City Pacific Limited

Townsville Ocean Terminal

Waste Minimisation & Management

---

1 November 2007

Report no: NS02983

City Pacific Limited

Townsville Ocean Terminal

Waste Minimisation & Management

Author: N. Hanke / L. Clough

Checker: R. Wainberg

Approver: R. Wainberg

Report no: NS02983 **Date:** 1 November 2007

Hyder Consulting Pty Ltd
ABN 76 104 485 289
Level 5, 141 Walker Street, North Sydney NSW 2060, Australia
Tel: +61 2 8907 9000 Fax: +61 2 8907 9001 www.hyderconsulting.com

Contents

Executive Summary

Character and Quantities of Waste Materials

This report provides technical details of the proposed waste treatment and minimisation measures to be implemented during the construction and operational phases of the Townsville Ocean Terminal (TOT) project as required pursuant to Section 4.5 of the terms of Reference. Such measures are described in Section 4.4 of this report. Proposed emission, discharge and disposal criteria are provided in Section 4.2.

The major waste types likely to be generated during the construction phase include: Excess fill and excavated material; concrete, timber, steel/metals, asphalt, cardboard, plastics and packaging materials, Plasterboard and Landscaping materials.

The figures presented in Table 2-1 are estimates of the total amount of waste generated throughout the construction phase of the project.

Table 1-1: Total waste generation during Construction Phase (per annum)

	Waste in tonnes/year
Townsville Ocean Terminal	101
Breakwater Precinct	9,177
Site workers	180
Total	**Approx. 9,458**

The major waste elements likely to be generated during operation of the TOT Precinct include food waste, plastics and packaging materials, paper and cardboard, oil, grease and hazardous waste, non-quarantine garbage from vessels (food, paper, glass, metals, plastics and packaging) and quarantine waste from vessels (galley and accommodation refuse; floor sweepings; organic wastes that constitute a health risk; and food subject to quarantine).

The waste stream elements expected to be generated from the Breakwater Cove Precinct include domestic garbage, aluminium, glass, steel, plastics (PET and HDPE) and paper and cardboard.

An inventory of wastes to be generated during the construction and operational phases of the project is provided in Sections 2.1 and 2.2 respectively. Decommissioning of the project is not expected to generate wastes as described in Section 2.3. Schematic diagrams indicating waste generating processes and associated waste streams are provided in Appendix A.

Cross references to relevant sections of the EIS that deal with potential impacts and mitigation measures is presented in Section 4.3. Section 4.4 provides measures for waste avoidance, reuse, recycling, treatment and disposal. There is no processing plant proposed for the TOT project.

Solid Waste Disposal

Solid waste disposal and the suitability of existing landfill and disposal facilities to accept project waste is discussed in Section 2.6. The Townsville City Council A total of 71,592 tonnes of waste is deposited each year at a landfill site in Vantassel Street, Townsville. This landfill has a projected lifespan of more than 70 years and is expected to be sufficient to accept domestic waste generated from the Breakwater Cove Precinct.

Liquid Waste

The management of liquid waste generated from the project is assessed in specialist studies. Quality and quantity of stormwater, site drainage and runoff from roads and hardstand areas within the site is considereddetailed in the Stormwater Management Plan. Management of groundwater during site excavations is described in the Water and Sediment Quality Report. Water supply and sewage treatment measures are described in the Infrastructure Report. Hazardous wastes and sediment and erosion control are addressed in the Construction Methodology Report. This is discussed in Section 2.7.

Description of Environmental Values

The environmental values that may be affected by wastes generated by the TOT Project include the values of receiving environments as identified below and described by site-specific investigations undertaken during preparation of the EIS. Cross-references to sections of the EIS where relevant environmental values are described are provided in Section 3

Table 3-1: Environmental values potentially affected by project waste

Environmental Values	Section of the EIS
Soils, geology and terrestrial land uses	4.2.1
surface water quality, downstream water uses, groundwater resources and coastal environments	4.6.1 and 4.7.1
Local air quality, public amenity and well-being	4.8.1
Visual amenity and landscape character	4.9.1
Flora and fauna species, communities and habitats	4.11.1
Community facilities, social amenity and well-being	4.13.1
Health and safety of community and workforce	4.14.1

.

Potential Impacts and Mitigation Measures

The objectives for waste minimisation and management are outlined in Section 4.1 and include:

- To minimise waste generated at the site to reduce the volume of waste requiring disposal to landfill.
- To prevent dispersal of waste from the site to receiving environments.
- To ensure compliance with the *Environmental Protection Act 1994* and the *Environmental Protection (Waste Management) Policy 2000* (EPP Waste).
- To encourage residents and operators within the TOT project site to implement waste reduction management measures.

Practical measures for achieving these objectives and protecting environmental values in accordance with relevant standards and performance indicators for waste monitoring and management are outlined in Section 4.4 and have been incorporated into the project EMP.

Potential environmental and human health impacts may occur as a result of poor waste management practices. Potential impacts are identified in Section 4.3.and Mmitigation measures are proposed in various sections of the EIS as outlined in Section 4.3. below.

Table 3-3: Potential waste impacts and proposed mitigation measures

Potential Impacts	Mitigation Measures	Section of the EIS
Excessive resource use leading to depletion of natural resources	Construction waste reduction and recycling measures	Waste 4.5.3
Excessive resource use resulting in greenhouse gas production	Greenhouse gas reduction measures	Air 4.8.X
Emission of polluting substances to surrounding waterways resulting in water quality impacts	Sewer and stormwater management measures	Infrastructure 4.4.2.3 and 4.4.2.4
	Hazardous substances management	Construction 3.4.1
Emission of polluting substances to surrounding waterways leading to ecological impacts	Sewer and stormwater management	Infrastructure 4.4.2.3 and 4.4.2.4
	Hazardous substances management	Construction 3.4.1
	Construction and operational waste management measures	Waste 4.5.3
Emission of polluting substances to air	Air quality control measures	Air 4.8.X

leading to human health impacts		
Emission of polluting substances to air leading to odour impacts	Air quality control measures	Air 4.8.X
Emission of polluting substances to land resulting in recreational and amenity impacts	Construction and operational waste management measures	Waste 4.5.3

Measures for management of wastes generated from the site to ensure the objectives for waste minimisation and environmental protection are achieved in accordance with the EP Act and the EPP Waste are as follows:

- Appropriate Protection measures proposed to mitigate these impacts during construction and operation are outlined in Section 4.4
- Hhandling, storage and disposal procedures for waste generated during construction and operation of the project are described in Section 4.4enforced through the EMP:
- . All waste generated at the site during construction and operation will be stored for collection by approved waste contractors and transported for treatment or disposal off-site. There is no proposal for treatment and disposal of wastes on site.
- Where practicable waste materials will be reused within the site and arrangements will be made for collection of recyclable waste by a licensed waste recycling facility.
- Discharge criteria for management of solid wastes are provided in Section 4.2. Criteria for liquid wastes are provided by specialist consultants reports as outlined in Section 2.7.set by the EMP
- There will be no waste dumps or impoundments within the site. Any stockpiles required for temporary storage of materials during construction will be appropriately located away from overland flow paths and stormwater runoff from the stockpile area will be treated by filtration and or sedimentation prior to discharge from the site.
- Waste minimisation and cleaner technology is addressed in Section 4.6. Cleaner production technology is applied to production processes. There are no production processes proposed during operation of the TOT project site that will result in generation of by-products or input of raw materials. Additionally there is no proposal for integrated process design, cogeneration of power or by-product re-use.
- However, waste minimisation principles have been applied to the construction and operational phases of the project to ensure reduction of energy and water consumption and to ensure efficient use of material resources.

