CONCEPT OPTIONS REPORT

MACS REEF WASTE TRANSFER STATION

FEBRUARY 2010

Prepared for

PALERANG COUNCIL

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Appendix I

Waste Management Survey Results Overview

1 Introduction

Palerang Council (Council) as part of its overall waste management strategy is considering the construction of a small vehicle waste transfer station (WTS) on the Lot containing Macs Reef Landfill to ensure that waste disposal services continue to be provided to the Wamboin/Bywong/Sutton East areas when the landfill reaches its capacity and is closed.

Quadro Australia Pty Ltd (Quadro) has been commissioned to develop a range of concept options for the WTS in terms of both its siting on the Macs Reef landfill site (Site) and its layout and operational parameters.

2 Background

Council, as part its engagement with its community, formed the Wamboin/Bywong/Sutton East Area Waste Management Working Group (Working Group), to assist with the development of the WTS project.

As a first step the Council in conjunction with the Working Group:

- Undertook a survey of the local community to identify and quantify its waste management needs and preferences
- Identified two (2) possible areas within the lot the landfill is situated on for the development of a WTS
- Developed a concept design brief for the WTS.

Following the development of the draft Concept Options report it was presented to the Working Group for comment and feedback prior to its finalisation and submission to Council for its consideration.

3 Site Details

3.1 LOCATION

Macs Reef landfill is located on the southern side of Macs Reef Road approximately 3.5 kilometres east of the Federal Highway within the Bywong district. (See Figure 3.1).

Source: © Department of Lands (2009)

Figure 3.1 Locality Map

3.2 REAL PROPERTY DESCRIPTION

The Site is a Crown Reserve (Crown Reserve No. 88693) under the care and control of Council and was gazetted as a Rubbish Depot on the 11 August 1972.

The cadastral description of the Site is Lot 7008 DP 96164.

The Site is bounded on the west by an unnamed road, on the north by Macs Reef Road and on the east and south by private property.

Figure 3.2 provides a view of the Site and its environs.

Source: © Department of Lands (2009)

Figure 3.2 Site Location

4 Environmental Characteristics

4.1 TOPOGRAPHY

The Site is located at the bottom of Macs Reef Hill and ranges in elevation from approximately 740m in the south-east corner to 700m in the north-west corner. (See Figure 4.1).

An intermittent watercourse traverses the north-eastern portion of the Site draining via three reinforced concrete culverts under Macs Reef Road. A lesser intermittent watercourse also traverses the southern boundary of the Site, drains across the unnamed road and onto Lot 4 DP 842101 on the western side of the unnamed road.

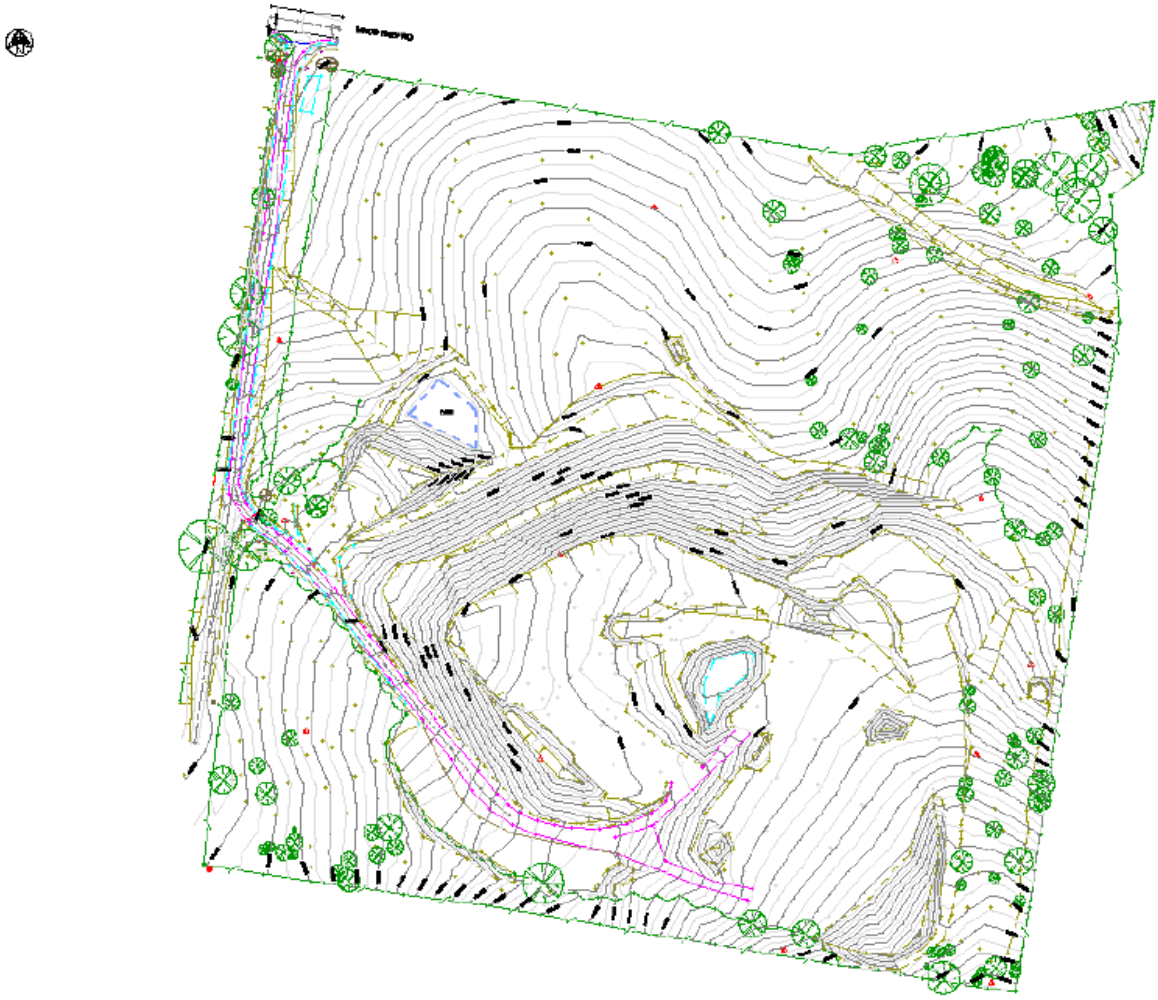


Figure 4.1 Site Survey Plan

4.2 GEOLOGY

The Murrumbidgee 1:250,000 geological services sheets show that the underlying geology of the Site relates to the Ordovician period with shale being the dominant bedrock of the area.

The soils across the area are generally thin consisting of loam underlaid by a gravelly clay developed from the Ordovician metasediments.

The soils range from well drained to poorly drained on the upper slopes and moderately drained on the lower and mid slopes.

4.3 CLIMATIC CONDITIONS

The climatic conditions of the area include:

- Mean daily temperatures of 6.5 C – 19.7 C
- Mean rainfall of 614.7mm/pa
- Decile 9* rainfall of 803.9mm/pa
- Mean daily evaporation of 4.7mm

*90% of totals will be at or below this figure
Source: Bureau of Meteorology (Canberra Airport)

The prevailing winds in the area are from the north-west in the morning and in the afternoons as shown in Figures 4.2 and 4.3 below.

