WSN Environmental Solutions

Alternative Waste Technology Facility, Lucas Heights Waste and Recycling Centre Environmental Assessment

Volume 1 – Main Report

August 2009

WSN ENVIRONMENTAL SOLUTIONS

Submission of Environmental Assessment

Prepared under the Environmental Planning and Assessment Act 1979, Section 75H

Environmental Assessment prepared by	Name:	David Gamble
	Qualifications:	Bachelor of Engineering (Mechanical) Bachelor of Economics Master of Engineering Science (Waste Management)
	Address:	GHD Pty Ltd Level 15, 133 Castlereagh St, Sydney NSW 2000
	In respect of:	Construction and Operation of an Alternative Waste Technology Facility, Lucas Heights Waste and Recycling Centre.
Development Application	Applicant name:	WSN Environmental Solutions
	Applicant address:	Level 1, Building A, Rhodes Corporate Park, 1 Homebush Bay Drive, Rhodes NSW 2138.
	Land to be developed:	The project is to be carried out on land as shown in the Environmental Assessment.
	Lot no, DP/MPS, vol/fol etc	Lot 111, DP 1050235 Lot 1, DP 233333
Environmental Assessment	An Environmental Assessment is attached.	
Certificate	I certify that I have prepared the contents of this Environmental Assessment and to the best of my knowledge: ◗ It is in accordance with the requirements of Part 3A; ◗ It contains all available information that is relevant to the environmental assessment of the development; and ◗ That the information contained in the Environmental Assessment is neither false nor misleading.	
	Signature	
	Name	David Gamble
	Date	31 August 2009

Glossary of Terms

Term	Definition
Acidogenic	Second (fermentation) stage in the four stages of anaerobic digestion that produces a weak acid.
Alternative waste technology	Technology that diverts waste away from landfill, recovers more resources from the waste stream and minimises the impacts on the environment. Provides more sustainable solution than landfilling. Can include mechanical separation, biological processes, thermal technologies and mechanical biological treatment. Mainly applied to mixed municipal wastes, commercial wastes or separated food and garden organics.
Anaerobic digestion	A biological process that occurs naturally when bacteria breaks down organic matter in the absence of oxygen, producing a biogas that can be used as a fuel to generate electricity and heat.
Aquifer	Rock or soil formation containing groundwater in recoverable quantities.
Aquitard	A layer of material that confines the aquifer.
Biogas	A source of renewable energy that is produced by the biological breakdown of organic matter in the absence of oxygen.
Biological treatment	Covers a range of technologies to process residual municipal waste and separated food and garden organics into biogas or composts/soil enhancement products.
Catchment	The area drained by a stream, lake or other body of water.
Cumulative impact	A significant impact created by accumulation or successive additions of individual impacts, which may not themselves be significant.
Digestate	Solid material remaining after an anaerobic digestion process.
Digestor	A process unit that carries out anaerobic digestion.
Ecologically sustainable development	Development that meets the needs of the present without compromising the ability of future generations to meet their own needs.
Effluent	Wastewater, which has generally been treated in a plant to reduce its pollutant loading.
Emission	Release of material into the atmosphere (e.g. gas, dust).
Environmental management plan	A document setting out the management, control and monitoring measures to be implemented during construction (a construction environmental management plan) and /or operation (operational environmental management plan) of a development, to avoid or minimise any potential environmental impacts identified during the environmental assessment process.
Flora and fauna	Plants and animals.
Greenhouse gases	Gases that accumulate within the earth's atmosphere (primarily water vapour, carbon dioxide and methane) and contribute to global climatic change/global warming (the 'greenhouse effect').