Waste management measures to be implemented to minimise generation of waste from the site are detailed throughout this report and are incorporated into the project EMP.

1 Introduction

Hyder Consulting Pty Ltd (Hyder) was commissioned to provide the technical assessment of Waste Minimisation and Management required under Section 4.5 of the Terms of Reference for the Townsville Ocean Terminal (TOT) Project.

1.1 Project Description

The site proposed for development of the TOT Project is located adjacent to the Townsville Hotel and Casino Complex and the Townsville Entertainment Centre. The ocean terminal and residential precincts will be constructed on reclaimed land to the north of Sir Leslie Thiess Drive and will form the western boundary of the Port of Townsville.

Development of the TOT Project will involve construction of a dedicated ocean terminal for use by cruise ships and naval vessels and a residential area providing for a range of uses including apartments, attached dwellings, detached dwellings, commercial and retail facilities services, landscaping and public utilities.

The project will generate waste throughout the construction and operational phases of development. Waste management measures will be implemented during the construction and operational phases to ensure there is no impact on the receiving environment.

This report describes the various types and estimated quantities of waste the TOT Project will produce throughout construction and operation. Existing waste management facilities are described with respect to domestic and commercial waste, possible future requirements, emissions and waste management measures. The waste aspects of the proposed open space area are also considered and elements of good practice public place recycling guidelines are provided.

2 Character & Quantities of Waste Materials

2.1 Construction Phase

Construction activities at the TOT Project will generate a range of wastes requiring various methods of disposal. The major waste types likely to be generated during the construction phase include:

- Excess fill and excavated material;
- Concrete, timber, steel/metals, asphalt;
- Cardboard, plastics and packaging materials;
- Plasterboard;
- Landscaping materials.

2.1.1 Site Reclamation Works

The volume of fill material required for site reclamation works has been reduced through re-evaluation of the construction methodology. Materials excavated from within the site will be reused as fill to form building platforms to the required levels. This methodology has reduced the requirement for rock and sand fill and has prevented the need for disposal of excavated material.

Civil infrastructure works to be undertaken once land platforms are constructed will be monitored to ensure that accurate material quantities are ordered to prevent excess material requiring disposal. Material that cannot be recycled or reused within the site will be either returned to the supplier or delivered to a recycling facility.

It is expected that waste materials generated during site reclamation works will be minimal and that materials requiring disposal can be accommodated by existing landfill and recycling facilities.

2.1.2 Building Works

To calculate the amount of waste from construction of buildings, it is estimated that 9.2kg of waste will be generated per $100 of building and construction work undertaken. This figure is taken from the levels of construction and demolition waste disposed of on an annual basis throughout 1990-98 in NSW – levels remained broadly constant for the duration of this period. However, when the value is adjusted for the amount of building and engineering construction work undertaken, it varies by up to 20% either side of the median value of 9.2kg (EPA NSW, 2000). It should

be noted that the construction of residences within the Breakwater Cove Precinct will be undertaken by external contractors following commissioning of the site and therefore is not formally a part of the EIS.

Terminal Building

Based on the expected expenditure as of May 2007, a total of $AUS 2.2 million will be allocated to the construction of the terminal building. The total amount of waste generated is estimated at 202 tonnes during the construction phase, which is expected to last for two years. This figure can differ between 162 and 243 tonnes when taking the 20% variation into consideration. This estimate is considered to be conservative as it is proposed to construct the terminal building from prefabricated tilt panel structures. This construction method would not be expected to generate as much waste as typical building construction requiring fabrication on site.

Future Residences and Marina

Similarly, if expenditure on buildings and structures within the Breakwater Cove Precinct including the future marina is approximately $AUS 399 million then the total volume of waste expected will be between 29,366 and 44,050 tonnes over an estimated four year period.

Construction Workforce

The waste generated by construction workers should also be taken into consideration. It is estimated that construction personnel for all works is 1,200 workers over seven years or more. If each worker generates around about 0.5kg of waste per day over 300 working days per year, this will generate waste equal to 180 tonnes per annum.

The figures presented in Table 2-1 are estimates of the total amount of waste generated throughout the construction phase of the project.

Table 2-1: Total waste generation during Construction Phase (per annum)

	Waste in tonnes/year
Townsville Ocean Terminal	101
Breakwater Precinct	9,177
Site workers	180
Total	**Approx. 9,458**

2.2 Operational Phase

2.2.1 Townsville Ocean Terminal Precinct

The major waste elements likely to be generated during operation of the TOT Precinct include:

- food waste;
- plastics and packaging materials;
- paper and cardboard;
- oil, grease and hazardous waste;
- non-quarantine garbage from vessels (food, paper, glass, metals, plastics and packaging); and
- quarantine waste from vessels (galley and accommodation refuse; floor sweepings; organic wastes that constitute a health risk; and food subject to quarantine).

Terminal Building

The TOT Precinct will consist of a terminal building which will incorporate 5 offices, 4 information and sales kiosks, 1 café and a security room. The expected number of employees will be around 20 personnel – 5 working in the café and 15 around the berth and various offices. It is noted that the terminal building will only operate whilst a vessel is berthed at the wharf. It is therefore expected that the TOT would operate for approximately one third of the year given that 20 cruise ships and 40 to 50 naval vessels are expected to use the facility each year.

Based on typical waste disposal rates for restaurants and businesses (refer to Table 2-2) it can be estimated that the café would produce approximately 2.54 tonnes of waste per employee each year. Therefore 5 café employees would produce around about 12.7 tonnes of waste each year, of which 5.3 tonnes would constitute food scraps. Given that the TOT will operate for only one third of the year, the expected waste generation from café employees would be approximately 3.8 tonnes per year.

The estimated amount of office waste generated per year is around 0.93 tonnes per employee each year, which would amount to 13.95 tonnes of waste for 15 office employees. Approximately 6 percent or 0.84 tonnes will be organic in nature. The expected rate of waste generation given that the facility will be operational for only one third of the year is approximately 4.19 tonnes per year.

Table 2-2: Waste Disposal Rates for Restaurants and Business Services. Source: California Waste Management Board, 2000.

	Waste (tonne/employee/year)	% Food Waste
Restaurant	2.54	43.9%
Business Service	0.93	6.0%

The number of visitors to the terminal each year has been assumed to be around 200,000 – this figure includes the number of persons on both cruise and military vessels. A tourist may be expected to produce around 0.1 - 0.2 kg of waste if required to spend 2 or 3 hours within the terminal. Day-trippers or persons visiting the TOT for recreational purposes may dispose of food packaging, organic waste etc that is either purchased on site or bought from elsewhere.