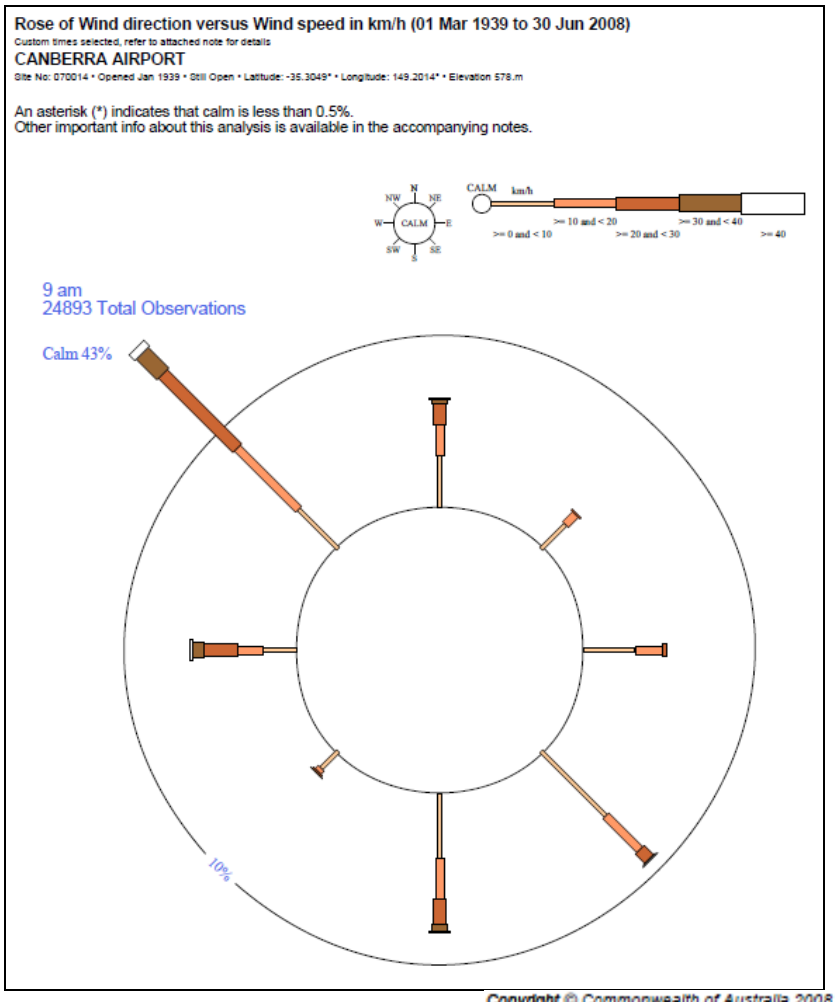


Figure 4.1 Prevailing winds at 9am

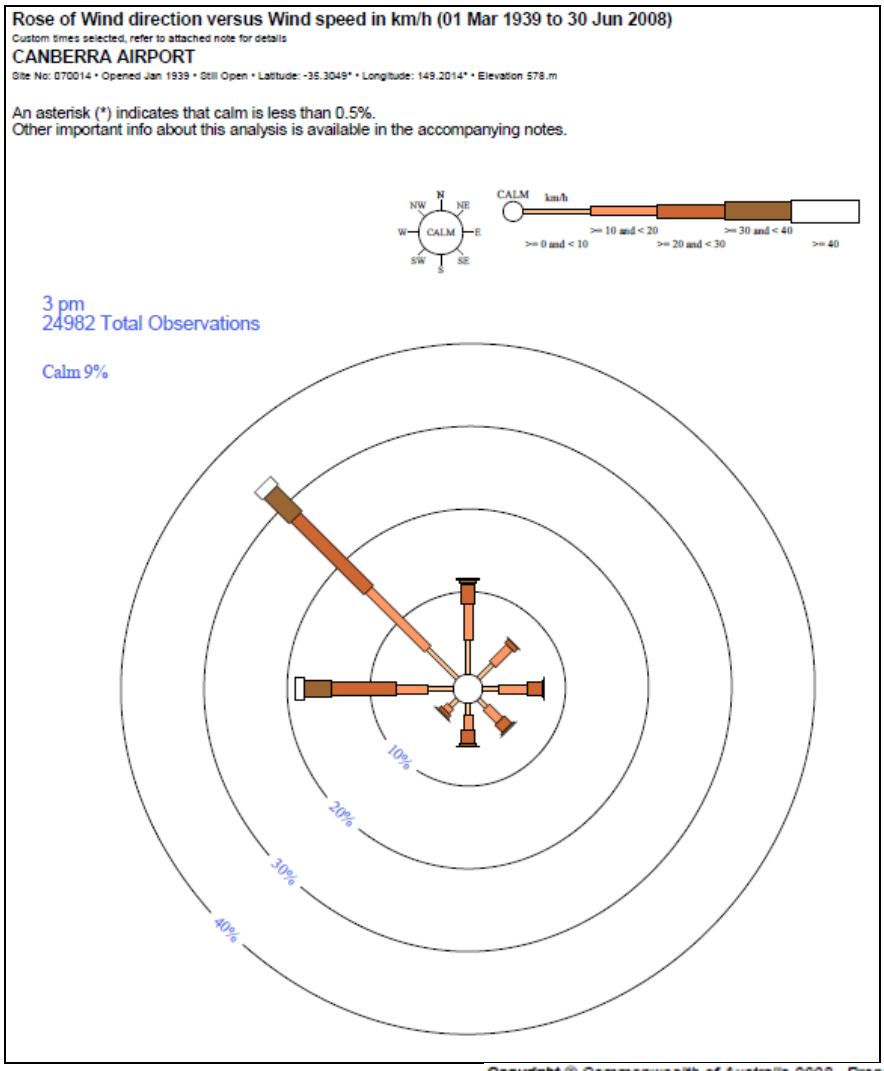


Figure 4.2 Prevailing winds at 3pm

4.4 FLORA AND FAUNA

Flora

The undisturbed portion of the Site is covered by a dry sclerophyll woodland in generally good condition with the understorey exhibiting a "sparse representative sample of the understorey sclerophyllous shrub and nature grasses" (Good Environmental Systems 2009).

There is little evidence of weed infestation or the establishment of exotic plants species in the undisturbed areas.

Where the landfill operations are being undertaken the native vegetation has been substantially removed. This has resulted in the establishment of a range of weed species and exotic plants.

The types and extent of native and exotic plant species that were identified on the Site during site investigations by Good Environmental Systems are detailed in Appendix E.

Good Environmental Systems reported that no threatened, locally rare or vulnerable native plant species were located and no significant vegetation habitats noted.

Fauna

The dry sclerophyll woodland provides very limited habitat for native fauna due to its sparseness.

Investigation undertaken by Good Environmental Systems revealed no specific or significant habitat for any native animals.

5 Existing Site Infrastructure, Operations and Services

5.1 SITE FEATURES AND OPERATIONS

Lot 7008 on which the Site is located is situated on the western slope of Macs Reef Hill.

Access to the Site is via a gate located on the western boundary of the Site which is accessed off a gravel road which leads to Macs Reef Road.

The Site has operated as a local landfill since the 1970's. The landfill has been progressively developed and currently occupies, in conjunction with the material storage areas and site facilities, approximately a third to a half of the southern portion of the Site (see Figure 5.1).

The landfill is currently being filled on a progressive lift basis to create a relatively level platform extending westwards from the natural surface on the eastern side of the landfill. The landfill batters along the northern and southern slopes of the landfill are relatively steep with a batter slope in the region of 2 horizontal to 1 vertical (2H:1V).

Council has advised that the landfill is reaching its operational capacity.

Source: © Department of Lands (2009)

Figure 5.1 Existing Site Features

5.2 SITE INFRASTRUCTURE

Site facilities provided on the Site include:

- All weather access road
- Storage areas for greenwaste, metals, construction and demolition materials, batteries, tyres

- Mixed solid waste landfilling
- Site office
- Small Buy Back Centre for domestic goods
- Signage
- Leachate/stormwater management pond and associated catchdrains
- Litter fencing along the eastern boundary of the landfill area to contain the windblown litter resulting predominantly from the north-westerly winds.
- Site fencing around all boundaries of the Site. This consists of security fencing along a portion of the western boundary and star picket and wire fencing to the remainder of the Site boundaries.

5.3 SITE SERVICES

There are no utility services currently available on the Site.

Underground telephone lines run along Macs Reef Road adjacent to the Site's northern boundary.

Overhead electricity lines extend into Lot 4 DP 842101 on the western side of the Site and traverse a route approximating Macs Reef Road, approximately 50-100m north of Macs Reef Road.

There are no water main services to the immediate area.

6 Siting Considerations

6.1 PLANNING

6.1.1 Introduction

The Site is covered by a range of planning instruments that have the potential to impact on the proposed WTS.

These instruments include:

- Yarrowlumla Local Environmental Plan (2002)
- Yarrowlumla Development Control Plan Rural Zones (2002)
- State Environmental Policy Number 55 – Remediation of Land
- Water Management Act 2000

6.1.2 Yarrowlumla Local Environmental Plan 2002

The Site is zoned Rural Residential 1(d) under the Yarrowlumla Local Environmental Plan 2002 (LEP).

Waste transfer facilities are not specifically listed within the LEP as being allowed or prohibited. Landfilling is permitted with consent under the LEP.

Discussions have been held with a representative of Council's Planning Department and advice has been received that the proposed WTS is permissible with consent on the basis of existing use rights and its consistency with the objectives of the zone.

In terms of the planning approval process Quadro was advised that:

- The proposed development must be developed to comply with the requirements of the Yarrowlumla Development Control Plan Rural Zones 2002 (DCP)
- If the proposed development does not trigger the criteria for a designated development then Council will be the consent authority
- If the proposed development does trigger the criteria for a designated development then the consent authority will be the Regional Planning Panel
- If the proposed development is a designated development then a full Environmental Impact Statement (EIS) will be required to be submitted with the development application
- Under the Environmental Planning and Assessment Regulation 2000 Part 1 Schedule 3 Clause 32 a WTS is considered a designated development when it is a facility
    - *(b) that sort, consolidate or temporarily store waste at transfer stations or materials recycling facilities for transfer to another site for final disposal, permanent storage, reprocessing, recycling, use or reuse and:*
        - *(i) that handle substances classified in the Australian Dangerous Goods Code or medical, cytotoxic or quarantine waste, or*
        - *(ii) that have an intended handling capacity or more than 10,000 tonnes per year or waste containing food or livestock, agricultural or food processing industries waste or similar substances, or*
        - *(iii) that have an intended handling capacity or more than 30,000 tonnes per year of waste such as glass, plastic, paper, wood, metal, rubber or building demolition material, or*
    - *(d) that are located:*
        - *(i) in or within 100 metres of a natural waterbody, wetland, coastal dune field or environmentally sensitive area, or*

(ii) in an area of high watertable, highly permeable soils, acid sulphate, sodic or saline soils, or

(iii) within a drinking water catchment, or

(iv) within a catchment of an estuary where the entrance to the sea is intermittently open, or

(v) on a floodplain, or

*(vi) within 500 metres of a residential zone or 250 metres of a dwelling not associated with the development and, **in the opinion of the consent authority**, having regard to topography and local meteorological conditions, **are likely to significantly affect the amenity of the neighbourhood** by reason of noise, visual impacts, air pollution (including odour, smoke, fumes or dust), vermin or traffic.*

6.1.3 Yarrowlumla Development Control Plan Rural Zones 2002

The Yarrowlumla Development Control Plan Rural Zones (DCP) sets out a number of requirements the proposed development must comply with, with respect to its location and operations. These include:

- Sealing of gravel roads where extra traffic will cause the need to address dust impacts to adjacent properties (Clause 11.1)
- Entrances shall be limited to one (1) per lot unless otherwise approved by Council (Clause 11.13)
- A minimum set back of 50 metres from the front boundary (Clause 18)
- Minimum set back from the rear and side boundaries of 25 metres (Clause 18, Lot area of 9.2 ha)
- Maximum height of 9m (Clause 19)
- Requirement for the facility to be designed to be compatible with the rural character and landscape (Clause 20)
- A minimum water supply of 20,000 litres for firefighting purposes (Clause 23.3)
- Internal driveways being constructed in accordance with Type 1a Road Specification with a maximum grade of 10% (Clause 25).

6.1.4 State Environmental Planning Policy No. 55 - Remediation of Land

State Environmental Planning Policy 55 (SEPP) applies to the Site as approximately one third of the Site has been used for landfilling of mixed putrescible waste.

Clause 7 of SEPP 55 requires Council to consider in determining a development application if:

a) The land is contaminated , and

b) If the land is contaminated, it is satisfied that the land is suitable in its contaminated state (or will be after remediation) for the purpose for which the development is proposed to be carried out, and

c) If the land requires remediation to be made suitable for the purpose for which the development is proposed to be carried out, it is satisfied that the land will be remediated before the land is used for that purpose.

A representative of Council's Planning Department has advised that:

- The Site is considered to be contaminated due to the landfilling activities that have been undertaken
- Council will require the remediation of the contaminated area (landfill) as part of the WTS development
- Closure of the landfill in accordance with the requirements of the Department of Environment, Climate Change and Water (DECCW), as laid down in the Environmental Guidelines: Solid Waste Landfills, would satisfy the requirements of SEPP 55.