Term	Definition
Greenhouse gases (scope 1 and 2)	According to the NGERS Scheme, Scope 1 emissions are direct greenhouse gas emissions from sources falling within the operational boundary of the assessment, from sources that are owned and/or operated by the organisation in question. Scope 1 emissions include direct carbon dioxide emissions from the combustion of stationary or transportation fuels (natural gas, coal, petrol and diesel) in boilers, furnaces, vehicles etc, and fugitive emissions of greenhouse gases from chemical processes, such as wastewater treatment and some product manufacturing. Scope 2 are indirect greenhouse gas emissions associated with electricity, heat or steam purchased by the organisation. These emissions physically occur at the facility where the electricity, heat or steam is generated, not necessarily at the Project site.
Hydrology	The science dealing with water on the land or under the surface, its properties and distribution.
Material recycling facility	A plant where kerbside recyclables are sorted into paper, metals and plastics using a combination of mechanical equipment and manual methods.
Material separation	Separation of a combined waste stream into different materials.
Methanogenic	Third stage of a Microorganisms that produce methane by the fermentation of simple organic carbon compounds under anaerobic conditions with the production of carbon dioxide.
Particulate	Comprising small particles, usually occurring in suspension.
pH	Measure of acidity (or alkalinity).
Preliminary hazard analysis	A hazard analysis is used to develop an understanding of the hazards and risks associated with an operation or facility and of the adequacy of safeguards. A preliminary hazard analysis occurs at an early stage of a project.
Preliminary risk screening	An assessment of the likelihood of risk, required under State Environmental Planning Policy No. 33 to determine the need for a Preliminary Hazard Analysis.
Preloading	The process of placing soil or sand over the site prior to construction of buildings/structures, to accelerate settlement of underlying soils and minimise the potential for future movement.
Project approval	An approval granted under Section 75J of the NSW *Environmental Planning and Assessment Act 1979*.
Putrescible	Capable of biological decomposition.
Sedimentation basin	A basin in which stormwater or wastewater is temporarily stored, so that suspended matter may sink to the bottom, before decanting of clarified water.
Sewer	A pipe or conduit for carrying of wastewater (sewage).
The proponent	WSN Environmental Solutions.
Threatened species	Species of animals or plants that are at risk of extinction (also known as 'endangered species') or becoming endangered within the next 25 years ('vulnerable species'), defined by the *Threatened Species Conservation Act 1995.*
Water balance	The difference between the water received by a site or facility and the water used by that facility.

List of Abbreviations

Abbreviation	Name
AADT	Average Annual Daily Traffic
ADC	Alternative Daily Cover
AHD	Australian Height Datum
ANSTO	Australian Nuclear Science and Technology Organisation
AS/NZS	Australian Standard/New Zealand Standard
AWS	Automatic Weather Station
AWT	Alternative Waste Technology
CAC	Community Advisory Committee
CBD	Central Business District
CEMP	Construction Environmental Management Plan
C&I	Commercial and Industrial
DA	Development Application
DCP	Development Control Plan
DECC	NSW Department of Environment and Climate Change (former)
DECCW	NSW Department of Environment, Climate Change and Water (incorporating the former NSW Environment Protection Authority/EPA)
DG	Director General
DLWC	NSW Department of Land and Water Conservation
DOP	Department of Planning
DS	Degree of Saturation
EA	Environmental Assessment
ECRTN	Environmental Criteria for Road Traffic Noise
ENCM	Environmental Noise Control Manual
EMP	Environmental Management Plan
EPA	Environment Protection Authority
EP&A Act	Environmental Planning and Assessment Act 1979
EPBC Act	Commonwealth Environment Protection and Biodiversity Conservation Act 1999
EPCM	Engineering Procurement and Construction Management
ESD	Ecologically Sustainable Development
GHG	Greenhouse Gas
GHD	GHD Pty Ltd
GLALC	Gamdamgara Local Aboriginal Land Council
INP	Industrial Noise Policy
LEP	Local Environmental Plan
LES	Local Environmental Study
LGA	Local Government Area
LHWRC	Lucas Heights Waste and Recycling Centre

LPG	Liquid Petroleum Gas
LOS	Level of Service
MDP	Metropolitan Development Program
MGB	Mobile Garbage Bin
MRF	Materials Recovery Facility
MRRP	Macarthur Resource Recovery Park
MSW	Municipal Solid Waste
NES	National Environmental Significance
NOx	Oxides of Nitrogen
NO2	Nitrogen Dioxide
NPW Act	National Parks and Wildlife Act 1974
NPWS	National Parks and Wildlife Service
NSW	New South Wales
OHS	Occupational Health and Safety
OEMP	Operational Environmental Management Plan
PCYC	Police and Community Youth Club
PEMP	Project Environmental Management Plan
PHA	Preliminary Hazard Analysis
POEO Act	Protection of the Environment Operations Act 1997
PPE	Personal Protective Equipment
PRP	Pollution Reduction Program
RBL	Rating Background Noise Level
REP	Regional Environmental Plan
RL	Reduced Level
SD	Statistical Division
SEPP	State Environmental Planning Policy
SOx	Oxides of Sulphur
SWL	Sound Power Levels
SREP	Sydney Regional Environmental Plan
SRT	Solids Retention Time
TSC Act	Threatened Species Conservation Act 1995
TSP	Total Suspended Particulates
VENM	Virgin Excavated Natural Materials
VOCs	Volatile Organic Compounds
WARR Act	Waste Avoidance and Resource Recovery Act 2001
WARRS	Waste Avoidance and Resource Recovery Strategy
WRC	Waste and Recycling Centre
WSN	WSN Environmental Solutions (the proponent)