Visiting ships

During operation, the expected shipping movements of the Townsville Ocean Terminal will consist of approximately 20 cruise ships and 40 to 50 military vessels each year. The operator of the TOT will have limited control over ship-board waste generation and waste avoidance will be the responsibility of vessel operators. Any ship visiting Townsville Ocean Terminal that has sailed in international waters is deemed foreign, and all waste on board will be subject to inspection by the Australian Quarantine and Inspection Service (AQIS). Plastics and metal which have been appropriately segregated may be suitable for recycling. In cases where contamination has occurred (e.g. contact with foodstuffs) the waste must be treated in accordance with AQIS requirements, which is either deep burial or incineration. All quarantine waste in Townsville is buried under AQIS supervision.

The type of solid and hazardous waste a typical cruise ship generates comprises of glass, paper, steel, food scraps, aluminium, cardboard etc. Waste types found on military vessels are similar. It should also be noted that small amounts of hazardous materials are generated on ships such as chlorinated hydrocarbons and solvents from on-board activities and processes that include photo processing, dry-cleaning, and equipment cleaning.

Based on the figures presented in Table 2-3, a typical cruise ship with approximately 1158 passengers and sea bound for 9.5 days will produce around 33 tonnes of domestic waste and 220 kg of hazardous waste. Assuming that all cruise ships carried the same amount of passengers and had the same excursion time, the amount of waste for 20 vessels over a

one year period would be around 660 tonnes of domestic waste and 4.4 tonnes of hazardous waste.

Table 2-3: Cruise and Military ship waste generation. Source: IMO 1995, Surfrider Foundation 2006 and McTavish, 2006.

	Cruise kg/person/day	Military kg/vessel/day
Domestic Waste	3	750
Hazardous Waste	0.02	-

Conversely, a military ship produces around 750kg of waste each day, hence a ship at sea for 5 days might come to shore with 3.8 tonnes of waste. Hence the total amount of domestic waste generated by 45 military vessels is approximately 169 tonnes/year. It is important to note that Americans produce more waste than their Australian counterparts therefore USN ships frequently exceed the amount mentioned in Table 2-2 (McTavish, 2006). A study undertaken on Garden Island and HMAS Kattabul found quarantine waste (either food or organic in nature) dominated the waste stream on naval vessels that returned from overseas or interstate. A report conducted by the Royal Australian Navy (1998) found that 60% of a ships waste mainly consisted of “food-associated waste”. There is no further information available on the amount of hazardous waste produced on military vessels.

2.2.2 Breakwater Cove Precinct

The waste stream elements expected to be generated from the Breakwater Cove precinct include:

- domestic garbage;
- aluminium;
- glass;
- steel;
- plastics (PET and HDPE); and
- paper and cardboard.

The Breakwater Cove Precinct will provide landform for future construction of approximately 500 apartments and 200 detached dwellings. 1,470 persons in both apartments and attached and detached dwellings. The Australian Bureau of Statistics Census Data (2001) shows that the average number of residents in Australian dwellings was 2.7 residents in detached dwellings and 1.7 residents in apartments. It is therefore estimated that around 1,390 persons will be accommodated in both apartments and

detached dwellings within the site. The predicted volume of waste generated from 1,390 persons is estimated at around 695 tonnes/year. This estimate is based on an average domestic waste generation rate of 0.5 tonnes/person/year.

2.2.3 Maintenance Dredging

Maintenance dredging will be required to maintain the dimensions of access channels and waterways within the project site for navigational purposes. Material dredged from the TOT berth pocket and from access channels will be disposed of at the Port of Townsville approved disposal site.

Volumes of material to be dredged and frequency of maintenance dredging is detailed in Section 3.5 of the EIS. Disposal of this material will be in accordance with existing Port of Townsville approvals.

Total Operational Waste Generated

Table 2-4 provides a summary of estimated quantities of waste from various sources within the TOT during its operation. It is noted that this is total waste generated, with a proportion of it being recycled, and a proportion transported to landfill for disposal. There is insufficient information available to estimate the potential for recycling from this waste stream however, the single largest component of the waste is expected to be food waste. Without a sophisticated system for separation and processing, the recycling opportunities will be limited to beverage containers and paper/cardboard. Therefore, the potential for waste reduction may be approximately similar to that from domestic waste through kerbside recycling.

Table 2-4: Total waste generated during Operational Phase (per annum)

	Waste in tonnes/year
Breakwater Cove Precinct[1]	695
Terminal Building[2]	8
Ships[3]	833
Day Visitors	30
Total	Approximately **1,566**

These figures are based on the following assumptions:
[1] 1,390 residents generating 0.5 tonnes/person/year
[2] 20 Personnel in total – 5 in café and 15 in various offices for one third of each year
[3] 20 Cruise ships with 33 tonnes each; 45 Military ships with 3.7 tonnes each

The waste stream elements and proposed treatment and disposal measures for the construction and operational phases are illustrated in Schematic Waste Diagrams provided in Appendix A.

2.3 Decommissioning

At the completion of site construction works, temporary buildings used as offices and other facilities will be demobilised off site. At the completion of site construction works and once the site is secure for public access, fencing material will be demobilised off site. It is expected that these materials can be reused and will not require disposal.

Rock material removed from temporary bunds and barge landing sites will be reused within the site in final profiling of breakwaters. The barge landing facility at the Riverside Marine stockpile site will require upgrade for delivery of construction materials to the site. This facility will be left in place for future use by Riverside Marine at the completion of site construction works.

2.4 Waste Related Traffic

Estimates of the volume of waste related traffic generated during construction and operation of the Townsville Ocean Terminal and Breakwater Cove Precinct are based on the following assumptions:

- Construction of the terminal and residential area would be undertaken over a 39 month period;
- the maximum sustained construction workforce would be approximately 1,200 workers; and
- Construction would take place six days per week over a 12 hour period.

Most truck movements will occur through delivery of materials to the construction site. There will be some additional traffic transporting waste and recycling materials in the opposite direction. Over the construction period of the ocean terminal and Breakwater Precinct it is estimated an average of 4 to 15 truck movements per day[1]. Some of these movements will be through trucks 'back loading' however, the extent of this is considered to be small as the majority of material delivered to the site will be used on site for the construction of the TOT works. These figures are the approximate maximum daily movements.

[1] 2-7 t per truck, 300 d/yr collection

During the operational phase of the terminal and Breakwater Cove precinct, traffic generation will be in the order of between 1 to 3 truck movements per day for waste collection and recycling from the terminal- based on the same truck capacity assumed above.

2.5 Volume of Product Produced

There are no production processes proposed during operation of the TOT project site that will result in generation of process wastes or by-products or that will require input of raw materials.

2.6 Solid Waste Disposal

2.6.1 Existing Waste Facilities

Domestic Waste Disposal

The City of Townsville kerbside collection program provides weekly services to approximately 30,000 premises within the City. Waste generation rates within Townsville are estimated at 1.36 tonnes/person/year (including domestic, commercial and industrial waste). This figure is higher than the regional North Queensland rate of 1.14 tonnes/person/year. However, the rate for Townsville is believed to be influenced by the high percentage of regional industries located within the City. Citiwaste Townsville collects some 45,000 tonnes of domestic waste each year. A total of 71,592 tonnes of waste is deposited each year at the landfill site in Vantassel Street, Townsville (refer to Table 2-5). This is the only operating landfill in Townsville and has a projected lifespan of more than 70 years. This facility is expected to be sufficient to accept domestic waste generated from the Breakwater Cove Precinct.