6.1.5 Water Management Act 2000

Under the Water Management Act a controlled activity approval is required for works on waterfront land (Section 91) with waterfront land being defined as:

(a) The bed of any river, together with any land lying between the bed of the river and a line drawn parallel to, and the prescribed distance inland of, the highest bank of the river, or

(a1) the bed of any lake, together with any land lying between the bed of the lake and a line drawn parallel to, and the prescribed distance inland of, the shore of the lake, or

(a2) the bed of any estuary, together with any land lying between the bed of the estuary and a line drawn parallel to, and the prescribed distance inland of, the mean high water mark of the estuary, or

(b) if the regulations so provide, the bed of the coastal waters of the State, and any land lying between the shoreline of the coastal waters and a line drawn parallel to, and the prescribed distance inland of, the mean high water mark of the coastal waters,

where the prescribed distance is 40metres or (if the regulations prescribe a lesser distance, either generally or in relation to a particular location or class of locations) that lesser distance. Land that falls into 2 or more of the categories referred to in paragraphs (a), (a1) and (a2) may be waterfront land by virtue of any of the paragraphs relevant to that land.

and river as:

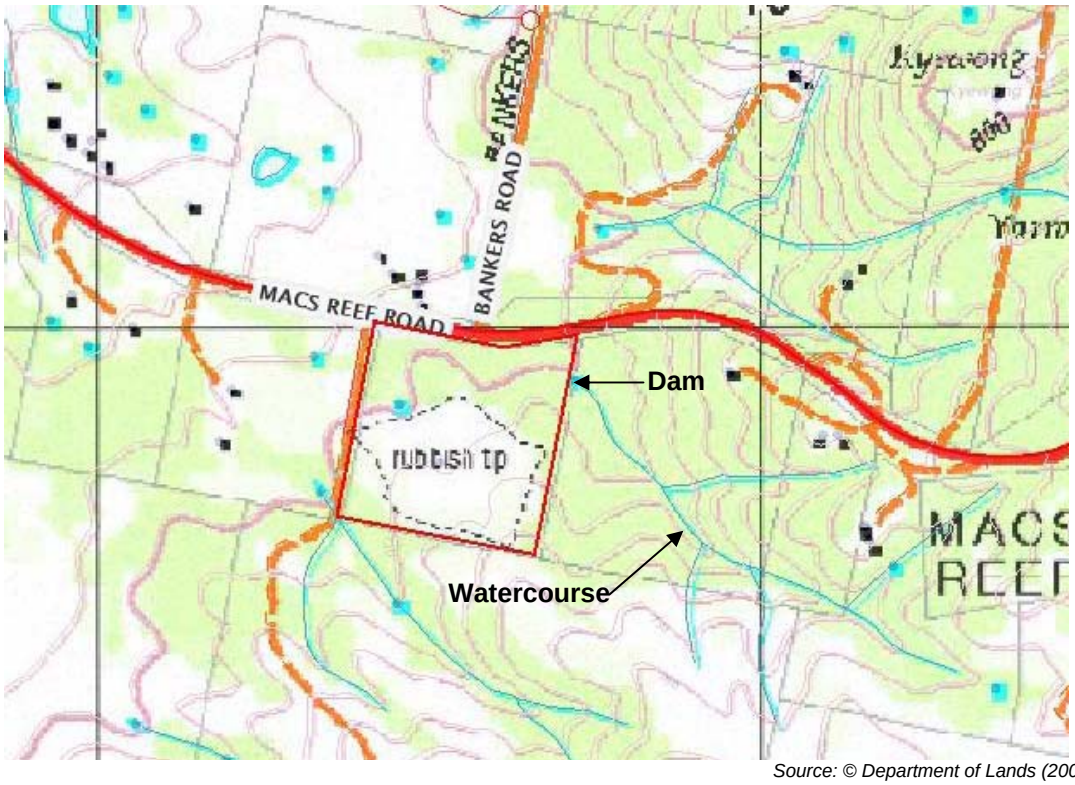
(a) any watercourse, whether perennial or intermittent and whether comprising a natural channel or a natural channel artificially improved, and

(b) any tributary, branch or other watercourse into or from which a watercourse referred to in paragraph (a) flows, and

(c) anything declared by the regulations to be a river,

whether or not it also forms part of a lake or estuary, but does not include anything declared by the regulations not to be a river.

Examination of the topographic maps available from the NSW Department of Lands show a watercourse leading towards the north eastern corner of the Site but terminating at a dam structure within the lot adjacent to the eastern boundary (see Figure 6.1).



Source: © Department of Lands (2009)

Figure 6.1 Topographic map

Discussions have been held with representatives of the DECCW who have advised that:

a) with regards to the watercourse in the NE corner of the site:

- The watercourse is one that would be covered by the Water Management Act.
- Under the Water Management Act any works within 40m of the watercourse will require the approval of the DECCW.
- **Councils are exempt from the requirement to seek approval for works within 40m of the watercourse.**
- Provided adequate bunding and water diversion systems are in place to protect the watercourse the DECCW should have no concerns over the proposed development.

b) With regards to the flow path below the sedimentation pond:

- As the flow path is not marked on the topographic maps with the watercourse symbol (blue line) it would not generally be considered to be a watercourse under the Water Management Act.
- The fact that the landfill has been constructed over the catchment which originally fed this flow path also mitigates against it being determined as a watercourse.
- On the basis of the above information the flow path from the sediment pond would not be considered to be a watercourse under the Water Management Act.

6.2 FLORA AND FAUNA

An environmental survey and assessment of the Site including a Seven Part Test under Section 5 of the Environmental Planning and Assessment Act and Section 94(2) of the NSW Threatened Species Conservation Act was undertaken by Good Environmental Systems (see Appendix E).

This assessment resulted in the conclusion that:

"No threatened, locally rare or vulnerable native plant species were located and no significant vegetation habitats noted.

No significant impacts will therefore accrue from the restoration of the tip or the construction of the waste transfer station. As a listed threatened native animal has been recorded for the local area near to the tip site the Seven Part Test has been applied to the 'development'."

6.3 CULTURAL HERITAGE

A cultural assessment of the Site has been undertaken by Archaeological Heritage Surveys. The survey included all the area contained with the Site and the Site's relationship to the surrounding areas.

The conclusions reached as a result of this assessment process were:

"No previously recorded Aboriginal or historic (European) archaeological sites occur at the tip and no archaeological sites or areas of Aboriginal archaeological potential were located during the survey.

The probability that undetected Aboriginal artefacts would be impacted by the proposed rehabilitation of the tip is considered low to very low."

and have recommended that:

"1. There are no Aboriginal or European cultural heritage constraints to the proposed rehabilitation of the Palerang Council tip site in Macs Reef Road, Wamboin.

2. If any previously undetected Aboriginal site or relic is uncovered or unearthed during rehabilitation work at the tip, work at that location must cease immediately and advice on

appropriate action be obtained from the South Branch of the Environment Protection and Regulation Division of the NSW Department of Environment and Climate Change."

A copy of the cultural heritage report has been included as Appendix F to this report.

6.4 SITE CONSTRAINTS MAPPING

Figure 6.4 demonstrates graphically the siting considerations that should be taken into account in assessing the most suitable location for the WTS.

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7 Existing Waste Stream

7.1 INTRODUCTION

The Macs Reef Landfill does not have weighbridge facilities therefore the quantity of waste accepted at the landfill has not been directly quantified.

There are two (2) principal options available for the calculation of the landfill's probable waste stream. These two options involve:

1. The use of Council's vehicle types and numbers data for the 2007/8 and 2008/9 financial years and the application of waste factors sourced from the DECCW's Environment Guidelines: Solid Waste Landfills 1996 (see Appendix G) to this data.
2. The use of the landfill's catchment property and population numbers and the application of a waste generation factor to these figures.

Waste generation rates have been calculated using both of these options and the information is presented below.

7.2 WASTE QUANTITIES – GENERATION BY VEHICLE NUMBERS

Council has advised the following vehicle numbers attended the Macs Reef Landfill in 2007/8 and 2008/9.

Table 7.1 Vehicle visits Macs Reef Landfill

Vehicle Type	Total Number per annum	
	2007/2008	2008/2009
Cars/station wagons	3836	4163
Utilities/trailers	4849	6208
Trucks	1033	1499

Table 7.2 sets out the applicable DECCW waste factors for vehicles attending the Landfill.

Table 7.2 DECCW's Waste Factors

Vehicle Type	Weight Factors (tonnes)	Waste Type
Cars/station wagons	0.06	All mixed waste
Utilities/trailers	0.30	All mixed waste
Trucks		
(a) Single rear axle with 2 tear wheels or 4 small wheels	0.62	Municipal, commercial and industrial waste
(b) Single rear wheel with 4 normal sized wheels	1.16	Municipal, commercial and industrial waste
(c) Average of categories (a) & (b) [(1)]	0.89	Municipal, commercial and industrial waste

Notes to Table:
[(1)] Category added by Quadro

The single rear wheel open truck category has been adopted as it is believed to be the most common vehicle attending the Site.

Utilising the vehicle number data and the above waste factors the estimated tonnages of waste entering the Site are:

- For trucks with 2 rear wheels or 4 small wheels.

Table 7.3

Financial Year	Total Tonnes per annum
2007/8	2325
2008/9	2883

- For trucks with 4 normal sized wheels

Table 7.4

Financial Year	Total Tonnes per annum
2007/8	3042
2008/9	3851

- For trucks using the average of the DECCW's waste factors detailed in Table 7.2

Table 7.5

Financial Year	Total Tonnes per annum
2007/8	2604
2008/9	3446

7.3 WASTE QUANTITIES – GENERATION BY POPULATION AND NUMBERS OF PROPERTIES

Council has provided the following property numbers for the Macs Reef Landfill catchment area.

Table 7.6 Properties within the Macs Reef Landfill Catchment

Geographical Area	Number Property Assessments
Wamboin	585
Bywong	428
Sutton (Palerang)	188
Lake George	14
Bungendore (part)	84
Yass Valley (Sutton)	unknown
Total	**1,299 + Yass Valley**

Council has also provided the following data relating to populations from the 2006 Census.

Table 7.7 Population by District

Area Description	Population
Part Bywong	315
Parts of Bywong and Bungendore	469
Part Wamboin	281
Part Wamboin	352
Part Wamboin and Bungendore	407
Part Wamboin	463
Part Wamboin	472
Palerang Sutton	641
Yass Valley LGA*	300
Total	**3,700**

*Council estimate

On the basis of the property numbers and population figures, the average number of persons per property can be calculated as approximately 2.6 persons per property.

Council has also advised that a population of approximately 300 is serviced in the Yass Valley area. This would equate, based on the 2.6 persons per property, of approximately 115 properties, giving a total catchment of 1,414 properties.

URS in the Waste Management Strategy prepared for Council in 2005 suggested a waste generation rate of 1 tonne of waste to landfill per rateable property. It is unknown if this quantity included waste collected by Council's kerbside collection system.

Using the URS waste generation figure and the estimated 1,414 properties in the Macs Reef catchment this equates to an annual tonnage to landfill of 1,414 tonnes.

Pryor Knowledge in their Resource Recovery Strategy for Palerang Council extrapolated the tonnages of waste being delivered to Macs Reef landfill on a per week basis, utilising vehicle numbers collected by Council and applying EPA waste factors (see Appendix G).

The resulting weekly tonnages are summarised in Table 7.7.

These figures have then been extrapolated to calculate annual tonnages which have also been included in Table 7.8.

Table 7.8 Waste Receival Tonnages, Macs Reef Landfill

Vehicle Type	Tonnes per week[2]	Tonnes per annum[3]
Cars/station wagons	5.9	306.8
Utilities/trailers[1]	16.9	878.8
Trucks	58.8	3,057.6
Totals	**81.6**	**4,243.2**

Source: Table 11 Pryor Knowledge Resource Recovery Strategy 2006

Notes to Table:

(1) A factor of half of EPA's weight factor was used by Pryor Knowledge as their observations suggested that most utilities were not loaded to capacity
(2) Figures are extrapolated on the basis of data provided by Council
(3) The annual tonnage is calculated from the weekly tonnage. It is unknown if the derived weekly tonnage is representative of the tonnage received each week of the year.

Due to the discrepancies between the waste generation rates calculated investigations have been held into waste generation rate in other regional areas in NSW.

NetWaste is a collaborative waste and resource management organisation comprising 28 councils in NSW encompassing a population in excess of 380,000.

NetWaste is divided in four (4) sub regions (Central, Mid Western, Eastern and Western.)

