area
- Stage 2:
  - Four towers with approximately 3,500 hotel rooms and 1.5 people per room
  - A casino with approximately 305 tables, 1,500 slot machines, a rainforest and food and beverage stores
  - A theatre with approximately 600 seats
  - Retails shops approximately 3,850 m^2 in area

Please note that the golf course in operation during Stage 1 will be located on land which Stage 2 will be constructed. Upon the onset of construction of Stage 2 therefore, a lower waste volumes will be produced during the continued operation of Stage 1. Further, calculations of combined waste volumes from operation of Stages 1 and 2 do not reflect the waste produced from operation of the Stage 1 golf course.

The wastes that may be generated from each of the developments were derived from Cascadia Consulting Group's (2006) waste generation data for various industries in California, USA. These were compared to studies undertaken for accommodation, retail and restaurant sectors by the Commercial and Industrial Waste Audit for Central Queensland Local Government Association.

The volumes of waste generated per visitor, employee or square meter for each development was sourced from Cascadia Consulting Group (2006). The numbers of people or employees or square metres for each development was estimated based on information provided by Aquis Resort.

The tables included in Appendix B present the sourced estimated percentage of each waste stream and the predicted yearly generated volumes of each waste type for each resort element. Total annual volumes for the separate and combines stages are summarised in Table 8.

Table 8: Estimated Annual Operational Waste Quantities

Waste Group	Waste Type	Annual Quantities (tonnes)
Stage 1		
Organic Wastes	Food	3,100
	Garden	275
	Grease trap waste	85
Re-usable Wastes	E-waste	15
	Textiles and carpets	70
Recyclable Wastes	Glass bottles	345
	Glass other	30
	Aluminium cans	20
	Metals other	210
	Paper and cardboard	2,840
	Recyclable plastics	420
	Tyres	10
Regulated Wastes	Hazardous and chemical	5
	Medical waste	0.05
General Waste	Plastic film	270
	Total	**7,695**
Stage 2		
Organic Wastes	Food	2,750
	Garden	250
	Grease trap waste	80
Re-usable Wastes	E-waste	15
	Textiles and carpets	60
Recyclable Wastes	Glass bottles	305
	Glass other	25
	Aluminium cans	20
	Metals other	170
	Paper and cardboard	2,525
	Recyclable plastics	364
	Tyres	10
Regulated Wastes	Hazardous and chemical	5
	Medical waste	0.05
General Waste	Plastic film	240
	Total	**6,820**

Waste Group	Waste Type	Annual Quantities (tonnes)
Stages 1 & 2		
Organic Wastes	Food	5,840
	Garden	520
	Grease trap waste	165
Re-usable Wastes	E-waste	30
	Textiles and carpets	130
Recyclable Wastes	Glass bottles	645

Waste Group	Waste Type	Annual Quantities (tonnes)
	Glass other	55
	Aluminium cans	40
	Metals other	375
	Paper and cardboard	5,340
	Recyclable plastics	780
	Tyres	20
Regulated Wastes	Hazardous and chemical	10
	Medical waste	0.10
General Waste	Plastic film	505
	Total	**14,455***

*Note that combined volumes of operational waste for Stages 1 and 2 do not include operation waste produced by the golf course operating during Stage 1.

5.4 Waste Management Strategy

5.4.1 Approach

The objectives of waste management during the operational phase of Aquis Resort include:

- Minimising waste generation.
- Maximising recovery, re-use, recycling of materials.
- Ensuring appropriate segregation, collection and storage of waste.

Controls that can be implemented during the operational phase include:

- Minimising volumes of materials purchased through:
  - Being as specific as possible in estimating volumes of materials to be used on a daily, weekly and monthly basis.
  - Avoiding ordering in large bulk where items, such as food, can degrade if not used in a timely manner.
  - Use of high quality products that will last longer and can be repaired more easily.
  - Training resort personnel to carefully plan the purchase of products in order to minimise over-ordering of potentially hazardous materials that requirie specialist disposal.
- Identifying potential re-use and recycling opportunities.
- Incorporating the use of recycled materials, such as sourcing recyclable packaging where practicable.
- Allocating correct bins for disposal and recycling, both communal and interim.
- Segregating waste streams at the source.
- Arranging centralised contractors for the transport, processing and disposal of waste and recycling materials.

5.4.2 Organic Wastes

The preferred option is to compost all organic waste on-site in enclosed in-vessel composting facilities. Adoption of this technology would provide limited opportunities for on-site co-generation.