Table 2-5: Volume of waste deposited at Vantassel Street Landfill per annum, Townsville. Source: Townsville City Council, 2006.

	tonnes/ annum
Domestic Collection (Citiwaste)	45,000
Commercial Collection (Contract)	9,600
Clinical Collection	192
Other (Private, Industrial, Commercial)	16,800
Total	71,592

Commercial Waste Disposal

Adequate waste disposal facilities exist within the Local Government area for disposal of waste generated during construction of the TOT and Breakwater Cove precincts. The Vantassel Street Townsville Landfill is also licensed to accept construction and demolition wastes. Based on waste generation and diversion rates for Queensland in 2002-03 (ABS, 2006) it has been estimated that the total amount of Commercial and Industrial (C+I) and Construction and Demolition (C+D) waste going to Townsville landfill is 38,239 (refer to Table 2-6).

Table 2-6: Commercial and Industrial - Construction and Demolition waste in tonnes, Townsville 2002-03

	C + I tonnes	C + D tonnes	Total
Disposed	20,045	18,194	38,239
Recycled	5,689	13,095	18,784
Generated	25,734	31,289	57,023

Port of Townsville Waste

The Port of Townsville currently provides shore-based facilities for receiving ship-generated waste to ensure compliance with MARPOL 73/78 (Convention for the Prevention of Pollution from Ships 1973 as modified by the Protocol of 1978). These waste products include:

- Oils and oily mixtures including chemicals;
- Noxious Liquid Substances (NLS);
- Sewage;
- Non-quarantine garbage from Australian vessels (food, paper, glass, metals, plastics and packaging); and
- Quarantine waste.

2.6.2 Future Requirements

The volume of waste produced throughout the construction of the project is estimated to be around about 38,170 tonnes and the sustained amount created throughout the life of the project is expected to be in the region of 1,566 tonnes per annum. Existing waste facilities are expected to be of sufficient capacity to receive this volume of waste. It is therefore not proposed to construct additional landfill for the project.

2.6.3 Emissions

Containers for waste collection and recycling in the TOT Precinct will be suitably covered or will be contained by a lid if putrescible waste is the main component, thereby minimising emissions. Additionally, all 'receptacles' will also be in good working order so that no leakage will occur during storage and transport. There will be no necessity to have any dedicated waste processing facilities on site as everything will be transported to existing Council managed or contracted facilities.

2.7 Liquid Waste

Quality and quantity of stormwater, site drainage and runoff from roads and hardstand areas within the site is detailed in the Stormwater Management Plan. A site stormwater analysis, usage of water and water supply for the project is detailed in the Infrastructure Report. The collection, treatment and disposal of wastewater origination from the project is described in the Infrastructure Report.

Management of groundwater during site excavations is described in the Water Quality Report. An erosion and sediment control plan will be prepared during the detailed design phase to be implemented during construction in accordance with the *Engineering Guidelines for Queensland Construction Sites* (Institute of Engineers Australia) to prevent mobilisation of pollutants in runoff from the site and to protect the water quality of surrounding waterways during construction. Management measures for handling of hazardous substances including liquid waste products is outlined in the project EMP.

2.8 Trade Waste

A trade waste approval will be obtained from Townsville City Council to allow discharge of waste water from the proposed oil and grit separators within the TOT precinct to the sewer. The TOT operator will ensure that all conditions of the approval are met including:

- maximum discharge quantity;
- maximum rate of discharge;
- waste water quality limits; and
- treatment and management requirements.

Discharge of trade waste to the sewer will be separated from the domestic waste discharge line. The discharge location will incorporate an inspection chamber located at ground level to allow for monitoring and sampling as required by Council.

Regular cleaning and removal of accumulated oil and grease from the oil and grit separator will be undertaken by an EPA-licensed contractor who will be responsible for waste tracking requirements. All trade waste will be transported, treated and disposed of in accordance with the *Environmental Protection Regulation 1998* and the *Environmental Protection (Waste Management) Regulation 2000*.

3 Description of Environmental Values

The environmental values that may be affected by wastes generated by the TOT Project include the values of receiving environments as identified below and described by site-specific investigations undertaken during preparation of this EIS. Cross-references to sections of the EIS where relevant environmental values are described are provided in Table 3-1.

Table 3-1: Environmental values potentially affected by project waste

Environmental Values	Section of the EIS
Soils, geology and terrestrial land uses	4.2.1
surface water quality, downstream water uses, groundwater resources and coastal environments	4.6.1 and 4.7.1
Local air quality, public amenity and well-being	4.8.1
Visual amenity and landscape character	4.9.1
Flora and fauna species, communities and habitats	4.11.1
Community facilities, social amenity and well-being	4.13.1
Health and safety of community and workforce	4.14.1

4 Potential Impacts & Mitigation Measures

4.1 Objectives

The objectives for waste minimisation and management at the project site during construction and operation are:

- To minimise waste generated at the site to reduce the volume of waste requiring disposal to landfill.
- To prevent dispersal of waste from the site to receiving environments.
- To ensure compliance with the *Environmental Protection Act 1994* and the *Environmental Protection (Waste Management) Policy 2000* (EPP Waste).
- To encourage residents and operators within the TOT project site to implement waste reduction management measures.

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

The EPP Waste outlines a 'waste hierarchy' to be adopted for waste minimisation and management. This hierarchy lists waste management practices in the preferred order of adoption. These include waste avoidance as a first option, then re-use, recycling, energy recovery and waste disposal as a last option. This waste hierarchy will be adopted in the implementation of impact mitigation strategies for the development.

4.2 Disposal Criteria

Disposal criteria proposed for management of solid wastes are provided in Table 3-2.

Table 3-2: Solid waste disposal criteria

Waste	Generation - Construction (tonnes/year)	Generation - Operation (tonnes/year)	Disposal Criteria
Construction	9,278	0	▪ Waste separation and collection facilities should be located in a designated bunded area within the construction site, with suitable access for collection vehicles ▪ Provide multiple pairs of skip bins to ensure sufficient disposal capacity ▪ All construction waste that cannot be reused on site or recovered will be disposed of at Vantassal St Landfill
Commercial and Industrial	0	26	▪ The recommended collection frequency for C&I waste is a weekly council collection ▪ Appropriate colour-coded receptacles for both recyclables and non-recyclables should be provided until waste can be either recovered or disposed of at Vantassal St Landfill
Municipal Solid Waste	180	735	▪ The recommended collection frequency for MSW waste is a weekly council collection ▪ Appropriate colour-coded receptacles for both recyclables and non-recyclables should be provided until waste can be either recovered or disposed of at Vantassal St Landfill
Quarantine Waste	0	500[1]	▪ All quarantine waste (e.g. organics) should be bagged and stored in sealed containers ▪ All quarantine waste must be treated in accordance with AQIS requirements, which is deep burial under AQIS supervision

[1]Assuming 60% of 833 tonnes of ship waste is organic in nature

4.3 Potential Impacts of Waste

Potential environmental and human health impacts may occur as a result of poor waste management practices. Potential impacts are identified in Table 3-3. Mitigation measures are proposed in various sections of the EIS as outlined in Table 3-3. Protection measures proposed to mitigate these impacts during construction and operation are outlined in Section 4.4.