The Sub regions comprise:

- Central Subregion Councils:
    - Blayney, Cabonne, Cowra, Forbes, Lachlan, Orange, Parkes, Weddin and Wellington
- Mid Western Subregion Councils:
    - Bogan, Brewarrina, Coonamble, Dubbo, Gilgandra, Narromine, Walgett, Warren, and Warrumbungle
- Eastern Subregion Councils:
    - Bathurst, Lithgow, Mid-Western Regional and Oberon
- Western Subregion Councils:
    - Bourke, Brewarrina, Central Darling, Cobar the NSW Unincorporated Area.

NetWaste's 2008 Regional Resource Recovery Plan identified generation rates on both a per capita basis and per property basis for the four NetWaste subregions. These generation rates are presented in Table 7.9 below.

Table 7.9 Generation Rates for Waste to Landfill NetWaste Region

Region	Waste to Landfill per Capita (tpa)	Waste to Landfill per Property (tpa)
Central	0.8	1.9
Mid Western	1.0	2.2
Eastern	1.2	3.0
Western	0.8	2.1
Average	**0.9**	**2.3**

Of the four regions it is believed that the central region approximates the Palerang region due to its essentially rural character interspersed with small village communities and the predominantly agricultural pursuit of the area.

Utilising the waste generation rates for the Central Region the annual tonnages accepted by Macs Reef Landfill annually would be:

- on a per capita basis 2,960 tonnes per annum
- on a per property basis 2,687 tonnes per annum,

or utilising the average NetWaste generation rates:

- on a per capita basis 3,300 tonnes per annum
- on a per property basis 3,252 tonnes per annum.

7.4 WASTE QUANITIES – CONCLUSIONS

Table 7.10 summarises the estimated quantities being received by Macs Reef Landfill as derived in Sections 7.2 and 7.3.

Table 7.10 Estimated Tonnages Waste to Landfill per annum

Data Source	Estimated Tonnes of Waste received at Macs Reef Landfill per annum
Extrapolation of vehicle data	
• 2007/08 (using the DECCW waste factors)	2,325 - 3,042*
• 2007/08 (using an average waste factor for trucks)	2,604
• 2008/09 (using the DECCW waste factors)	2,883 - 3,851*
• 2008/09 (using an average waste factor for trucks)	3,446
Extrapolation of URS waste generation data	1,414
Extrapolation of Pryor Knowledge waste generation data	4,244
Extrapolation of NetWaste data for the Central Region	2,960
• On a per capita basis	2,687
• On a per property basis	
Extrapolation of NetWaste's average generation rate data	
• On a per capita basis	3,300
• On a per property basis	3,252

* Dependent on truck axel configuration

Based on the results detailed above an annual tonnage of 3,450 tonnes has been adopted on the basis that:

- It provides an upper level estimate of the tonnages calculated via the different methods
- The improvement of the amenity of the facility may increase its usage by residents both within and outside its existing catchment

- Its adoption is reflective of a more conservative figure which will in turn result in a more conservative design.

7.5 WASTE STREAM DISTRIBUTION

An annual tonnage of 3,450 has been adopted as representative of the quantity of material that is being received at the Macs Reef Landfill.

As for the waste quantities there is no data available on the distribution of the waste stream across the year.

As indicated previously Council has been collecting data relating to vehicles delivering waste to the Site. It is believed this data provides an indication of the relative waste flows across the year.

Figure 7.1 below graphs the attending vehicle numbers.

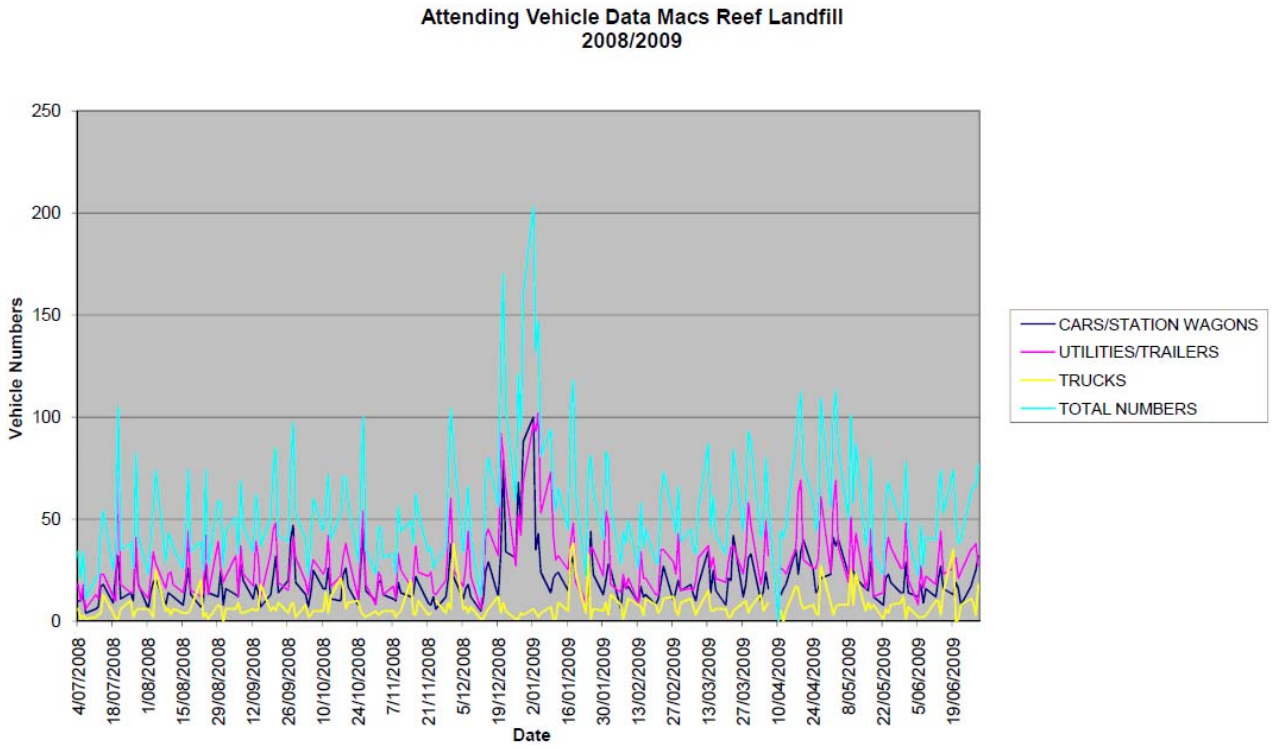

Figure 7.1 Attending Vehicle Data Macs Reef Landfill 2008/2009

As can be seen from Figure 7.1 the vehicle numbers are relatively consistent except for the period from mid December to mid January where the number of vehicles doubled.

Closer analysis of the data reveals that for each Friday to Monday period there was no particular regular peak day of the week.

Using this information for the 2008/09 financial year the following representative 4 day tonnages have been derived for the peak period and for the remainder of the year.

Table 7.11 Adopted Representative 4 Day Period Tonnages

Period	Representative 4 day period (1) tonnage	
	Peak 4 day period	Average 4 day period
Peak Period (19/12/2008 – 19/01/2009 inclusive)	135	107
Off Peak Period	111	62

Notes to Table:

(1) The figures have been derived using:

- Vehicle numbers data provided by Council
- DECCW waste factors for cars, station wagons, utilities and trailers
- Averaged DECCW waste factors for single rear axle trucks

8 Design Guidelines and Parameters

The project brief and the information gathered during the project scoping meeting identified the following design guidelines and parameters which have to be applied in the development of the concept options:

- Waste is to be deposited in waste bins
- Two or three waste bins are to be provided
- Loading of the waste bins is to be from an elevated platform
- Maximum size of the mixed solid waste bin is $30m^3$
- Maximum size of the recyclables bin is $20m^3$
- Bins are to have lids or be under cover to limit wind effects and water ingress
- Facilities are also to be provided for emptying 240 litre mobile garbage bins into the waste bins
- Access to the facilities will be limited to vehicles of less than 2 tonnes
- Staff facilities are to be provided for 1 staff member
- Acceptable materials in addition to domestic waste include:
    - Batteries
    - Oil (utilising the existing moveable disposal facility at the site)
    - E-waste
    - Small cut-up metal pieces
    - Small swappable items
    - Other small valuable items
- A small Buy Back Centre is to be included (similar size to Captains Flat WTS). The Centre is to be co-located with the staff facilities.
- Materials that will not be accepted include:
    - Greenwaste unless part of domestic mixed waste load
    - Commercial quantities of commercial and industrial (C&I) waste
    - Commercial quantities of construction and demolition (C&D) waste
    - Clean fill or VENM
    - Tyres
    - Mattresses
    - White goods and large scrap metal
    - Large items including furniture
    - Asbestos
    - Chemicals
    - Dead animals
- There is to be no stockpiling of materials on the Site
- Access roads and maneuvering areas are to be bitumen sealed or concrete
- Stormwater and leachate management facilities are to be provided
- Litter collection fences/structures are to be provided
- Access is to be off the unnamed gravel road
- The gravel road is to be upgraded in accordance with DCP requirements (Road Type 10) from Macs Reef Road to the entrance to the new facility

- The intersection of the existing unnamed road and Macs Reef Road is to be upgraded to RTA standard's
- After hours security of the Site is to be catered for
- Consideration is to be given to local amenity and distance to neighbouring residences
- A growth rate of 1% is to be allowed for
- The landfill will continue to operate until the WTS becomes fully operational.

9 Waste Transfer Station Waste Stream

9.1 CALCULATION OF WTS ANNUAL WASTE STREAM

A total annual tonnage of waste to landfill of 3,450 tonnes has been adopted for the Macs Reef landfill for design purposes based on the investigations detailed in Section 7.

In calculating the tonnage of material to be accepted at the WTS and then transferred to the Bungendore WTS, material that will not be accepted at the WTS needs to be excluded from the adopted total design tonnages.

As detailed in the design guidelines and principles in Section 8 the following materials will not be accepted at the WTS.

- Greenwaste loads
- Tyres
- Mattresses
- White goods and large scrap metals
- Builders waste
- Demolition waste
- Soil and excavated materials
- Large items including furniture
- Asbestos
- Chemicals
- Dead animals

Pryor Knowledge in their Resource Recovery Strategy detail in Table 12 of Attachment 3 the waste flows and waste breakup for Palerang waste sites. This table is reproduced in Table 9.1 below.

Table 9.1 Pryor Knowledge Waste Flow Data

INFLOW/	POTENTIAL DESTINATION				CURRENT DESTINATION			
	Sum	C&D	C&I	MUN	Landfill	Recycled	Cover	Burnt
Clean fill (out of area)	2000	1900	0	100			2000	
Other out of area	2500	200	2000	300	2350	150		
Garden Organics	2750	350	400	2000	1000	250		1500
Difficult Organics	2500	0	1000	1500	2500			
Stumps	50	40	5	5	25			25
Bricks Tiles Concrete	1000	700	250	50	750	250		
Construction Timber, Fittings & Fixtures	250	150	50	50	175	50		25
Unpaint Plasterboard	5	5	0	0	5			
Resaleable Household/Office	300	0	50	250	225	75		
Containers, P&C	1000	0	350	650	250	750		
Oil & Batteries	5	0	3	2	3	2		
White goods	40	0	10	30	10	30		
Non-ferrous	30	5	15	10	10	20		
Steel	500	40	150	310	150	350		
Other recyclables	70	10	17	43	47	23		
Residual	2000	100	500	1400	2000			
	15000	**3500**	**4800**	**6700**	**9500**	**1950**	**2000**	**1550**

This information has been used to determine the size of the waste stream that will be accepted at the WTS both for disposal and recycling (see Table 9.2).