Minimum features considered appropriate for Aquis Resort include the following:

- Airtight

- Internally ventilated with air pollution control filters installed at points of air expulsion
- Capable of composting meats, food scraps, garden waste and grease trap waste.

A list of companies and other guidance can be found at The Recycled Organics Unit (Part of the University of New South Wales) (http://www.recycledorganics.com).

Compost that is produced will be used for maintenance of gardens and the golf course within the Aquis Resort.

Other options for managing organic wastes will be considered during the detailed planning and design of Aquis Resort that would take into account opportunities for co-generation.

5.4.3 Other Wastes

All non-organic waste generated within the Aquis Resort will be collected by appropriate commercial waste contactors as follows:

- Recoverable Wastes: Pre-segregated re-usable/recyclable wastes will be sent to appropriate commercial, CRC or community facilities.
- Regulated Wastes: Pre-segregated regulated and hazardous wastes will be sent to appropriate commercial facilities for resource recovery or disposal to landfill.
- General Wastes: Residual general wastes will be sent to Springmount Landfill either directly from the Aquis Resort or via the Wooree Transfer Station.

5.4.4 Summary

Based upon the assumption that best practice source separation of waste will be undertaken, recovery/re-use targets adopted for each of the nominated waste types, for each stage, are summarised in Table 9. Note that Stage 2 will operate in combination with Stage 1, however, for transparency the total operation waste of Stage 2 individually has been included.

Table 9: Aquis Resort Operational Waste Recovery Summary

Waste Type	Estimated Quantities (tonnes)	Recovery/Reuse Target	Estimated Operations Landfill Disposal Quantities (tonnes)
Stage 1			
Organic Waste	3,460	90%	345
Re-usable Waste	85	80%	15
Recyclable Waste	3,875	90%	390
Regulated Waste	5.05	20%	4
General Waste	270	7.5%	250
Totals	**7,695**	**90%**	**770**
Stage 2			
Organic Waste	2,905	90%	310
Re-usable Waste	75	80%	15
Recyclable Waste	4,305	90%	340
Regulated Waste	5.05	20%	4
General Waste	325	7.5%	220
Totals	**7,615**	**90%**	**670**
Stages 1 & 2			
Organic Waste	6,345	90%	655
Re-usable Waste	160	80%	30
Recyclable Waste	8,160	90%	725
Regulated Waste	10	20%	8
General Waste	590	7.5%	465
Totals	**15,265**	**90%**	**1,885**

Adoption of best practice waste management systems for the operation of Aquis Resort should result in the following tonnes per annum that require disposal to landfill within the Cairns Region:

- Stage 1 – 770 tonnes
- Stage 2 – 670 tonnes
- Stages 1 and 2 combined – 1,885 tonnes.

Management of all wastes should have minimal impact upon the existing waste infrastructure in the Cairns.

Table 10 presents the management of waste streams during the operational phase of Aquis Resort.

Table 10: Aquis Resort Operational Waste Management Summary

Waste Stream	Relevant Waste Materials	Waste storage	Waste Collection Method	Potential Waste Destinations
Organic wastes	■ Food waste ■ Green waste ■ Grease	Dedicated organic waste bins in hotel suites, apartments and villas, as well as in kitchens and all public spaces.	Cleaners, kitchen staff and grounds maintenance staff will collect organic waste and transfer to bulk bins twice weekly. Any bins are will be cleaned after being emptied.	In order of preference, potential waste destinations include: 1) Establish an in-vessel composting facility on-site. Maintenance staff will transfer bulk bins to on-site in-vessel composting facilities and manage these. Use of compost material within the development will be managed by maintenance staff. 2) Develop a commercial composting facility in collaboration with commercial contractor/CRC. 3) Transport to landfill.
Re-useable wastes	■ Textiles ■ E-waste	Designated storage cages at each area of the resort.	Maintenance staff will collect on request.	Materials will be taken on a regular basis to re-use facilities such as local charities and Council and privately run recycling and recovery facilities
Recyclable wastes	■ Paper and cardboard (dry) ■ Glass ■ Aluminium cans ■ Steel cans ■ Plastic bottles ■ E-waste	■ Dedicated co-mingled recycling bins in hotel suites, apartments and villas, as well as in kitchens and all public spaces. ■ Designated co-mingled recycling bulk bins for recyclables at each area of the resort.	■ Cleaners will collect co-mingled recycling waste bins on a daily basis. ■ Maintenance staff will manage bulk bins and transport to designated recycling facilities.	In order of preference, potential waste destinations include: 1) Transport to designated commercial/CRC recycling facilities. 2) In conjunction with commercial contractors, establish a transfer station off-site for waste destined for landfill.