Table 3-3: Potential waste impacts and proposed mitigation measures

Potential Impacts	Mitigation Measures	Section of the EIS
Excessive resource use leading to depletion of natural resources	Construction waste reduction and recycling measures	Waste 4.5.3
Excessive resource use resulting in greenhouse gas production	Greenhouse gas reduction measures	Air 4.8.X
Emission of polluting substances to surrounding waterways resulting in water quality impacts	Sewer and stormwater management measures	Infrastructure 4.4.2.3 and 4.4.2.4
	Hazardous substances management	Construction 3.4.1
Emission of polluting substances to surrounding waterways leading to ecological impacts	Sewer and stormwater management	Infrastructure 4.4.2.3 and 4.4.2.4
	Hazardous substances management	Construction 3.4.1
	Construction and operational waste management measures	Waste 4.5.3
Emission of polluting substances to air leading to human health impacts	Air quality control measures	Air 4.8.X
Emission of polluting substances to air leading to odour impacts	Air quality control measures	Air 4.8.X
Emission of polluting substances to land resulting in recreational and amenity impacts	Construction and operational waste management measures	Waste 4.5.3

4.4 Protection Measures

This section provides measures for management of wastes generated from the site to ensure the objectives for waste minimisation and environmental protection are achieved in accordance with the EP Act and the EPP Waste. All monitoring requirements and performance indicators are provided in the project EMP.

All waste generated at the site during construction and operation will be stored for collection by approved waste contractors and transported for treatment or disposal off-site. There is no proposal for treatment and disposal of wastes on site. Where practicable waste materials will be reused within the site and arrangements will be made for collection of recyclable waste by a licensed waste recycling facility.

There will be no waste dumps or impoundments within the site. Any stockpiles required for temporary storage of materials during construction will be appropriately located away from overland flow paths and stormwater runoff from the stockpile area will be treated by filtration and or sedimentation prior to discharge from the site.

4.4.1 Construction Phase

The project construction phase contractors are to adopt a policy of waste management that ensures protection of natural resources through minimisation of construction materials and reduction of environmental impacts by ensuring appropriate recycling, reuse and disposal methods. The contractor will adopt the waste hierarchy for waste avoidance, reuse and recycling ensuring that disposal of wastes to landfill is the last option after all other options have been considered.

Separation of waste materials for recycling will be undertaken within the project site. In addition, opportunities may be identified at a later stage for separation and re-use/recycling of certain materials at businesses off site. Recovery of energy generated from waste, for example by burning of waste material to capture heat for use in other processes, is not considered to be feasible for this project as the majority of waste is generated over a limited period of time only, preventing the establishment of facilities that would need to operate for at least 10 or 15 years to ensure a viable return on investment. Waste avoidance involves reducing the volume of waste generated by an activity. This may be achieved during construction by avoiding over-estimation of material supplies or by using alternative materials and processes to minimise the amount of material requiring disposal. Waste requiring disposal will be stored within a designated area inside the construction site compound for collection by a licensed contractor and disposal at an approved landfill facility

The contractor is to ensure that separate waste receptacles are provided within the construction site for reuse of waste materials. Separate colour-coded containers will be provided for domestic wastes of staff and contractors; timber materials for reuse on-site; and paper, cardboard, unused timber, glass, metals and plastic for recycling. Construction waste materials requiring disposal will be collected for disposal at Vantassel St landfill facility. Waste separation and collection facilities will be located in a designated bunded area within the construction site with suitable access for collection vehicles.

Opportunities for reuse and recycling of construction wastes include the following:

- Clean plasterboard may be recycled for manufacture of new plasterboard. Plasterboard that is not suitable for reuse may be shredded and used in the remediation of soils.
- Wood waste can be reprocessed to suit a number of uses such as compost for soil improvement, mulch to control weeds and reduce evaporation, as wood chips for landscaping and even as wood flour to clean spills. Clean wood waste can also be reconstituted into particle board with the appropriate technology. Timber that is suitable for reuse or remilling may be collected for sale to second-hand timber yards.
- Metals, glass, plastics, paper and cardboard may be separated and stored for collection by Council's recycling service and treated at Visy's MRF.
- Crushed concrete can potentially be used as aggregate for road bases, pipe bedding material, for kerb and guttering, in footpaths and parking areas and as filter material and backfill for structures such as retaining walls.
- Bricks, masonry and tiles can be cleaned for re-use or crushed for use in applications that require fill and bedding materials
- Asphalt can be recycled in new hot mix asphalt, hot-in-place or cold

4.4.2 Operational Phase

Access and parking for waste collection vehicles will be provided in a designated secure location ensuring the amenity of adjacent residential areas is protected and that port operations are not affected. A storage tank will be provided within the TOT precinct to provide interim storage of sewage from vessels at berth in accordance with the requirements of the Project Specification. Sewage will be discharge from this tank by means of a pump station and pipe work for treatment at the Townville City Sewage Treatment facility. It is anticipated that waste removal contractors similar to those used by the Port of Townsville will provide services for collection of oily waste and garbage from the cruise ship terminal. Waste oil and oily mixtures are currently being collected by North Queensland Resource Recovery and transported from the site for recycling. Garbage from Australian vessels is currently collected by specialist waste contractors J.J. Richards and removed to a waste disposal facility. J.J. Richards ensure all waste tracking is undertaken in accordance with EPA requirements.

Where waste is proposed to be removed from vessels, best practice standards will apply in accordance with the *Australian Quarantine*

Guidelines for Cruise Vessel Agents and Operators (AQIS 2006). These guidelines outline procedures for all vessels arriving in Australia from international waters. Vessels will be required to manage waste onboard the vessel in accordance with the Convention for the Prevention of Pollution from Ships (MARPOL 73/78) regulations.

All quarantine waste is to be removed by an authorised contractor to be treated by autoclave. Quarantine waste products include:

- Organic galley and accommodation refuse;
- Packing material and floor sweepings;
- Other organic wastes that constitute a health risk; and
- Interstate food subject to quarantine.

Ship masters will be required to contact the relevant waste contractors not less than 24 hours prior to expected discharge of waste from the ship. Information will be provided at that time on the type and volume of waste to be discharged and the time and location of transfer of waste from the ship. The ship's master will be required to ensure that wastes have been adequately separated and contained on-board and that quarantine waste is segregated from other wastes and contained in an authorised manner. Any waste that was separated for recycling on the vessel will be transferred to recycling receptacles upon arrival. Waste for disposal will be collected by an approved waste disposal contractor and transported for disposal off-site.

Best practice standards will be adopted for the implementation of waste receptacles on site. Separate bins will be provided within the TOT site for general waste and recyclable waste within the terminal and associated facilities. Signage will be displayed around terminal buildings to inform building users of the requirements for waste management within the site. Regular inspections of the site and shoreline will be undertaken to evaluate the effectiveness of waste storage and collection practices.