Table 9.2 WTS Waste Streams

	Palerang Landfills Overall (tpa)	% Waste stream	Macs Reef WTS (tpa)
Total waste stream	**9500**		**3450**
Materials not accepted at Macs Reef WTS			
garden organics	1000	10.5%	
difficult organics (C&I portion)	1000	10.5%	
stumps	25	0.3%	
bricks & concrete	750	7.9%	
fittings & fixtures	175	1.8%	
white goods	10	0.1%	
steel	150	1.6%	
non-ferrous	10	0.1%	
other out of area	2350	24.7%	
total	**5470**	**57.58%**	**1986**
Materials not include in disposal waste stream (recyclable)			
containers, P&C	250	2.6%	
other recyclables	47	0.5%	
oils and batteries	3	0.0%	
total	**300**	**3.16%**	**108.9**
Remaining waste stream for disposal	**3730**	**39.26%**	**1355**
Totals	9500	100.00%	3450

Based on this analysis the total design tonnages for transport from Macs Reef WTS to a waste disposal facility or recycling facility (excluding oil) are:

- Annual tonnage for disposal = 1,355
- Annual tonnage for recycling = 109

9.2 WASTE STREAM ADJUSTMENT FOR RESIDENT PRACTICES

The theoretical annual waste stream that will be presented at the WTS has been calculated in Section 9.1 as:

- Accepted annual waste stream for disposal of 1,355 tonnes
- Accepted annual waste stream for recyclables of 109 tonnes

Council, in conjunction with the Working Group has ascertained from its community that:

- Approximately 19% of the residents in the WTS catchment utilise a private collection service and intend to continue with that service (see Question 4 of the Waste Management Survey Results Overview – Appendix I to this report)
- Of the residents in the catchment that do not use a private service, approximately 15% do not use the Macs Reef Facility and do not intend to change this practice (See Question 8 of the Waste Management Survey Results Overview – Appendix I to this report)

and has advised that these results should be taken into consideration in the design of the WTS.

Applying these correction factors the estimated current annual waste stream becomes:

- Accepted annual waste stream for disposal is 944 tonnes
- Accepted annual waste steam for recyclables is 76 tonnes

Council has estimated that the average annual growth rate in the population of the WTS will be 1%. Assuming the current level of diversion continues, the estimated growth rate to be applied to the waste stream for disposal and the recyclables waste stream would be 1% resulting in the estimated annual tonnages as detailed in Table 9.3.

Table 9.3 Estimated Annual Tonnages

Waste Steam	Currently	In 5 yrs	In 10 yrs	In 20 yrs	In 50 yrs
Waste Stream for Disposal	944	992	1042	1151	1552
Waste Stream for Recycling	76	80	84	93	125

9.3 CALCULATION OF WTS 4 DAY WASTE STREAM

Based on the design tonnages for the 2008/09 financial year (see Section 7 and Section 9.1) the current representative 4 day tonnages, as detailed in Table 9.4, can be derived.

Table 9.4 Derived Representative 4 Day Period Tonnages

Period	Representative 4 day period tonnage			
	For Disposal		Recyclables	
	Peak	Average	Peak	Average
Peak Period (19/12/2008 – 19/01/2009 inclusive)	37	29.5	2.9	2.3
Off Peak Period	30	17	2.4	1.3

Tables 9.5 and 9.6 below detail the 5, 10, and 20 year representative 4 day period tonnages.

Table 9.5 Derived Representative 4 Day Period Disposal Tonnages

Period	5 yr		10yr		20yr	
	Peak	Average	Peak	Average	Peak	Average
Peak Period	38.8	30.8	40.8	32.4	45.1	35.8
Off Peak period	31.7	17.8	33.3	18.8	36.8	20.7

Table 9.6 Derived Representative 4 Day Period Recyclable Tonnages

Period	5 yr		10yr		20yr	
	Peak	Average	Peak	Average	Peak	Average
Peak Period	3.1	2.5	3.3	2.6	3.6	2.9
Off Peak period	2.5	1.5	2.6	1.5	2.9	1.7

9.4 TRANSPORTATION OPTIONS AND LIMITATIONS

For the transfer of waste, the limiting factor is generally the tonnage to be transported, as transportation vehicles are limited in the weight they are allowed to carry on public roads.

The identified design parameters and guidelines indicated that a roll-on roll-off or hook-lift bin system was to be provided.

Such a system can handle a variety of skip sizes and in general the actual bin sizes and capacities are slightly different depending on the supplier/manufacturer. A selection of the range of bin sizes is presented in Table 9.7.

Table 9.7 Typical Roll-on Roll-off, Hook-lift Bin Sizes

Supplier/Manufacturer	Bin Sizes (M^3)
J J Richards	10, 15, 23, 30
Artec Engineering	10, 20, 30
Instant Waste Management	10, 22, 33
John Toro	10, 15, 30, 32, 35
Sita Environmental Solutions	8, 11, 23, 31

Council has advised that the Bungendore WTS can accept up to a (nominal) $30m^3$ skip.

Typically a $30m^3$ (nominal) skip is capable of accepting the weight up to the carrying capacity of a typical hook-lift truck. These have payloads in the region of 14t to 15t.

Advice from organisations utilising this type of equipment suggests that generally:

- A $30m^3$ (nom) bin filled with uncompacted mixed waste will have a maximum capacity of 5 – 7 tonnes.
- A $30m^3$ (nom) bin filled with mixed waste compacted using the bucket of a loader will have a maximum capacity of 9 – 10 tonnes
- A $30m^3$ (nom) bin loaded by waste compaction equipment will have a maximum capacity of 14 tonnes.

In comparison a $60m^3$ compacting semi trailer would have a capacity of in the order of 22 tonnes.

9.5 WTS BIN REQUIREMENTS

The WTS is proposed to be open 4 days, or part days, a week.

Ideally the number of containers available on the site:

- Should allow for them to be only emptied after the 4 day period in the first instance
- Should accept the peak 4 day period without needing to be emptied in the first instance
- Provide for increased frequency clearing as the waste stream grows with time.

Utilising the waste disposal quantities detailed in Section 9.3 and the bin capacity as detailed in Section 9.4, Table 9.8 and 9.9 below list the bin number options for waste disposal for the current 5, 10, and 20 year time periods.

Table 9.8 Bin Number Requirements Based on Accepting 4 Day Peak Period with varying compaction levels

	Current		5yr		10yr		20yr	
	Compaction Level		Compaction Level		Compaction Level		Compaction Level	
	lower level	upper level	lower level	upper level	lower level	upper level	lower level	upper level
Peak Tonnes	36.9	36.9	38.8	38.8	40.8	40.8	45.0	45.0
Uncompacted 30 cu.m bin	7.4	5.3	7.8	5.5	8.2	5.8	9.0	6.4
Loader compacted 30 cu.m bin	4.1	3.7	4.3	3.9	4.5	4.1	5.0	4.5
Compactor compacted 30 cu.m bin	2.6	2.6	2.8	2.8	2.9	2.9	3.2	3.2

LEGEND 4 bins serviced at end of 4 day period

4 bins serviced at end of 4 day period plus 1 bin will require emptying during the 5 day period

Table 9.9 Bin Number Requirements Based on Accepting 4 Day Non-Peak Period with varying compaction levels

	Current		5yr		10yr		20yr	
	Compaction Level		Compaction Level		Compaction Level		Compaction Level	
	lower level	upper level	lower level	upper level	lower level	upper level	lower level	upper level
Peak Tonnes	30.1	30.1	31.6	31.6	33.2	33.2	36.7	36.7
Uncompacted 30 cu.m bin	6.0	4.3	6.3	4.5	6.6	4.7	7.3	5.2
Loader compacted 30 cu.m bin	3.3	3.0	3.5	3.2	3.7	3.3	4.1	3.7
Compactor compacted 30 cu.m bin	2.1	2.1	2.3	2.3	2.4	2.4	2.6	2.6

LEGEND 4 bins serviced at end of 4 day period

4 bins serviced at end of 4 day period plus 1 bin will require emptying during the 5 day period

CONCLUSIONS

Based on the above analysis the following conclusion have been reached with regard to the number of bins and the level of compaction that the WTS is to be designed to accommodate.

(a) For Waste Disposal

A loader, or similar should be provided on site to allow the compaction of the waste bins and on this basis:

1. 4 x 30m^3 (nom) waste bins should be provided allowing the acceptance of the current 4 day perk period
2. 4 bins will mean that only 1 service per 4 day period will be required outside the peak period for up to 20 years
3. For the peak period the 4 bins will accept the 4 day peak waste stream for up to 5 years after which additional services will be required during the 4 day period.

(b) For the Recyclables Stream

1. 1 x 20m^3 (nom) bin will service the catchments' need for up to 20 years
2. While the 20m^3 (nom) bin will take a number of periods to fill, utilising a 20m^3 (nom) bin has the advantages that:
   - The location of the waste bins are interchangeable
   - One type of vehicle can service both the waste and recycling bins
   - In the future, should Council wish, the bay provided for the recyclables bin can be utilised for a waste bin and the recyclables can be stored in a different bin (e.g. walk in bin) on another part of the site.

10 Concept Options

10.1 SITING OPTIONS

Council, in preparing the brief for this project, identified two (2) possible sites for the location of the WTS. These two sites are shown on Figure 10.1. (Sites 1 and 2).

Quadro has identified a further site, shown as Site 3 on Figure 10.1, which can be considered for the location of the proposed WTS.

Source: © Department of Lands (2009)

Figure 10.1 WTS Siting Options

10.2 CONCEPT LAYOUTS

10.2.1 Introduction

For each of the three (3) sites a concept layout has been developed which takes into account:

- Site development constraints including the physical characteristics of each site
- Access requirements
- Capacity requirements
- Servicing requirements

- Operational requirements
- The need to construct the WTS while the landfill is operational
- The operational needs of the landfill closure process

The three (3) concept designs can be found in Appendix A, B and C.

During the presentation of the draft Concept Options Report Council asked that a further option be considered. This option involved the rotation of Quadro's Site 1 Option through 90° so that its long axis was parallel to Macs Reef Road. This option has been included as Option 1B in Appendix A.

10.2.2 General Features

The following features have been included in the four (4) Concept Option designs.

i. Vehicular Access Movement

Access into and around the site has been designed in accordance with AS 2890-2 Parking Facilities Part 2 Off-Street Commercial Vehicle Facilities for Articulated Vehicles.