Units of Measure

Length	mm	Millimetres
	m	Metres
	km	Kilometres
	RL	Reduced Level
Area	m^2	Square metres
	ha	Hectares
Volume	L	Litres
	v/v	Volume for volume
	m^3	Cubic metres
Mass	µg	Micrograms
	mg	Milligrams
	g	Grams
	kg	Kilogram
Noise	dB	Decibel – unit of sound measurement
	dB(A)	Unit used to measure 'A-weighted' sound pressure levels
	Hz	Hertz – unit used to measure frequency
	L_N	Noise exceedance level (N = percentage of sampling period)
Time	s	Seconds
Odour	OU	Odour Units
Miscellaneous	%	Percentage
	$	Australian dollars
	@	At
	ºC	Degrees Celsius
	º	Degree (angle between slope and horizontal)
	pH	Measure of acidity

Executive Summary

INTRODUCTION

WSN Environmental Solutions (WSN) proposes to develop an alternative waste technology (AWT) facility within the suburb of Lucas Heights in New South Wales (NSW). The project would use patented ArrowBio material separation and anaerobic digestion technology to process up to 100,000 tonnes of municipal solid waste per year.

The project would divert an estimated 70% of incoming material from landfill and thereby assist some of Sydney's councils to achieve the 2007 NSW Waste and Resource Recovery Strategy targets for diversion of waste from landfill.

This environmental assessment has been prepared by GHD Pty Ltd (GHD) in accordance with the requirements of Part 3A of the *Environmental Planning and Assessment Act 1979* (EP&A Act). An EA is required under Part 3A to support an application to the NSW Minister for Planning for approval of the project and to address the requirements of the Director-General of the NSW Department of Planning (the Director-General's Requirements) received on 23 August 2008.

In preparing this environmental assessment, consideration has been given to potential cumulative impacts associated with other development applications being prepared concurrently by the proponent for areas adjacent to the project site (a proposed truck parking area and relocation of the current mini-bike club).

THE PROPONENT

The project is being jointly proposed by Sutherland Shire Council and WSN Environmental Solutions (WSN). Although both Sutherland Shire Council and WSN are proponents for the purposes of the project application, the project would be constructed and operated by WSN (referred to in this document as 'the proponent').

WSN, formerly known as Waste Service NSW, is a NSW Government owned corporation and has been operating for over 35 years in the business of integrated waste management. WSN is Sydney's major provider of waste management and recycling services, handling over 1.7 million tonnes of putrescible waste annually. It owns and operates four major landfills, seven large waste transfer stations, and two materials recovery facilities. Sydney's first alternative waste technology facility for domestic waste, at Eastern Creek and an alternative waste technology facility at the Macarthur Resource Recovery Park (MRRP) (currently being commissioned), are also part of the WSN network.

Sutherland Shire Council is a local government organisation that manages the area of land called Sutherland Shire, an area of 370 km^2 stretching from the Georges River in the north, Deadman's Creek and Woronora Dam in the west, the Royal National Park in the south and the Pacific Ocean in the east. Sutherland Shire Council was established in 1906 and currently administers the Sutherland Shire on behalf of 215,000 residents and ratepayers, making it the second largest local government in NSW in terms of the number of people it serves.

THE PROJECT

The project involves construction and operation of an AWT facility using patented ArrowBio technology to process up to 100,000 tonnes per year of municipal solid waste.

The project would involve use of material separation technologies to recover recyclable materials from the municipal waste stream and anaerobic digestion. The AWT facility would produce:

- Stabilised sludge with market potential as soil conditioner;
- Biogas, which would be used to generate approximately 2 MW of electricity for use onsite and excess exported to the electricity grid; and
- Other residual material which would be disposed of to landfill.