Regulated wastes	■ Household chemicals ■ Medicinal ■ Batteries ■ Oils	■ Dedicated disposal bins will be provided in medical clinics and maintenance facilities. ■ Any chemical, pesticides, batteries, oils and paints will be stored in a hard-stand, bunded area.	■ Maintenance staff will collect as required / upon request.	Cleaning chemicals, pesticides, car batteries, oils and paints will be sent to private or Council-run collection facilities. Unwanted medicines and syringes will be collected by private contractors.
General wastes	■ Plastic packaging ■ E-waste	■ Dedicated general waste bins in hotel suites, apartments and villas, as well as in kitchens and all public spaces. ■ Designated general waste bulk bins at each area of the resort	■ Cleaners will collect general waste bins on a daily basis. ■ Maintenance staff will manage bulk bins and transport to waste destination.	In order of preference, potential waste destinations include: 1) Transfer from the resort directly to landfill by private contractors. 2) In conjunction with commercial contractors, establish a transfer station off-site for waste destined for landfill.

6.0 CONCLUSIONS

The following conclusions have been drawn from the assessment of solid waste management requirements for the Aquis Resort:

- Existing waste generated within the Cairns Region is currently managed by Cairns Regional Council and a range of commercial contactors.
- Cairns Regional Council primarily focuses on meeting the needs of domestic households, with its existing waste infrastructure having limited capacity to accept estimated waste material quantities that will be generated by the Aquis Resort during both construction and operational phases.
- Existing commercial waste contractors are primarily responsible for the management of commercial and industrial wastes and construction and demolition wastes, with relatively large existing waste management capacity accept estimated waste material quantities that will be generated by the Aquis Resort during both construction and operational phases.
- Waste generation quantities during the construction phase are estimated to be:
  - Between approximately 23,745 tonnes and 42,355 tonnes for Stage 1
  - Between approximately 11,480 tonnes and 21,515 tonnes for Stage 2.
  - A total volume for Stages 1 and 2 of between 35,225 tonnes and 63,865 tonnes.

  Adopting the current industry targets of 75 percent recovery, the volume of waste requiring disposal to landfill during construction should be:

  - Less than 10,600 tonnes for Stage 1
  - Less than 5,400 tonnes for Stage 2
  - Less than 16,000 tonnes for both stages combined.

  Adoption of best practice waste management systems of 95 percent recovery during the planning, design and procurement of Aquis Resort presents the opportunity to reduce waste requiring disposal to landfill during construction to:

  - Less than 2,150 tonnes for Stage 1
  - Less than 1,050 tonnes for Stage 2
  - Less than 3,200 tonnes for both stages combined.

  The range of a total of 3,200 to 16,000 (based on upper estimates of waste generation) tonnes of construction waste for both Stages 1 and 2 requiring disposal to landfill is considered to be well within the capacity of existing commercial contractors and infrastructure.
- Waste generation quantities during the operations phase are estimated to be in the order of 7,695 tonnes per year during the operation of Stage 1 alone and 14,455 tonnes per year during the operation of both Stages 1 and 2.

  Adoption of best practice waste management systems during the planning, design and operation of Aquis Resort presents the opportunity to reduce ongoing waste disposal to landfill to approximately 770 tonnes per year during the operation of Stage 1 alone and 1,885 tonnes per year during the operation of both Stages 1 and 2, well within the capacity of existing commercial contractors and infrastructure.
- Use of the SITA ARRT facility for the processing of organic wastes from the Aquis Resort should be considered with caution given the relatively poor quality compost produced at present.

- Given the estimated volume of wastes to be generated during the operation phase, particularly organic and recyclable wastes, there are opportunities to seek partnerships with Cairns Regional Council and commercial operators to enhance existing waste management infrastructure (e.g. CRC MeRF and SITA ARRT) to provide improved resource recovery outcomes for the Cairns Region.

7.0 REFERENCES

Australian Bureau of Statistics, 2006, *Australia's Environment Issues and Trends*, Commonwealth of Australia, ACT.

Cairns Regional Council, 2009, *Waste Management Strategy.*

Cascadia Consulting Group, 2006, *Targeted Statewide Waste Characterization Study: Waste Disposal Findings for Selected Industry Groups*, California.

Green Building Council of Australia, 2013, *The Value of Green Star – A Decade of Environmental Benefits*.

8.0 LIMITATIONS

Your attention is drawn to the document - "Limitations", which is included as Appendix D in this report. The statements presented in this document are intended to advise you of what your realistic expectations of this report should be. The document is not intended to reduce the level of responsibility accepted by Golder Associates, but rather to ensure that all parties who may rely on this report are aware of the responsibilities each assumes in so doing.