The use of the templates for articulated vehicles allows for the use of both truck and dog vehicles for bin movements as well as articulated vehicles should Council decide to adopt $60m^3$ bins or compacting semi trailers.

ii. Waste Disposal Areas

Facilities have been provided to accept five (5) roll-on roll-off bins, four (4) for waste acceptance and one (1) for co-mingled recyclables.

As suggested by Council officers the design also incorporates one (1) bay which allows a vehicle to draw alongside the bin and then drive away in a forward direction rather than having to reverse up to the bin. This provides an opportunity for "express" waste disposal for those with only a small amount of waste (e.g. a garbage bag full).

Access to the bin storage areas has been limited by the inclusion of gates.

The design is readily adaptable to allow the use of $60m^3$ bins should Council wish to explore this option.

iii. Site Office

A 2m x 3m site office has been provided within the Buy Back Centre building for the use of the WTS operator.

The office is to include a sink serviced by the buildings' rainwater tank. Waste water from the sink is to be piped to the on-site effluent disposal system.

iv. Weighbridge

No weighbridge has been provided and no allowance has been made for a weighbridge in the design of the WTS.

This decision was made on the basis that:

a) The small quantities of waste received on the site, approximately 1,300 – 1,400 tonnes per annum, does not justify the expense of the provision of a weighbridge and supporting systems.

b) Waste transported from the site for disposal or processing will be weighed into the accepting facility. This will provide Council with waste flow data for ongoing monitoring and management systems.

v. Buy Back Centre

The concept plans include a prefabricated colourbond steel building to house the Buy Back Centre. The facility consisting of a 6m x 6m building with a 3m wide awning to the front.

The Buy Back Centre will operate as a shop with goods accepted, displayed and made available for sale and reuse by the community.

vi. Car Parking

Car parking is required for the WTS operator and for customers visiting the Buy Back Centre.

The Council's standards for off street parking do not provide any parking rates for waste management facilities or for rural residential zones.

The RTA Guide to Traffic Generating Developments (RTA Guide) does not provide rates for waste management facilities or definitive rates for bulky good warehouses (a similar function to the Buy Back Centre).

The RTA Guide does provide off street parking rates for shops. A parking rate of 6.1 car parking spaces per $100m^2$ (GLFA 0-10,000).

The Buy Back Centre has a GLFA of $30m^2$ which equates to a requirement for 1.83 parking spaces.

The proposed WTS includes 6 car parking spaces allowing for:

- Council staff (1 space)
- Disabled parking (1 space)
- Public parking (4 formal spaces)

This is considered to be adequate for the proposed use.

vii. Site Amenities

Allowance has been made for a separate disabled access sanitary facility incorporating a toilet and hand basin (Australian Portable Building Toilet 2.4 x 2.4m Accessibility or equivalent). The facility being for both public and staff use.

viii. Water Supply

Roof water from the Buy Back Centre is to be collected in a potable tank for use in the site office and amenities. A tank of minimum capacity of 4,500 litres will be required. This will provide an operating allowance of 150 litres per day for up to a month at a time.

If required, due to weather conditions, the tank can be filled by a water tanker.

ix. Liquid Waste Management System

The proposed facility does not lie within a sewerage scheme catchment therefore it requires an on-site management system.

As the facility is only open four (4) days a week and there is only one staff member it is not believed that there will be enough feedstock for an on-site waste water treatment system such as a Biolyfix BF2.

It is therefore proposed that a septic tank and absorption system be installed.

x. Fire Fighting Water Supply

A minimum 20,000 litre water tank has been provided for dedicated fire fighting purposes.

10.3 INTERSECTION DESIGN

In addition to the development of the four (4) concept options, a design was also prepared for the intersection of Macs Reef Road and the existing gravel road which is to be reconstructed as part of the development of the WTS.

The intersection has been designed in accordance with Section 4, Intersections at Grade, of the Roads and Traffic Authority of NSW Road Design Guide (Guide) as detailed below.

10.3.1 Design Criteria

Macs Reef Road

- Travel speed, 100km/hr
- Nominal lane width, 3.50m
- Intersection angle with minor road, 90°
- Intersection type, two lane two way road with T junction
- Assumed traffic growth, 3%pa (Council's advice)

Minor Road

- Travel speed, 60km/hr
- Nominal lane width, 3.5m

10.3.2 Traffic Volumes Macs Reef Road

Council supplied average daily traffic (ADT) figures for Macs Reef Road for the period 20/07/2008 to 27/12/2009 inclusive for a position near the Federal Highway (to the west of the WTS site).

The ADT figures, which were based on seven (7) and five (5) day counts, range from 2,700 for the week ending 03/08/2008 (7 day count) to 3,839 for the week ending 01/02/2009 (5 day count).

The highest recorded ADT figure was adopted for the purpose of the intersection design.

As no peak hour volume was available a design peak hour volume of 15% of ADT was adopted as recommended by the Guide.

This provides for

- ADT of 1,920 vehicles per day (vpd) each way
- Peak hour volume of 288 vehicles per hour (vph).

No ADT Figures were available for vehicle movements from Macs Reef Road into and out of the road leading to the WTS.

10.3.3 Traffic Volume Minor Road

No ADT figures are available for this road.

Council, within the brief, did provide Macs Reef Landfill user numbers for the 2007/2008 financial year (see Table 10.1 below).

Table 10.1 Macs Reef Landfill User Numbers 2007/2008

MACS REEF LANDFILL - USER NUMBERS
TOTAL - 9,718 vehicles
3836 (cars/s. wagons) 4849 (utes/trailers) 1033 (trucks)

	CARS/STATION WAGONS			CARS/STATION WAGONS			CARS/STATION WAGONS		
	Ave	Max. Day	Total	Ave	Max. Day	Total	Ave	Max. Day	Total
Friday	12	33	609	17	83	889	6	20	293
Saturday	17	96	899	22	103	1161	4	15	203
Sunday	24	83	1275	30	109	1612	4	12	205
Monday	20	92	1053	22	72	1187	6	21	332

Adopting the maximum daily visit numbers for each category gives the following vehicle numbers.

Categories	**Maximum Number Vehicles per day**
Cars/Station wagons	96
Utilities/trailers	109
Trucks	20
Total	**225**

Using the maximum daily visit numbers ensures that the resulting design will take a conservative approach and provide a greater design life.
Utilising a design peak hour volume of 15% of the daily number provides a peak hour volume of 34vph.

10.3.4 Intersection Design

10.3.4.1 Intersection Type

(a) Current Traffic Volumes

Design peak hour flow on Macs Reef Road = 288vph
Design peak hour flow to turn right off Macs Reef Road = 34vph *(assuming the worst case scenario with all vehicles approaching from the west)* or = 17 if a more appropriate right turn movement of 50% of the peak flow is adopted.

Utilising figure 4.5.12 of the Guide for both scenarios, the appropriate intersection types are:

Movement	Intersection Type	
	100% WTS vehicles making nominated movement	**50% WTS vehicles making nominated movement**
Right turn off Macs Reef Road	AUR	AUR
Left turn off Macs Reef Road		
• For 500 hrs per year (5.7% yr)	AUL	AUL
• For remainder of year (94.3% yr)	AUL	BAL

(b) Future Traffic Volumes

Adopting design life of 20 years and a 3% pa growth in traffic:

Design peak hour flow on Macs Reef Road = 505vph
Design peak hour flow to turn right off Macs Reef Road = 41vph *(assuming the worst case scenario with all vehicles approaching from the west)*

Utilising figure 4.5.12 of the Guide, the appropriate right turn intersection type is CHR.

Adopting a possibly more appropriate right turn movement of 50% of expected site visitations, the appropriate right turn and left turn types become:

Movement	Intersection Type	
	100% WTS vehicles making nominated movement	**50% WTS vehicles making nominated movement**
Right turn off Macs Reef Road	AUR	AUR
Left turn off Macs Reef Road		
• For 500 hrs per year (5.7% yr)	AUL	AUL
• For remainder of year (94.3% yr)	AUL	BAL

(c) Conclusions

i. Based on the above intersection detail AUR was adopted for the right turn movement off Macs Reef Road as it is believed to represent an appropriate design level for the purpose of developing and costing the concept designs, however recommendations have been included in the report that traffic counts be conducted for vehicles leaving and entering Macs Reef Road to confirm the assumptions made.

ii. For the left turn movement off Macs Reef Road the intersection type boarders AUL and BAL. The determining factor is the actual turning traffic numbers. There is no actual traffic count data available for vehicles entering and leaving the WTS site and adjoining residences. Traffic data presented above is based on the worst case scenarios.

For the purpose of the concept design a BAL left turn treatment has been adopted and recommendations included in the report that a traffic count be conducted to ascertain the actual movement numbers so that this information can be included in the final design process.

10.3.4.2 Intersection Design – Current Traffic Volumes

(a) Practical Absorption Capacity (C_p)

Major Stream Volume Q = 288vph

Left hand turn into Major Road	t_a = 5 sec t_f = 2-3 sec C_p = 900vph
Right hand turn from Major Road	t_a = 4 sec t_f = 2 sec C_p = 1100vph
Right hand turn from Minor Road	t_a = 3 sec t_f = 3 sec C_p = 1100vph

(b) Average Delay

Right hand turn from Major Road	Q_p = 288 Q_m = 34 (*assuming worst case scenario with all vehicles entering via right hand turn)* W_m = 0.75sec
Left hand turn into Major Road	Q_p = 1100 Q_m = 34 (*assuming worst case scenario with all vehicles making this movement)* W_m = 1.3sec
Right hand turn from Minor Road	Q_p = 1100 Q_m = 34 (*assuming worst case scenario with all vehicles making this movement)* W_m = 7.5sec

(c) Storage Requirements

Right hand turn from Major Road	Q_m = 34*(assuming worst case scenario with all vehicles arriving from the same direction)* Q_s = 1100/0.8 = 1375 Utilisation Ratio = Q_m/Q_s = 34/1375 = 0.025 Queue Length = 2 vehicles (95% probability) Provide for a queue length of 3 x 8m = 24m.

10.3.4.3 Intersection Design – Future Traffic Volumes

Adopting:

- Design life of 20 years
- 3% pa traffic growth

Macs Reef Road

- Design peak hour current = 288vph
- Design peak hour future = 505vph
- Current ADT = 3839vpd
- Future ADT = 6732vpd

Minor Road

- Design peak hour current = 34vph
- Design peak hour future = 41vph

(a) Practical absorption Capacity (C_p)

Major stream Q = 505vph

Left hand turn into Major Road	t_a = 5 sec t_f = 2-3 sec C_p = 580vph
Right hand turn from Major Road	t_a = 4 sec t_f = 2 sec C_p = 950vph
Right hand turn from Major Road	t_a = 3 sec t_f = 3 sec C_p = 600vph

(b) Average Delay (W_m)

Right hand turn from Minot Road	Q_p = 505 Q_m = 21 *(assuming 50% of traffic from each direction)* W_m = 1.5sec
Left hand turn into Major Road	Q_p = 505 Q_m = 21 *(assuming 50% of traffic from each direction)* W_m = 2.5sec
Right hand turn from Minor Road	Q_p = 505 Q_m = 21 *(assuming 50% of traffic from each direction)* W_m = 0.8sec

(c) Storage Requirements

Right hand turn from Major Road	Q_m = 41*(assuming worst case scenario with all vehicles arriving from the same direction)* Q_s = 600/0.8 = 750 Utilisation Ratio = Q_m/Q_s = 41/750 = 0.054 Queue Length = 2 vehicles (95% probability) Provide for a queue length of 3 x 8m = 24m.