It would divert an estimated 70% of the incoming material from landfill. The project would involve development of the following facilities onsite:

- Receival hall;
- Separation plant;
- Biological plant;
- Energy generation plant;
- Staff facilities;
- Laboratory;
- Weighbridge;
- Parking area for 72 cars and other vehicles;
- Internal road network; and
- Site access.

The technology is similar to that currently being commissioned at WSN's Ecolibrium^{TM} Mixed Waste Facility at the MRRP in south-west Sydney.

THE EA PROCESS

Part 3A of the EP&A Act applies to the project. The project is considered to meet the definition of a resource recovery or waste facility listed in Schedule 1 Clause 27(3) of *State Environmental Planning Policy 2005 (Major Projects)* as it will handle more than 75,000 tonnes per year of waste, and has a capital investment value of more than $30 million.

The NSW Minister for Planning is the approval authority for the project, and an environmental assessment (this document) is required to support the application for project approval in accordance with the requirements of the EP&A Act.

THE SITE

The site of the project is located in the suburb of Lucas Heights, within the Sutherland local government area (LGA), approximately 30 km south west of the Sydney city centre. It comprises Lot 111 of DP 1050235 and Lot 1 of DP 233333 and covers an area of 11 ha in the south east corner of the Lucas Heights Waste and Recycling Centre (LHWRC). It is bounded to the south by New

Illawarra Road, to the north by Little Forest Road and a biogas power plant operated by EDL, to the east by Little Forest Road, and to the west by rehabilitated landfill at the LHWRC.

The site is owned by the Australian Nuclear Science and Technology Organisation (ANSTO) and leased to the proponent. The site falls within the ANSTO 1.6 km radius exclusion zone that provides a safety buffer for ANSTO activities.

CONSULTATION

Statutory consultation was undertaken, according to the Director General's requirements, during preparation of the environmental assessment. Stakeholder comments were addressed in the environmental assessment. In addition, consultation with the community was undertaken to create awareness in the community about the project including information brochure distribution, media release, advertisements in local newspapers, discussions and presentations at Community Advisory Committee meetings and development of a project website.

NEED AND ALTERNATIVES

Proponent's objectives and business strategy

The proponent is committed to providing environmentally sound and sustainable waste management solutions that improve resource recovery, and reduce the quantities of waste being disposed to landfill. The objectives of the proponent are set out in the *Waste Recycling and Processing Corporation Act* 2001, which includes the requirements to protect the environment by managing waste in accordance with the principles of ecological sustainable development.

In addition, the project is a strategic response aimed at implementing the key objectives of the NSW Waste Avoidance and Resource Recovery Strategy (WARRS) 2007, which contains four operating principles including:

- Avoiding and preventing waste;
- Increased use of renewable and recovered materials;
- Reducing toxicity in products and materials; and
- Reducing litter and illegal dumping.

The project would divert valuable resources from landfill and would meet the proponent's objectives and business strategy.

Strategic planning drivers

The project is consistent with an increasing focus on sustainable waste management. The project would assist councils who use it meet the objectives of the *Waste Avoidance and Resource Recovery Act 2001* and targets for resource recovery set by the NSW Waste Avoidance and Resource Recovery Strategy 2007, including the 66% resource recovery target for municipal solid waste. It would also meet the aims of the Sydney Metropolitan Strategy 2005.

As well as meeting State targets for waste management, the proponent forecasts that the community will demand ongoing improvement in waste management, and higher standards of environmental performance, sustainability and resource recovery. The project would satisfy community expectations for improved waste management practices.

The project is also consistent with the sustainability objectives of the Sutherland Shire Local Environmental Plan 2006 which includes emphasis on the principles of ecologically sustainable development.

Demand

The proponent has contracts to receive approximately 65,000 tonnes per annum of municipal solid waste from Bankstown and Parramatta Council. This requires an AWT facility to be built and operating by 2013. This timeframe can be achieved by obtaining environmental approvals by late 2009 and building the proposed facility at the LHWRC, which could take 2-3 years to complete.