A central waste storage area within apartment lots will be provided for holding of domestic waste and separation of recyclables prior to collection. These facilities will be provided within a designated containment area to prevent dispersal of waste materials to waterways and will be appropriately screened from view. The Body Corporate will be responsible for maintenance of the central waste storage area and for on-street placement of bins for collection by waste contractor vehicles. The waste collection area will be located to enable easy access and manoeuvring of collection vehicles.

Council currently provides residents with Mobile Garbage Bins (MGB) ranging from 120L to 240L. The Body Corporate will be encouraged to consider providing 120L bins to properties within Breakwater Cove to minimise the disposal of waste and encourage recycling. Such bins would

not be used for disposal of garden waste. Residents of Breakwater Cove will be encouraged to separate household rubbish and recyclables by provision of services for collection of separated wastes. Arrangements will be made with Townsville City Council to enable services to be provided by Council's existing waste contractors for weekly kerbside collection of domestic waste and fortnightly collection of recyclables.

Any garden waste generated in the parks and green areas of the new TOT project site will be kept separate from other waste materials and transported to Vantassel Street for processing and converting into compost.

4.5 Recycling

4.5.1 Domestic Waste Recycling

Fortnightly services are provided for kerbside collection of recyclables. This service is currently provided by Visy under contract to Council and materials are processed at the Visy Material Recovery Facility (MRF) at Mount Louisa. A Review of Townsville City Council's Kerbside Recycling Service for 2003 to 2005 showed that Townsville's per capita recycling rates had steadily risen over a three year period from 2003.

Based on an extrapolation from the Review in 2005 the amount of material recycled in Townsville amounted to 6,799 tonnes or 69.7 kg per person/annum (15.1% of total domestic waste generated). A comparison of Townsville's per capita recycling rates for the past three years is given in Table 4-1. Here, a steady increase in both gross and net recyclate capture can be observed. Coupled with falling contamination rates, this would tend to indicate greater awareness and utilisation of the kerbside recycling service amongst Townsville's residents.

Since the implementation of the new recycling service, both Townsville's gross and net recycling service has continued to increase. Moreover Townsville's gross recycling rate rose by 10.8% from 2003/04 to 2004/05 while the net recycling rate rose by 11.6%. That is, the present system's effectiveness has risen above and beyond the increase in recyclables capture.

Table 4-1: Townsville Per Capita Recycling Rates. Source: Nolan ITU, 2005.

	2003	2003/04	2004/05
Townsville Population	93,911	95,947	97,547*
Per Capita Gross Recyclate Capture (kg/capita/yr)	60.7	64.0	69.7

Per Capita Net Recyclate Capture (kg/capita/yr)	46.5	49.0	53.7

* Projected from ABS population figures for 1999-2003

Cardboard is currently recycled by a subcontractor of Visy. A collection service for garden waste is not currently provided by Council. However, all green waste may be dropped off at Vantassel Street where it is processed close to the site and sold to locals for landscaping supplies.

4.5.2 Commercial Waste Recycling

The total amount of Commercial and Industrial and Construction and Demolition waste generated in Townsville in 2002-03 was around 57,023 tonnes of which 33% or 18,784 tonnes was recycled. Specific measures for waste minimisation and management including recycling strategies are contained in the project specific Environmental Management Plan (EMP).

4.5.3 Recycling Strategy

A proportion of domestic waste at TOT will be recycled. It is assumed that the current rate of 15.1% can be bettered to 20% if many of the suggestions incorporated in the EMP are implemented. Another option is to include a mixed waste or food waste processing system at TOT. However, this will only work efficiently in combination with the entire Townsville Township and not in complete isolation. The proportion of construction waste recovered for recycling in Sydney in 2004/05 was 66% (DEC, 2006). It is assumed that this figure can be increased by 10% for the TOT project - that is 76% or 7,051 tonnes of construction waste recovery out of the 9,278 tonnes produced each year.

4.6 Waste Minimisation & Cleaner Production

Cleaner production technology is applied to production processes to reduce generation of industrial waste, greenhouse gas emissions and consumption of raw materials. Strategies are developed for modification of production processes, use of new technologies and reuse of process by-products.

Generally, methods for achieving cleaner production include substitution of input used in production processes with less hazardous substances; product reformulation to provide a less hazardous end-product; production process modification; improved operation and maintenance of production equipment and methods; and closed-loop recycling to ensure extended use of substances within the production process.

There are no production processes proposed during operation of the TOT project site that will result in generation of by-products or input of raw

materials. Additionally there is no proposal for integrated process design, cogeneration of power or by-product re-use.

However, waste minimisation principles have been applied to the construction and operational phases of the project to ensure reduction of energy and water consumption and to ensure efficient use of material resources. Waste management measures to be implemented to minimise generation of waste from the site are detailed throughout this report and are incorporated into the project EMP.

Additional measures for reducing greenhouse gas emissions and minimising energy consumption are dealt with in other studies being undertaken for the EIS. Gaseous wastes are being monitored as part of the air quality assessment and minimisation measures are described in the Air Quality Assessment. A greenhouse gas assessment is being conducted and measures for maximising energy efficiency are described in the Air Quality Assessment.

4.7 Open Space Areas/ Public Places

The open space area is not only designed to provide protection for the residential area of Breakwater Cove Precinct but it will also serve as public parkland suitable for passive recreation such as fishing and walking. The area will comprise some 3.96 ha (excluding roads) of reclaimed land located by the current Northern Breakwater.

To date, public place recycling along the Strand in Townsville has been very effective with both residents and visitors. The bins display appropriate signage to assist in effective waste disposal and utilises campaigns similar to “Don’t Waste Australia”, converted in this case to “Don’t Waste Our Strand”.

Figure 4-1: Strand Recycling bins, Townsville

A Waste Management System Review conducted on Centennial Parklands in 2003 found around 5 million visitors (2% growth rate/annum) each year generated approximately 206 tonnes of waste. This consisted of 157 tonnes of material going to waste bins and 49 tonnes diverted to recycling bins. Each visitor can be thought of as generating some 140 grams of waste in total, consisting of 105 grams of waste suitable for landfill and 35 grams of potentially recyclable material. However, total waste quantities do fluctuate on a seasonal basis as a reflection of increased park patronage. Understandably, summer holidays invoke the most notable peak.

Table 4-2: Centennial Parklands Waste and Recycling Container Summary. Source: Nolan ITU, 2003.

Location	Total Area (hectares)	Number of waste bins	Number of recycling bins	Total Bins
Moore Park	115	29	35	64
Centennial Park	189	117	64	181
Queens Park	26	10	10	20
Total	330	156	109	

Based on the results from Centennial Parklands (2003), the total amount of waste generated can be estimated to be 42 tonnes per annum. The assumption is that there will be around 300,000 TOT park visitors and 140 grams waste/visitor/annum. With proper recycling bins provided, around 25% or 10.5 tonnes can be potentially recycled. The recovery rate can be drastically improved as in the case of Lane Cove National Park where an appropriate Public Place Recycling Program increased recycling to 77% with less than 1% contamination.