10.3.5 Adopted Design Criteria

The following design criterion has been adopted for the intersection.

Travel speed	100km/h
Lane width (W)	3.5m
Intersection angle	90°
Storage length (b)	35m
Transition length (a)	75m
Right turn treatment	AUR major road
	BAR minor road
Left turn treatments	BAL (ADT>50)

Should Council decide to adopt an AUL treatment for exit from Macs Reef Road onto the road into the WTS then the following design features would apply.

Design speed of approach road	100km/h
Design speed of exit curve	0km/h *(assumes required to stop)*
Diverge length	100m
Storage length	use requirements for right hand turn (see Section 10.3.4.3). = (3-1)x8 = 16m
Total length auxiliary lane	116m

Based on these design criteria, additional pavement areas of:

2 coat seal pavement	231m^2
Shoulder	116m^2

will be required at an estimated additional cost of $43,500.00 including a 25% contingency allowance.

11 Opinion of Costs

Opinion of Costs have been developed for both the initial capital cost and the ongoing operational costs. These are presented below.

11.1 CAPITAL COST

Set out below in Table 11.1 is a summary of the opinion of costs that have been developed for the four (4) concept options. (A detailed breakdown of these costs is included as Appendix H).

The format of the opinion of costs has been developed to allow Council to identify the principal tasks associated with the development and construction of the project and to be able to identify the construction costs associated with both the improvement of the access to the site and the development of sediment/leachate management structures both for the landfill and the WTS.

Table 11.1 Opinion of Capital Cost Summary

Project Element	Estimated Cost (1)			
	Site 1A ($)	Site 1B ($)	Site 2 ($)	Site 3 ($)
Site Investigations	10,000	10,000	10,000	10,000
Planning Process	130,000	130,000	90,000	130,000
Site Establishment	3,893	3,893	3,893	3,893
Macs Reef Road Intersection Construction (2)	72,297	72,297	72,297	72,297
Gravel Road Reconstruction	62,551	34,337	24,985	26,444
WTS Construction	700,031	858,041	840,177	732,143
Sediment/Leachate Pond Construction	10,678	10,678	10,678	10,678
Subtotals	989,450	1,119,246	1,052,030	985,454
Contingency (3)	247,363	279,812	263,008	246,364
TOTAL (4)	**1,237,000**	**1,400,000**	**1,316,000**	**1,231,900**

Notes to Table:

(1) The estimated costs are exclusive of GST

(2) The nominated costs include the reconstruction of the first 35m of the existing gravel road from which the site gains access and allow for a BAL intersection treatment for vehicles leaving Macs Reef Road. Should Council adopt a type AUL treatment for this movement an additional $43,500 (including 25% contingency) should be added to these costs.

(3) The opinion of costs has been developed on the basis of a global appreciation of the works involved. When an opinion of costs is of a global nature it may have plus or minus error. The extent of this error is reduced during the detailed design process. An appropriate confidence level for the opinion of costs, based on the extent of the design work undertaken in the development of the concept options is +25% to -25%.

(4) Rounded up to the nearest $100.00

In addition to the information provided in the Notes to Table 11.1, the following additional site specific information and qualifications are also provided.

Site 1A

i) An allowance of $50,000 has been made for the preparation of an Environmental Impact Statement (EIS) as the site lies within 250m of a residence.

ii) A single sediment/leachate management pond has been included to service the WTS.

iii) Security fencing encompasses the WTS site only.

Site 1B

i) An allowance of $50,000 has been made for the preparation of an Environmental Impact Statement (EIS) as the site lies within 250m of a residence.

ii) A single sediment/leachate management pond has been included to service the WTS.

iii) Security fencing encompasses the WTS site only.

Site 2

i) An allowance of $10,000 has been made for the preparation of a Review of Environmental Factors (REF), rather than $50,000 for an EIS, as the site is greater than 250m from a residence.

ii) A single sediment/leachate management pond has been included to service the WTS.

iii) Security fencing has been provided either side of the access road to and around the WTS as well as for the length of the frontage of the site from Macs Reef Road to the proposed WTS entrance gates and a portion of Macs Reef Road frontage.

Site 3

i) An allowance of $50,000 has been made for the preparation of an Environmental Impact Statement (EIS) as the site lies within 250m of a residence.

ii) A single stormwater/leachate management pond has been included to service the WTS.

iii) Security fencing encompasses the WTS site including the site's frontage to Macs Reef Road and the frontage of the site from Macs Reef Road to the proposed WTS entrance gates.

Sites 1A to 3

Should Council wish to construct a roof over the bin bays as shown on the elevations sheets for each Concept Option then the opinion of costs shown in Table 11.2 should be added to the total costs shown in Table 11.1.

Table 11.2 Opinion of Cost, Roof Structure

Estimated Cost [1]	**($)**
Supply and install roof structure	$35,000
Contingency[2]	$8,750
Total [3]	**$44,000**

Notes to Table:

(1) The estimated costs are exclusive of GST

(2) The opinion of costs has been developed on the basis of a global appreciation of the works involved. When an opinion of costs is of a global nature it may have plus or minus error. The extent of this error is reduced during the detailed design process. An appropriate confidence level for the opinion of costs, based on the extent of the design work undertaken in the development of the concept options is +25% to -25%.

(3) Rounded up to the nearest $100.00

11.2 OPERATIONAL COSTS

There are two (2) principal areas of ongoing operational costs. These are:

i) The staffing and operation of the WTS

ii) The supply and ongoing movement of the skip bins from the WTS to the receival facilities.

Set out below is Quadro's opinion of costs for these recurrent costs.

11.2.1 Operation of the WTS

Council has advised that as a result of discussions held in the Working Group the proposed operating hours for the WTS are:

2.00pm to 5.00pm Fridays

8.00am to 4.00pm Saturdays and Sundays

7.00am to 11.00 Mondays

Council has also advised that it wishes to staff the WTS with one staff member (Facility Operator) who will be responsible for:

- Overall day to day facility management
- Site security

- Traffic control
- Controlling, monitoring and recording of incoming waste
- Waste handling and management
- Odour control
- Leachate and surface water management
- Litter control
- Fire management
- Spills management
- Incident reporting
- Complaints receival

Additional staff time will also be required on a regular basis to:

- Collect windblown litter
- Maintain the landscaping
- Maintain the stormwater/leachate management system.

Based on the proposed operating hours of the WTS and the additional duties required to maintain the site and its environs it is envisaged that the Facility Operator's hours will be 30 hours per week made up of:

Opening hours of WTS	23 hours per week
Extra hours for:	
o Compacting waste in the bins	2 hours per week*
o Litter control	2 hours per week
o General maintenance and cleaning	2 hours per week
o Administration duties	1 hour per week
Total	30 hours per week

*This is compaction at the end of the day. The bins will also require compacting during the open hours of the WTS.

As the Facility Operator will be required to operate the plant required to compact the waste into the bins, he/she will be required to hold the appropriate WorkCover permits. On this basis Council has advised that the appropriate base hourly rate including on-costs for the Facility Operator is $33.80 per week.

In addition to the base rate Council has advised the position will also attract the following allowances and penalties.

Allowances

Meal Allowances: $998.40 per annum

Disability Allowance: $1,705.60 per annum

Penalties

As the WTS is regularly open on Saturdays and Sundays, the following penalty rates apply.

Saturday: time and a half

Sunday: double time.

In addition to the ongoing staffing costs of the WTS costs will also be incurred for:

a) The plant required to compact the waste in the bins
b) The plant and equipment required to maintain the WTS and its environs
c) The supervision and support of the operations at the WTS.

Set out below in Table 11.3 is a summary of the opinion of costs associated with the operation of the WTS based on the information and advice supplied by Council.

Table 11.3 Opinion of WTS Operational Costs

Activity	Cost per Annum ($)
Staffing of facility (1)	
Staff costs	$ 74,103
Allowances	$ 2,704
Plant Hire	
Loader (2)	$ 11,856
Small tools	$ 1,053
Supervision	$ 2,212
Total	**$ 91,928**

Notes to Table
(1) Based on 30 hours per week
(2) Based on 4 hours per week

11.2.2 Transfer of Waste and Recyclables

Enquiries have been made with a number of waste management companies in the region to ascertain a budget cost for:

- The provision of four (4) 30m^3 (nom) roll-on roll-off bins for waste disposal
- The provision of one (1) 20m^3 (nom) roll-on roll-off bins for recyclables collection
- The transfer of the four (4) waste bins to the Bungendore Landfill site once a week
- The transfer of the recyclables bin to a MRF located in Hume ACT.

The companies were asked to exclude the cost of the disposal of waste at the receiving facility on the basis that Council would meet this cost separately.

The information received suggests:

- The purchase price of a 30m^3 bin is in the order of:
  - $15,000 for a bin with no lid
  - $20,000 for a bin with multiple lids
- A bin has an average life of five (5) years
- The cost to transport the bins to a receiving facility is approximately $100 - $120 per hour.

Using this information Table 11.4 below provides a summary of the budget costs provided for the transfer of waste and recyclables.

Table 11.4 Opinion of Material Transfer Costs

Item	Cost (1)	Unit	Cost per annum
Option 1 - Council to provide the bins with transfer by contractor			
Capital Cost (2)			
four (4) waste bins (3)	$ 80,000	item	$ 16,000.00
one (1) recycling bin (3)	$ 18,000	item	$ 3,600.00
Recurrent Costs (4)			
transfer of waste	$ 120	per hour	$ 74,880.00
transfer of recyclables	$ 120	per hour	$ 18,720.00
Total			**$ 113,200.00**
Option 2 - Contractor to supply bins and transfer materials			
supply of bins	$ 500	per week	$ 26,000.00
transfer of waste (4)	$ 120	per hour	$ 74,880.00
transfer of recyclables (4)	$ 120	per hour	$ 18,720.00
Total			**$ 119,600.00**

Notes to Table
1. Costs are transfer costs only and do not include disposal fees at the receiving facility
2. Assuming 5 year bin life
3. Assuming bins with multiple lids
4. Assuming
   * three hour turn aroud time to Bungendore landfill site
   * three hour turn aroud time to the recycling facility
   * waste bins carried by truck and dog

12 Evaluation of Concept Options

The four (4) Concept Options that have been developed have been ranked based on a range of factors including planning requirements, construction costs and operational parameters.

This ranking has been based on a system where each factor is ranked from 1 to 5 with a ranking of 1 being applied to the option receiving the best results and 5 the worst results.

While this system is subjective it does provide an indication of the relative merits of each Concept Option.

The results of this ranking process are provided in Table 12.1.