Alternative locations

The proponent has identified other locations within the LHWRC that could also be used for siting an AWT facility. However the proposed site is relatively far from existing residential areas and has good proximity to major roads. In addition, the site is able to accommodate additional AWT infrastructure if demand increases, noting that any additional future AWT infrastructure would be subject to a separate development application and approvals process.

Technology selection

The proponent undertook its own review of alternative waste technologies before commencing this project. The conclusion was that the best technical and commercial solution was to utilise the ArrowBio technology that is currently being implemented at the MRRP, as the technology was judged to be suitable for treating the types of waste to be received at the LHWRC, and the design and construction of this facility could be optimised from experience gained during building and commissioning of the MRRP.

ENVIRONMENTAL ASSESSMENT

Waste management

The majority of construction waste would be reused on-site, disposed of at the adjacent landfill, or transported from the site to nearby re-processors and recyclers. Construction activities at the site are not expected to impact significantly on the waste management operations and waste minimisation goals of the region.

Waste generated during operation of the project would be reused and recycled where possible. The remaining waste would be disposed of at the adjacent landfill. The project would provide high levels of resource recovery and diversion of waste from landfill.

Operation of the project is expected to assist councils to reach their waste minimisation goals by diverting up to 70% of incoming municipal solid waste from landfill.

Soil and water

Construction impacts would result in a disturbance of soils, as cut and fill methods of levelling would be undertaken and some shallow excavation would be required. As a result, there is the potential for sediment movement.

The project is not expected to have any acid sulphate soil impacts or impacts on local salinity. The project is also designed to minimise the likelihood of contamination of soil and water. Any potential contamination would be managed as part of the environmental management plans that would be

developed for the project. This includes development of an asbestos management protocol during earthworks.

During the operational phase, impervious surfaces have the potential to result in changed storm water runoff characteristics.

One additional groundwater monitoring bore would be installed downstream of the AWT facility and included in the groundwater monitoring program for the site. Existing groundwater monitoring would continue as part of the LHWRC monitoring program.

Potential impacts on water would be mitigated by the water management features of the design, These include site grading and channelling of stormwater away from active construction zones and unsealed areas, early construction of all weather access roads and hardstand areas, and the use of sedimentation dams during construction works, A permanent stormwater collection dam and first flush dam would be implemented during the operational phase of the project.

Process water would be treated in an on-site wastewater treatment plant. Treated process water would be stored in a process water dam on the site, which would have a high permeability liner system to protect underlying groundwater.

The resulting impacts of the project on surface water and groundwater quality would be minimal.

Air quality and odour

Construction of the project has the potential to result in minor air quality impacts at various times (e.g. dust disturbance). Impacts on local air quality would depend on equipment usage and local weather conditions. Potential impacts would be managed by implementing environmental management measures such as watering of unsealed areas, as outlined by the construction environmental management plan.

Whilst the facility is a potential source of odour, off-site odour levels are expected to be minimal, and the current amenity of existing developments in the area should not be altered by site operations.

The design of the project includes a number of measures to minimise odour and air quality impacts. These include partial enclosure of the receival hall and processing hall, and deodorisation of air prior to discharge, using a treatment system such as ozone injection.

None of the potential odour and air quality impacts are likely to affect local amenity in residential or commercial areas due to the distance from such receivers.

Traffic and transport

During construction, additional traffic movements would occur for delivery of construction materials and site construction personnel. All vehicles would access the site via a new access off Little Forest Road. Off-street parking would be provided on site for construction workers. The impact of the construction traffic on the road network surrounding the site would be temporary and would be limited to the anticipated 18 month construction period. The traffic assessment concluded that the additional traffic demand on the road network serving the site would be minor.

The project is located on a sub-arterial road, which provides easy access to the arterial road network. Although the project would result in additional traffic visiting the site, the traffic would access the site via the arterial road network and would be accommodated by the existing external road network and intersections.

Traffic generation during operation of the AWT facility pre-2025 (when AWT residual is deposited at the LHWRC landfill) is expected to be approximately 216 vehicles per day, 18 vehicles per hour (two-way) during AM peak periods and 22 vehicles per hour (two-way) during PM peak periods.

Traffic generation during operation of the AWT facility post-2025 (when AWT residual is deposited off-site) is expected to be approximately 230 vehicles per day, 20 vehicles per hour (two-way) during AM peak periods and 24 vehicles per hour (two-way) during PM peak periods.