GOLDER ASSOCIATES PTY LTD

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APPENDIX A

Aquis at Great Barrier Reef Concept Land Use Plan

North

RICHTERS CK

Walking Trail

Horse Trail

Lake Inlet/Outlet Pipeline

Golf Course

Lake Overflow

Golf Course

Lake Overflow

Lake Overflow

RICHTERS CK

Staff Carpark

Water Quality Treatment Area

YORKEYS CK

Golf Course

Golf Driving Range

Tennis Centre

Water Quality Treatment Area

Equestrian Centre

Archery Field

YORKEYS KNOB ROAD

18 Hole Golf Course

Netball

Soccer Field

Maintenance Sheds

DUNNE ROAD

Rugby Field

AFL / Cricket

Water Quality Treatment Area

VARLEY STREET

SIMS ESPLANADE

CATTANA ROAD

HALF MOON CK

AQUIS
GREAT BARRIER REEF RESORT

Drawing
AQUIS MASTER PLAN

Scale
1 : 10000 @ A3
1 : 5000 @ A1
0 50 100 150 200 250 (m)

Date
14.03.14

Aedas

APPENDIX B

Operation Waste Generation Quantity Estimates

The waste generation volumes presented in this report should be treated as indicative values only and not used for any other calculations for detailed planning and design for the Aquis Resort.

Table 11: Yearly Waste Generation Volumes for Stage 1 Accommodation

Waste Materials	Percentage of total waste generated*	Yearly Total (tonnes)
Food	39	1,895
Green	3	155
E-waste	0.3	15
Glass bottles	5	245
Glass other	5	10
Aluminium cans	0.3	15
Metals other	2	135
Paper and cardboard	33	1,600
Recyclable plastics	5	235
Plastic film	3	140
Hazardous and chemical	0.1	5
Medical waste	0	0
Textiles and carpets	1	45
Tyres	0	0
Total		**4,495**

*Note that percentage construction and demolition waste, which forms a proportion of overall wastes from the utilised source, has not been included in this table.

Table 12: Yearly Waste Generation Volumes for Stage 1 Casino

Waste Materials	Percentage of total waste generated*	Yearly Total (tonnes)
Food	18	75
Green	8	35
Grease trap waste	N/A	40
E-waste	0.1	0.5
Glass bottles	4	15
Glass other	1	4
Aluminium cans	0.4	2
Metals other	3	10
Paper and cardboard	39	160
Recyclable plastics	6	25
Plastic film	4	20
Hazardous and chemical	0	0
Medical waste	0	0
Textiles	1	6
Tyres	1	3
Total		**395**

*Note that percentage construction and demolition waste, which forms a proportion of overall wastes from the utilised source, has not been included in this table.

Table 13: Yearly Waste Generation Volumes for Stage 1 Food and Beverage Outlets

Waste Stream	Percentage of total waste generated*	Yearly Total (tonnes)*
Food	53	930
Green	0	2
Grease trap waste	N/A	48
E-waste	0	0
Glass bottles	2	40
Glass other	0.1	2
Aluminium cans	0.1	2
Metals	1.9	35
Paper and cardboard	24	605
Recyclable plastics	3	50
Plastic film	3	55
Hazardous and chemical	0	0
Medical waste	0	0
Textiles	0.2	4
Tyres	0	0
Total		**1,775**

*Note that percentage construction and demolition waste, which forms a proportion of overall wastes from the utilised source, has not been included in this table.

Table 14: Yearly Waste Generation Volumes for Stage 1 Retail

Waste Stream	Percentage of total waste generated*	Yearly Total (tonnes)*
Food	7	10
Green	1	2
E-waste	0	0
Glass bottles	0.3	0.5
Glass other	3	4
Aluminium cans	0.3	0.5
Metals other	2	3
Paper and cardboard	46	70
Recyclable plastics	27	40
Plastic film	7	10
Hazardous and chemical	0.3	0.5
Medical waste	0	0
Textiles	0.6	1
Tyres	0	0
Total		**140**

*Note that percentage construction and demolition waste, which forms a proportion of overall wastes from the utilised source, has not been included in this table.