Table 12.1 Ranking of Concept Options

Evaluation Criteria	Ranking (1)			
	Site 1 - Concept Option 1A	**Site 1 -** Concept Option 1B	**Site 2 -** Concept Option 2	**Site 3 -** Concept Option 3
Planning Considerations				
Likelihood of the Site not being classified as Designated Development	5	5	1	4
Siting Considerations				
Proximity to residences	5	4	1	3
Visual exposure from surrounding area	3	1	5	2
Construction Costs (2)				
Construction Costs	1	5	2	1
Operational Considerations				
Site surveillance by Operator	1	1	5	2
Litter control (wind exposure)	2	1	5	2
Work required to mitigate effect on water courses				
- water course under the Water Management Act	1	1	1	2
- other water courses	3	3	3	2
WTS effect on landfill closure operations	2	1	5	1
Totals (3)	**23**	**22**	**28**	**19**

Notes to Table

1 Ranking system is based on a 1 to 5 ranking with the best result receiving 1 while the worst result receives 5

2 Construction costs based on amalgam of costs for the WTS, the leachate & stormwater management system and the reconstruction of the the gravel entrance road

3 Lowest total score is the preferred option

As can be seen from Table 12.1, Sites 1A, 1B and 3 are similar in ranking while Site 2 is markedly different.

Site 3 has been ranked slightly better than Sites 1A and 1B principally on the basis of:

- It's cost
- The site only being within the 250m zone of influence of the residence on the northern side of Macs Reef Road
- The additional distance from the residence on the northern side of Macs Reef Road compared to Sites 1A and 1B.

13 Recommendations

Based on the results of the investigative and design processes undertaken, Quadro recommends that:

1. The design of the WTS incorporate the design features developed for the four concept options including:
    - Two level design to allow the top loading of roll-on roll-off bins
    - Five (5) bays to accommodate 4 x 30m^3 (nom) bins for waste disposal and 1 x 20m^3 (nom) bin for recyclables
    - Combined Buy Back Centre and office
    - Recycling bays for oil, e-waste etc.
2. That the roll-on roll-off bins be fitted with manual controllable multiple lids to allow sections of the bins to be closed off at any time and to limit ingress of rainwater and wind effects.
3. That Council provide a loader or equivalent piece of plant to allow the waste to be compacted in the bins.
4. Site 3 and Concept Option 3 be adopted for the site of the Macs Reef Waste Transfer Station (WTS) on the basis of:
    - Capital costs
    - The lesser effect on surrounding residences
5. Discussions be held with the owners of the three (3) adjacent residences and Council's Planning Department to clarify whether the proposal as presented in Concept Option 3 can proceed through the planning process on the basis that while the proposed facility is located within 250m of an adjacent residence it is unlikely to significantly affect the existing amenity of the neighbourhood.
6. That a traffic count be undertaken to quantify the number of vehicles utilising the road from which access is gained to the WTS and their approach and departure direction.
7. That the results of the traffic count be used during the final design process to determine the appropriate intersection details.

14 References

- Good Environmental Systems, 2009: Environmental Survey and Assessment of the Macs Reef Tip Restoration and Redevelopment Site
- Archaeological Heritage Surveys, August 2009: Macs Reef Road Tip Cultural Heritage Assessment.
- Palerang Waste Management Strategy; Palerang Council, adopted June 2005.
- Yarrowlumla Local Environment Plan, June 2002.
- Yarrowlumla Development Control Plan, Rural Zones, June 2002.
- NSW Environmental Planning and Assessment Act, 1979
- NSW Environmental Planning and Assessment Regulation, 2000
- NSW Protection of the Environment Operations Act, 1997
- Managing Land Contamination, Planning Guidelines, SEPP 55 – Remediation of Land, Department of Urban Affairs & Planning, EPA, 1998
- RTA Guide to Traffic Generating Development, Version 2.2
- RTA Road Design Guide
- Landcom Soils and Construction Vol. 1, 4th Edition, March 2004
- Environmental Guidelines: Solid Waste Landfills. EPA,1996
- Department of Environment, Climate Change and Water, 2006: Handbook for Design and Operation of Rural and Regional Transfer Stations
- Pryor Knowledge (Act) Pty Ltd, Resource Recovery Strategy 2006
- URS Palerang Waste Management Strategy: 2005 – 2025, 2005
- As 2890.2 – 2002 Parking Facilities, Part 2: Off Street Commercial Vehicle Facilities

Appendix A

Site 1 Concept Designs A and B

Appendix B

Site 2 Concept Design

Appendix C

Site 3 Concept Design

Appendix D

Macs Reef Road Intersection Concept Design

Appendix E

Good Environmental Systems Report 2009

Appendix F

Archaeological Heritage Surveys Report

Appendix G

Waste Factors by Vehicle Type and Waste Type

Environmental Guidelines; Solid Waste Landfills 1996

Waste factors by vehicle and waste type (All units in tonnes)

Vehicle type	Description	Weight factor		
Small vehicle		**All mixed waste**		
A	Car/station wagon	0.06		
B	Van/utility/trailer	0.30		
Open truck		**Municipal, commercial and industrial waste**	**Building and demolition waste**	**Clean natural excavated materials**
C	Single rear axle with two rear wheels or four small rear wheels	0.62	0.98	2.47
D	Single rear axle with four normal-size wheels	1.16	2.76	5.58
E	Tandem rear axle (bogie drive)	3.74	7.14	10.97
F	Twin steer with twin rear axles	5.57	7.61	10.97
G	Tipping semi-trailer	5.79	15.00	15.00
Enclosed truck and compactor		**All mixed waste**		
H	Single steer with single rear axle		2.72	
I	Single steer with tandem rear axle		6.38	
J	Twin steer with tandem rear axle		7.96	
K	Waste transfer truck		19.89	

Appendix H

Concept Plans Opinion of Costs

Appendix I

Waste Management Survey Results Overview

ATTACHMENT 1

Waste Management Survey Results Overview

1 Summary Data

Survey forms posted out	1236		
Survey responses received	674	=	54.5%

Note that, in the following data, totals do not always add up to 100% because not all respondents answered all questions, even when it might seem logical that they would.

2 Preferred Option

In response to the question "Which [option] do you prefer?" (only one option could be selected):

Roadside Collection	133	=	19.7%
Waste Transfer Station	507	=	75.2%

3 Support for Trial

In response to the question "Do you support the [proposed] trial?"(only one option could be selected):

Yes	212	=	31.5%
No	454	=	67.4%

4 Private Collection Service

In response to the question "Do you use O'Sullivans Household Rural Waste Collection Service?":

Yes	129	=	19.1%
No	540	=	80.1%

5 Private Collection Frequency

For those respondents who indicated that they used O'Sullivans, their response to the question "How often do you have O'Sullivans collect your waste?":

Weekly	40	=	31.0%
Fortnightly	76	=	58.9%

Monthly	9	=	7.0%
Occasionally	1	=	0.8%

6 Private Collection Service Location

For those respondents who indicated that they used O'Sullivans, their response to the question "From where does O'Sullivans collect your waste?":

Roadside	32	=	24.8%
House	94	=	72.9%

7 Landfill Usage

In response to the question "Do you use an existing landfill rubbish tip?":

Yes	636	=	94.4%

8 Tip Location

Respondents who indicated that they used either of the two local landfill rubbish tips (respondents could nominate both sites if they used both):

Macs Reef Road	545	=	85.7%
Bungendore	200	=	31.4%

9 Macs Reef Road Tip Usage

For respondents who indicated that they used either of the two local landfill rubbish tips, "How often do you use the tip for household waste?":

Weekly	98	=	15.4%
Fortnightly	125	=	19.7%
Monthly	161	=	25.3%
Occasionally	161	=	25.3%
(Never	30	=	4.7%)

10 Bungendore Tip Usage

For respondents who indicated that they used either of the two local landfill rubbish tips, "How often do you use the tip for household waste?":

Weekly	37	=	5.8%
Fortnightly	29	=	4.6%
Monthly	35	=	5.5%

Occasionally	99	=	15.6%
(Never	179	=	28.1%)

11 # Bags of Rubbish per Tip Trip

In response to the question "On average, what quantities of household rubbish do you take to Council tips per visit (# of 'standard' plastic shopping bags)?":

1-3	75	=	11.8%
4-6	104	=	16.4%
7-9	101	=	15.9%
10-12	170	=	26.7%
13-15	8	=	1.3%
16-18	13	=	2.0%
19-21	33	=	5.2%
21-24	8	=	1.3%
>24	87	=	13.7%

12 Tip Items

In response to the question "Tick every item you take to the tip (at least occasionally)?":

General Household Waste	548	=	86.2%
Recyclable Items	494	=	77.7%
Batteries	153	=	24.1%
Building Waste	291	=	45.8%
Computers	123	=	19.3%
Furniture	169	=	26.6%
Green Waste	287	=	45.1%
Oil	172	=	27.0%
Paint	93	=	14.6%
Tyres	94	=	14.8%
White Goods	175	=	27.5%
Wire/Fencing	219	=	34.4%
Other Items	145	=	22.8%

13 WTS Usage with Collection

In response to the question "How often would you need to use a transfer station if there was a roadside collection service?":

Weekly	39	=	6.1%
Fortnightly	72	=	11.3%
Monthly	111	=	17.5%
Occasionally	324	=	50.9%
Never	29	=	4.6%

14 WTS Usage without Collection

In response to the question "How often would you need to use a transfer station if there was no roadside collection service?":

Weekly	129	=	20.3%
Fortnightly	155	=	24.4%
Monthly	170	=	26.7%
Occasionally	139	=	21.9%
Never	7	=	1.1%

15 Recycling

In response to the question "Roughly what percentage of your recyclables do you take to a Council recycling facility?":

0%	96	=	14.2%
1-25%	54	=	8.0%
26-50%	66	=	9.8%
51-75%	26	=	3.9%
76-99%	234	=	34.7%
100%	198	=	29.4%

16 WTS Items

In response to the question "What items would you want to take to a waste transfer station?":

General Household Waste	437	=	68.7%
Recyclable Items	446	=	70.1%
Batteries	168	=	26.4%
Computers	136	=	21.4%
Oil	169	=	26.6%
Other Items	203	=	31.9%

Responses to items 2, 3, 4 & 10 were also analysed according to the location of respondents, but in order to preserve the anonymity of individual respondents these data have not been made publicly available. Nonetheless, while these particular breakdowns were interesting, they did not show any trends that would impact the interpretation of the overall results.

The results for Items 2 & 3 were also analysed with respect to whether or not respondents already used a collection service:

Preferred roadside collection

Total	133		
With existing service	29	=	22.5% of those with existing service
Those at roadside	14	=	43.8% of those with roadside service
Those at house	13	=	13.8% of those with house service
No location nominated	2		
Without existing service	102	=	18.9% of respondents
Status unknown	2		

Supported trial

Total	212		
With existing service	41	=	31.8% of those with existing service
Those at roadside	19	=	59.4% of those with roadside service
Those at house	21	=	22.3% of those with house service
No location nominated	1		
Without existing service	170	=	31.5% of respondents (without service)
Status unknown	1		