The additional traffic entering all intersections as a result of the project is considered to be low in comparison to the background traffic levels, which were assumed in the assessment to increase by 2% per annum until 2018 due to natural growth. The traffic impact assessment concluded that the project would not result in any notable changes in external intersection operating characteristics and that the traffic increases can be accommodated by the internal road network and internal intersections.

Access and egress to the proposed AWT facility, proposed truck parking area (separate development application), the relocated PCYC and EDL site would be provided via a new internal access road and intersections. The traffic assessment found that these proposed arrangements would accommodate traffic to and from these areas without compromising on accessibility.

A total of 72 parking spaces would be included at the site, which exceeds Sutherland Shire Council Development Control Plan 2006 requirements for 'industrial facilities' and would accommodate all staff at shift changes and some visitor parking.

Greenhouse gas

Considering scope 1 and scope 2 emissions, the project is expected to result in a net annual greenhouse gas reduction of 3,320 tonnes CO_2-e, which is approximately 0.002% of the state's total emissions in 2007. Hence the project would have a positive environmental impact in terms of greenhouse gas and climate change.

Biodiversity

The site has previously been used for at least 20 years by the Police and Community Youth Club (PCYC) mini-bike club, resulting in significant land degradation. The project would result in the clearance of approximately 1.43 ha of remnant vegetation, including vegetation that would be impacted by the project footprint and vegetation that would need to be removed to satisfy Asset Protection Zone requirements.

The project footprint was selected to maximise use of existing cleared and disturbed areas, and permit much of the existing vegetation on the eastern and southern to remain undisturbed. This would assist in screening the plant from surrounding areas. Vegetation that would be removed consists of weed-infested areas, open grassed areas and disturbed patches of the Sydney Sandstone Ridgetop Woodland vegetation community. This community is not listed as threatened under the *Threatened Species Conservation Act 1995* (TSC Act) and/or *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Although the site does provide some connectivity value, the assessment identified more suitable and substantial vegetated areas adjoining the site, which would provide a 'stepping stone' for mobile fauna species.

The potential for any adverse impacts on threatened fauna and flora species is considered to be low given the highly modified nature of the site, the fact that the project maximises use of disturbed areas, and the large area of quality habitat in the general vicinity of the site.

An assessment of the likely impacts of the project on threatened species and endangered ecological communities concluded that the project is unlikely to have a significant impact on threatened species, endangered ecological communities or their habitat, given that the footprint of the project is located in an area that is already disturbed, and that no threatened species or communities have been recorded on site.

Hazards

A preliminary hazard analysis (PHA) was undertaken for the project. This concluded that the SEPP 33 threshold screening value for dangerous goods is not exceeded by any of the proposed dangerous goods to be stored. Additionally, the transportation screening thresholds would not be exceeded by any of the dangerous goods.

The qualitative risk assessment/hazard identification study identified hazard scenarios, and concluded that only one scenario presented an unacceptable risk – fire or explosion of biogas – but the PHA found that this scenario does not exceed risk criteria and operation and engineering controls would minimise the risk to as low as reasonably practical.

Furthermore, implementing a comprehensive safety management system would ensure that hazards associated with the site are identified and managed, so that all activities are undertaken in a safe manner.

A bushfire assessment was also undertaken, which concluded that the project would meet the aims and objectives of Planning for Bushfire Protection (RFS 2006) and that reasonable overall bush fire protection outcomes would be achieved by implementing appropriate mitigation measures.

Noise

Potential noise impacts of the project during construction and operation are expected to be minimal and would comply with design goals at nearby sensitive receivers. The site is quite distant from residential areas.

Social and economic

The site was previously used by the PCYC for the mini-bike club. Development of the project means that this use of the site would no longer be possible. However, in accordance with the existing masterplan, this activity is being relocated to another area in the LHWRC site. This is expected to occur in mid to late 2009.

The project would generate employment during both construction and operation - an estimated construction workforce of 30-50 people and approximately 69 staff during operation, over three shifts.

The potential for negative amenity impacts would be significantly reduced by the implementation of appropriate design features and stringent environmental management controls guided by the construction and operation environmental management plans.

Potential positive impacts of the project include:

- Cost effectiveness;

- Employment;
- Generation of income;
- Supply of goods and services;
- Generation of 'green' energy; and
- Diversion of waste from landfill.