Table 4-3: Average Number of Bins per hectare for Centennial Parklands

	Number of waste bins	Number of recycling bins
Average	2.11	3.03

Centennial Parklands consists of an area spanning 330 hectares, with a total of 265 waste and recycling bins covering the area (Table 4-2). The average number of waste bins and recycling bins per hectare is 2.11 and 3.03 respectively (Table 4-3). The open space at TOT therefore, will require approximately 8 waste bins and 12 recycling bins if based on the average found at Centennial Parklands. The appropriate positioning of the bins will need to be determined at the detailed design phase so as to prevent littering.

4.7.1 Elements of Good Practice Public Place Recycling

The findings and results of research conducted by Hyder Consulting of Public Place Recycling have been formulated into some key factors required to provide good practice Public Place Recycling. A summary appropriate to the TOT project is provided in Appendix B.

References

Australian Bureau of Statistics, 2006. 4613.0 - Australia's Environment: Issues and Trends, 2006.

Australian Maritime Safety Authority, 2005. Australian Port – Townsville. URL: http://www.amsa.gov.au/Marine_Environment_Protection/Protection_of_Pollution_from_Ships/Waste_reception_Facilities/Townsville.asp

Australian and New Zealand Environment and Conservation Council (ANZECC). *Best Practice Guidelines for Waste Reception Facilities at Ports, Marinas and Boat Harbours in Australia and New Zealand.*

California Waste Management Board, 2006. URL: http://www.ciwmb.ca.gov/wastechar (5.12.2006).

Department of Defence, June 2004. Waste Management Plan Garden Island Dockyard and HMAS Kuttabul. Prepared by Nolan-ITU and HLA-Envirosciences.

Department of Environment and Conservation NSW, 2006. Waste Avoidance and Resource Recovery Strategy and Performance Report 2006 – Consultation draft.

EPA NSW, 1998. Construction and Demolition Waste Action Plan.

EPA NSW, 2000. State of the Environment Report. Chapter 2: Human Settlement. URL:http://www.epa.nsw.gov.au/soe/soe2000/ch/ch_2.6.htm#ch_2.2_ind_2.27

Meinhardt (NSW) Pty Ltd. September 2000. *North Queensland Regional Waste Management Strategy*.

McTavish, Ian 2006. Regional Manager – Australia. Patrick Defence Logistics. Personal Communication 12/12/06

Nolan ITU, 2003. Centennial Parklands: Waste Management System Review and Options.

Nolan ITU, 2005. Review of Townsville City Council's Kerbside Recycling Service for 2003/04 and 2004/05.

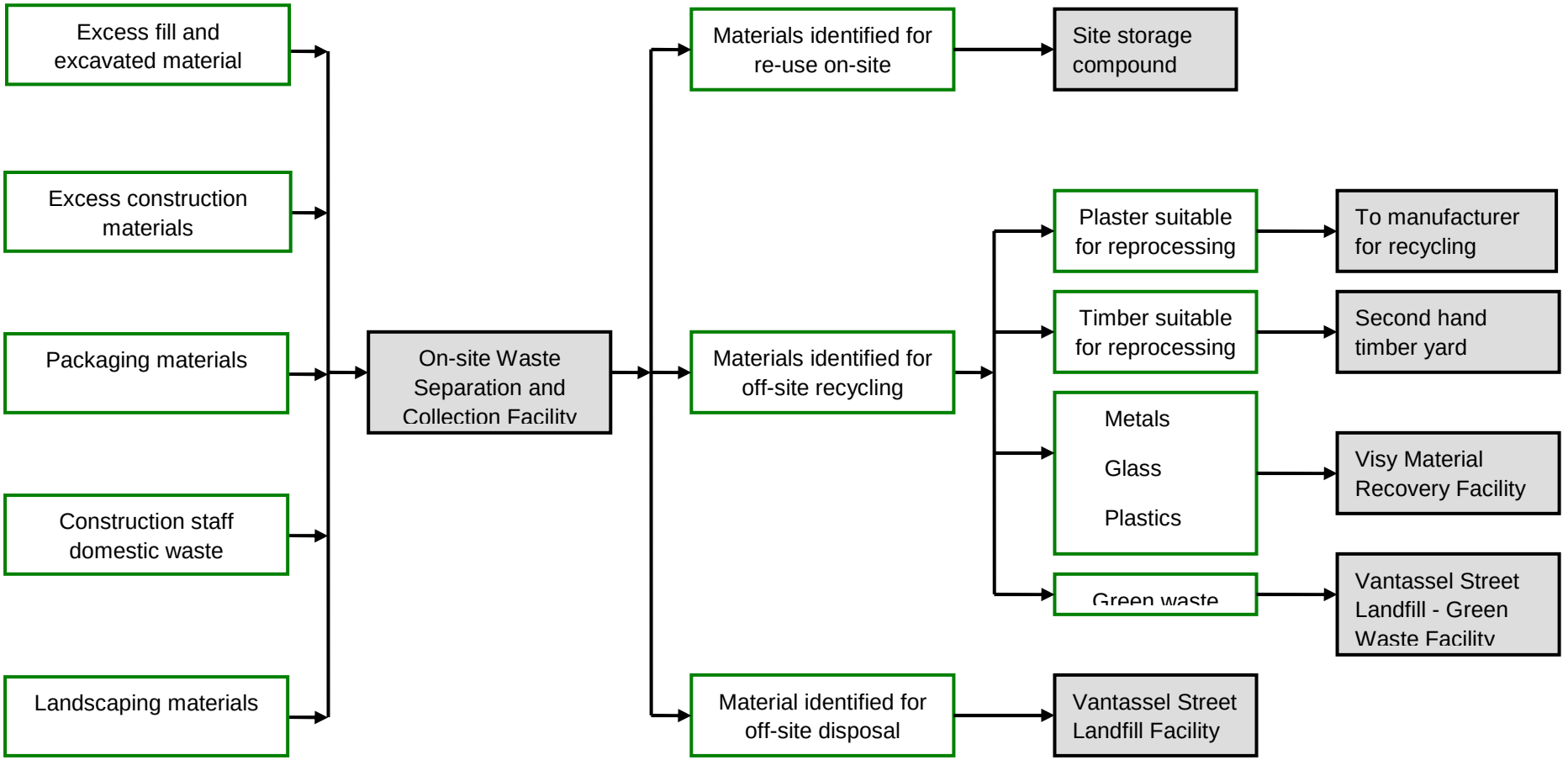
Queensland EPA and National Packaging Covenant Council, Draft Report 2006. Independent Assessment of Public Place Recycling.

Royal Australian Navy Ship Garbage Management Working Group (1998), RAN Ship Garbage Management – Part 1 Executive Summary, Objectives, Strategies and Recommendations.