Table 15: Yearly Waste Generation Volumes for Stage 1 Theatre

Waste Materials	Percentage of total waste generated*	Yearly Total (tonnes)
Food	18	180
Green	8	80
Grease trap waste	N/A	0
E-waste	0.1	1
Glass bottles	4	40
Glass other	1	10
Aluminium cans	0.4	4
Metals other	3	25
Paper and cardboard	39	380
Recyclable plastics	6	60
Plastic film	4	45
Hazardous and chemical	0	0
Medical waste	0	0
Textiles	1	15
Tyres	1	7
Total		**845**

*Note that percentage construction and demolition waste, which forms a proportion of overall wastes from the utilised source, has not been included in this table.

Table 16: Yearly Waste Generation Volumes for Stage 1 Golf Course

Waste Materials	Percentage of total waste generated*	Yearly Total (tonnes)
Food	18	30
Green	8	15
Grease trap waste	N/A	0
E-waste	0.1	0
Glass bottles	4	6
Glass other	1	1
Aluminium cans	0.4	1
Metals other	3	4
Paper and cardboard	39	60
Recyclable plastics	6	10
Plastic film	4	7
Hazardous and chemical	0	0
Medical waste	0	0
Textiles	1	2
Tyres	1	1
Total		**135**

*Note that percentage construction and demolition waste, which forms a proportion of overall wastes from the utilised source, has not been included in this table.

Table 17: Yearly Waste Generation Volumes for Stage 2 Accommodation

Waste Materials	Percentage of total waste generated*	Yearly Total (tonnes)
Food	39	1,655
Green	3	135
E-waste	0.3	15
Glass bottles	5	215
Glass other	5	8
Aluminium cans	0.3	15
Metals other	2	100
Paper and cardboard	33	1,400
Recyclable plastics	5	207
Plastic film	3	120
Hazardous and chemical	0.1	4
Medical waste	0	0
Textiles and carpets	1	40
Tyres	0	0
Total		**3,915**

*Note that percentage construction and demolition waste, which forms a proportion of overall wastes from the utilised source, has not been included in this table.

Table 18: Yearly Waste Generation Volumes for Stage 2 Casino

Waste Materials	Percentage of total waste generated*	Yearly Total (tonnes)
Food	18	75
Green	8	30
Grease trap waste	N/A	40
E-waste	0.1	0
Glass bottles	4	15
Glass other	1	4
Aluminium cans	0.4	2
Metals other	3	10
Paper and cardboard	39	155
Recyclable plastics	6	25
Plastic film	4	20
Hazardous and chemical	0	0
Medical waste	0	0
Textiles	1	6
Tyres	1	3
Total		**385**

*Note that percentage construction and demolition waste, which forms a proportion of overall wastes from the utilised source, has not been included in this table.

Table 19: Yearly Waste Generation Volumes for Stage 2 Food and Beverage Outlets

Waste Stream	Percentage of total waste generated*	Yearly Total (tonnes)*
Food	53	835
Green	0	2
E-waste	0	0
Glass bottles	2	35
Glass other	0.1	2
Grease trap waste	N/A	45
Aluminium cans	0.1	2
Metals other	1.9	30
Paper and cardboard	24	545
Recyclable plastics	3	45
Plastic film	3	50
Hazardous and chemical	0	0
Medical waste	0	0
Textiles	0.2	3
Tyres	0	0
Total		**1,595**

*Note that percentage construction and demolition waste, which forms a proportion of overall wastes from the utilised source, has not been included in this table.

Table 20: Yearly Waste Generation Volumes for Stage 2 Retail

Waste Stream	Percentage of total waste generated*	Yearly Total (tonnes)*
Food	7	6
Green	1	1
E-waste	0	0
Glass bottles	0.3	0.5
Glass other	3	3
Aluminium cans	0.3	0.5
Metals other	2	2
Paper and cardboard	46	45
Recyclable plastics	27	27
Plastic film	7	7
Hazardous and chemical	0.3	0.5
Medical waste	0	0
Textiles	0.6	0.6
Tyres	0	0
Total		**95**

*Note that percentage construction and demolition waste, which forms a proportion of overall wastes from the utilised source, has not been included in this table.

Table 21: Yearly Waste Generation Volumes for Stage 2 Theatre

Waste Materials	Percentage of total waste generated*	Yearly Total (tonnes)
Food	18	180
Green	8	80
E-waste	0.1	1
Glass bottles	4	40
Glass other	1	10
Aluminium cans	0.4	4
Metals other	3	25
Paper and cardboard	39	375
Recyclable plastics	6	60
Plastic film	4	45
Hazardous and chemical	0	0
Medical waste	0	0
Textiles	1	15
Tyres	1	7
Total		**840**

*Note that percentage construction and demolition waste, which forms a proportion of overall wastes from the utilised source, has not been included in this table.

APPENDIX C

Limitations

LIMITATIONS

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