Economic costs associated with undertaking the proposal include:

- Capital cost;
- Infrastructure costs; and
- Environmental monitoring.

Heritage

No items or places of heritage significance were identified and the heritage assessment concluded that the project would not impact on Aboriginal or historic cultural heritage.

Visual amenity

The construction of the project would generate visual impacts during the 18 month construction period. These impacts would be limited to motorists traveling along New Illawarra Road. During construction works, exposed soils would be visible, along with machinery and equipment required for construction, and the buildings under construction. These impacts would be temporary and limited to the construction period.

A proposed minimum 10 m landscape/screening zone comprising a combination of vegetation enhancement, new vegetation and retainment of existing vegetation, will help to reduce the potential visual impact of the project in the mid to long term (5 years plus). The buildings would be set back approximately 35 m from the site boundary, with an additional 10-15 m of land before the verge of New Illawarra Road. This setback consists of 25 m wide asset protection zones as recommended in the bushfire assessment and a 10 m wide landscape zone. The setback, and the retention of existing vegetation where possible, would significantly reduce the visibility of new structures from New Illawarra Road.

The project would not be visible from residential areas or other significant viewpoints. The nearest residential areas are located over 2 km from the site. Given the relatively non-sensitive nature of the potential views of the project (passing motorists) and the fact there are other industrial/scientific and waste facilities in the surrounding area, the visual impact of the project is not considered to be significant.

PROJECT JUSTIFICATION AND CONCLUSIONS

The justification for the project is based on a number of factors:

- The project is consistent with the strategic direction for waste management in NSW and the proponent's corporate objectives and strategic drivers;
- The project meets a need for alternative waste technologies needed to increase resource recovery from municipal waste and divert valuable materials from landfill;

- The project would assist in satisfying regional demand for more sustainable waste management facilities;
- The project would enable councils to reduce their long term waste management costs and reduce greenhouse gas emissions associated with landfilling their wastes;
- The site is suitable for the proposed use; and
- The project uses innovative technology already operating locally at a similar scale.

This environmental assessment has considered the potential impacts of the proposal to construct and operate an alternative waste technology facility adjacent to the LHWRC at Lucas Heights.

The environmental assessment has examined a number of key issues surrounding the project, including identification of potential negative impacts. There are no major environmental issues with this project. The main potential impacts that need to be managed are:

- Potential air quality issues such as dust generation associated with construction of the project;
- Noise-related impacts associated with construction and operation of the project;
- Hazards and bushfire risks;
- Visibility of the project to passing traffic and neighbouring sites; and
- Construction impacts (traffic generation, soil and water management etc).

The environmental assessment concludes that many of the potential issues identified (including air and noise issues) would be effectively managed through project design features. To manage other issues, and in some cases eliminate them completely, a number of mitigation and management measures (commitments) would be implemented.

Commitments made by the proponent include the preparation of a construction environmental management and operational environmental management plan to ensure that the mitigation and management measures are developed, implemented and monitored. These plans would also ensure compliance with relevant legislation and any conditions of approval.

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PART A
Introduction and Context

1. Introduction

1.1 Overview

WSN Environmental Solutions (WSN) proposes to develop an alternative waste technology (AWT) facility within the suburb of Lucas Heights in New South Wales (NSW) (referred to as 'the project' for the purposes of this assessment). The facility would use patented ArrowBio material separation and anaerobic digestion technology to process up to 100,000 tonnes of municipal solid waste per year.

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1.2 The proponents

The project is being jointly proposed by Sutherland Shire Council and WSN – the proponents. Although both Sutherland Shire Council and WSN are proponents for the purposes of the project application, the project would be constructed and operated by WSN (referred to in this document as 'the proponent').

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WSN is committed to providing environmentally sound and sustainable waste management solutions that improve resource recovery, and reduce the quantities of waste being disposed to landfill. WSN will achieve this using appropriate alternative waste treatment processes and simple separation solutions such as material recycling facilities.

Sutherland Shire Council is a local government organisation that manages the area of land called Sutherland Shire, an area of 370 km^2 stretching from the Georges River in the north, Deadman's Creek and Woronora Dam in the west, the Royal National Park in the south and the Pacific Ocean in the east. Sutherland Shire Council was established in 1906 and currently administers the Sutherland

Shire on behalf of 215,000 residents and ratepayers, making it the second largest local government in NSW in terms of the number of people it serves.