APPENDIX A

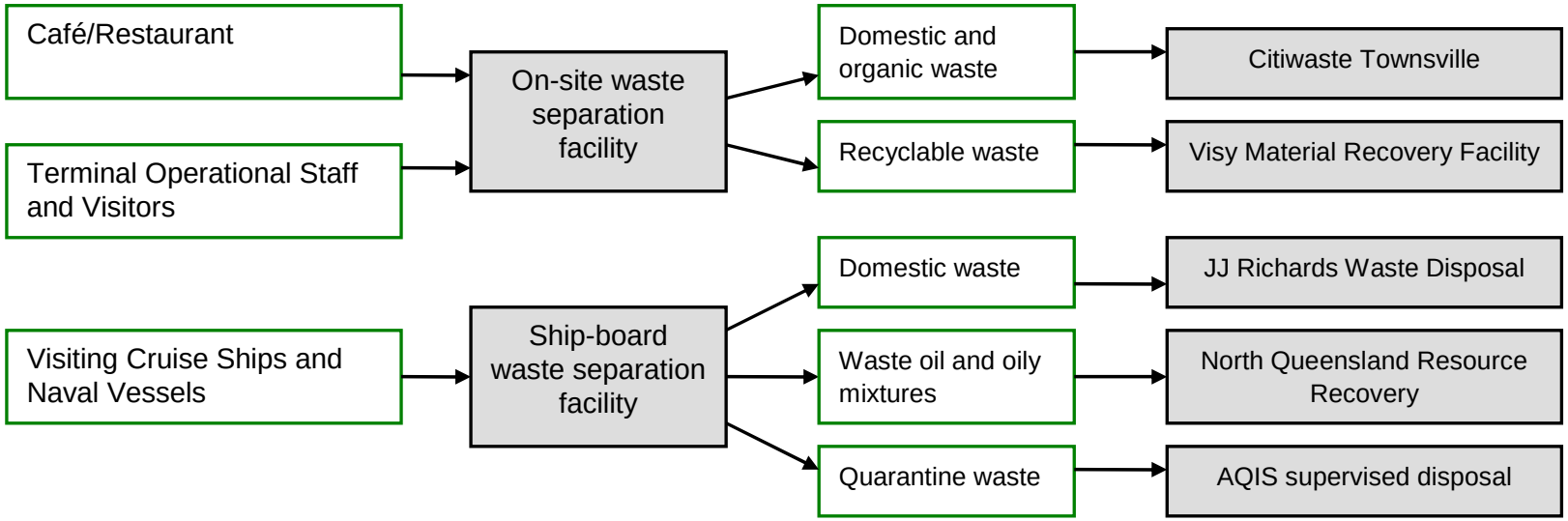
SCHEMATIC WASTE DIAGRAMS

Schematic Waste Diagram – Construction/Site Preparation

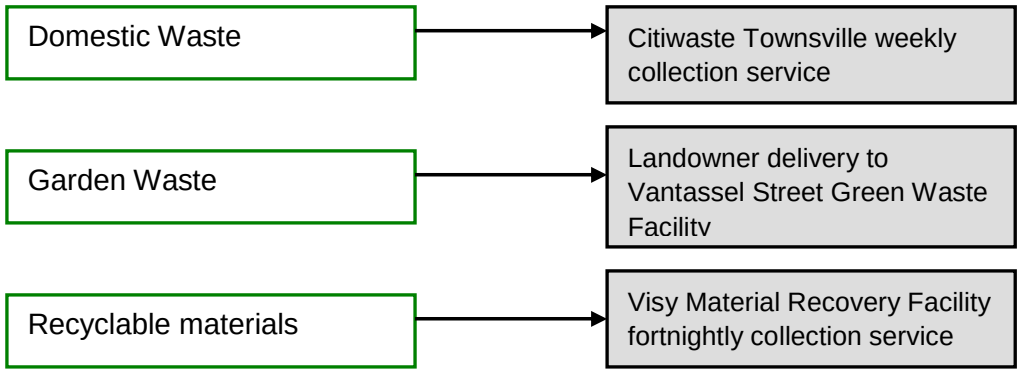


Schematic Waste Diagram – Operation

TOWNSVILLE OCEAN TERMINAL PRECINCT



BREAKWATER COVE PRECINCT



APPENDIX B

GOOD PRACTICE PUBLIC PLACE RECYCLING

Table A-1: Factors for Good Practice Public Place Recycling

Owners and managers of public places should assess every public place under their control to determine whether recycling can be successful. The following issues need to be considered:

- The results of any waste audits
- Contractual or other work arrangements with cleaners (The ideal time to introduce a new recycling system is at the commencement of a new cleaning contract when service of the recycling bins can be taken into account. Introducing recycling bins during an existing contract may result in the contractors seeking a variation at additional expense.)
- Costs and benefits, not all of which may be financial (Costs can include money to acquire and install infrastructure as well as more work for cleaners. Benefits can include reduced amounts of litter, reduced costs to service bins[2], improved public opinion).
- The characteristics of each public place including
  - the sale or distribution of food, drink and packaging
  - its size
  - whether people dwell or pass through
  - types and numbers of entrances and exits
  - visual amenity and the 'look' of the site
  - location or proximity of shops, offices, services, transport facilities, leisure facilities and other open spaces
  - systems in operation at nearby public places
- The characteristics of those using the public place including
  - whether they are at leisure or not
  - how long they spend in the public pace
  - are they alone or with others
  - what they do in the place (eat, drink, sit, walk, lie down)

Waste audits should be conducted of the existing system to determine:

- quantities of both recyclable and non-recyclable materials present
- what materials might be recoverable
- potential recovery rates
- potential recycling station locations
- the number of possible recycling stations
- costs
- possible servicing regimes

The bins should:

- be conveniently located where waste is discarded
  - near entrances and exits (patrons will see them on the way in and use them on the way out)
  - near toilets (this is a necessary trip and often used to dispose of rubbish. The bins will be seen by everyone who uses the toilets)
  - in known eating areas (near tables or popular picnic locations)
  - next to or at either end of natural walkways, 'unofficial' pedestrian corridors and high traffic areas – such as between eating/shopping areas and car parks
  - be positioned side-by-side not back-to-back
  - be colour coded with one colour for each different type of bin. Colours should conform to the standard.
- be clearly visible and prominent in the landscape, not hidden behind structures or

[2] If multiple small garbage bins are replaced by fewer large recycling stations

plants ➢ not be positioned to make servicing easier where this compromises performance ➢ be accessible to children and the disabled (including the visually impaired) ➢ vermin- and bird-proof where necessary
The lids on the recycling bins should: ➢ be secured closed ➢ have holes to admit the correct recyclables and prevent contamination
The lids on the litter bins should be open
There should not be a recycling bin without a litter bin on either side
The bins should be clearly marked with labels on the front, side and tops
There should be overhead signs so that the location of the bin stations can be seen even if there is a crowd
The signs and labels should: ➢ comply with the state standard if there is one and if not then comply with the standard promoted by the Queensland EPA ➢ communicate by colours, symbols and words ➢ use unambiguous line drawings ➢ use the colour yellow for recycling ➢ use word 'recycle' and the chasing arrows symbol ➢ use expressions such as 'soft drink' and 'milk' when referring to bottles ➢ not use plastic number codes or 'R' symbols ➢ be multi-lingual where appropriate ➢ use the international 'no' symbol (at right)  ➢ use ticks and arrows
Bin stations should be ➢ regularly emptied and not allowed to overflow ➢ regularly cleaned and, if an enclosure is used, material not allowed to build up inside the enclosure ➢ maintained in good condition so they do not present any risk to public safety or occupational health