These facilities divert valuable resources from landfill, allowing the maximum recovery and recycling of resources from the waste stream.

Landfilling of putrescible waste is the dominant method for waste disposal in Australia and worldwide. It is now widely recognised that this method of waste disposal, particularly of putrescible materials, can result in significant environmental impacts that need to be managed in the medium to long term.

WSN is transforming its business from a predominantly landfill operation for putrescible waste to an environmentally sound and sustainable business platform, using appropriate engineering solutions such as materials recycling facilities and AWT facilities.

1.3 The site

The site of the project is located in the suburb of Lucas Heights, within the Sutherland local government area, approximately 30 km south west of the Sydney city centre (refer chapter 3 for a detailed site description). Figure 1-1 shows the location of the site.

Figure 1-1 Location of the site

The site comprises Lot 111 of DP 1050235 and Lot 1 of DP 233333 and covers an area of 11 ha in the south east corner of the Lucas Heights Waste and Recycling Centre (LHWRC). It is bounded to

the south by New Illawarra Road, to the north by Little Forest Road and a biogas power plant operated by EDL, to the east by Little Forest Road, and to the west by rehabilitated landfill at the LHWRC.

The site is owned by the Australian Nuclear Science and Technology Organisation (ANSTO) and leased to the proponent. It falls within the ANSTO 1.6 km radius exclusion zone that provides a safety buffer for ANSTO activities.

1.4 Key features of the project

The project involves construction and operation of an AWT facility using patented ArrowBio technology to process up to 100,000 tonnes per year of municipal solid waste. The project life would be 20 years.

The project would involve use of material separation technologies to recover recyclable materials from the municipal waste stream and anaerobic digestion. The facility would produce:

- Stabilised sludge with market potential as soil conditioner;
- Biogas, which would be used to generate approximately 2 MW of electricity for use onsite and excess exported to the electricity grid; and
- Other residual material which would be disposed of to landfill.

It would divert an estimated 70% of the incoming material from landfill. The project would involve development of the following facilities onsite:

- Receival hall;
- Separation plant;
- Biological plant;
- Energy generation plant;
- Staff facilities;
- Laboratory;
- Weighbridge;
- Parking area for 72 cars and other vehicles;
- Internal road network; and
- Site access.

The technology is similar to that currently being commissioned at WSN's Ecolibrium™ Mixed Waste Facility at the MRRP in south west Sydney.

1.5 The environmental assessment

1.5.1 Summary of approval requirements

Part 3A of the EP&A Act applies to the project. The project is considered to meet the definition of a resource recovery or waste facility listed in Schedule 1 Clause 27(3) of *State Environmental*

Planning Policy 2005 (Major Projects) as it will handle more than 75,000 tonnes per year of waste, and has a capital investment value of more than $30 million.

The NSW Minister for Planning is the approval authority for the project, and an environmental assessment (this document) is required to support the application for project approval in accordance with the requirements of the EP&A Act.

1.5.2 Purpose and scope of the environmental assessment

The environmental assessment supports an application for project approval for the project from the Minister for Planning under Part 3A of the EP&A Act. It has been prepared in accordance with the EP&A Act and the Director-General's requirements (included in Appendix A). The environmental assessment provides:

- Information on the project, including the project need and alternatives considered;
- An assessment of the potential key environmental impacts of the project identified by the Director General's requirements; and
- The proponent's commitments in terms of measures to minimise and manage potential environmental impacts.

The environmental assessment is structured as follows:

Volume 1 – Environmental Assessment (Main Report)

Volume 1 includes:

- Part A Introduction and context – provides an introduction to the environmental assessment (chapter 1); information on the assessment requirements under relevant legislation and environmental planning instruments (chapter 2); a description of the location and existing environmental features of the site and surrounds (chapter 3); and a summary of the consultation that occurred during the assessment process and planned consultation (chapter 4);
- Part B Information on the project – describes the need for the project and the alternatives considered as part of the project development process (chapter 5); and includes a description of the project (chapter 6);
- Part C Environmental assessment – based on the project described in Part B, this part includes an environmental risk analysis identifying key potential environmental issues (chapter 7); and describes the results of the assessment of key environmental issues identified by the Director General's requirements (chapters 8-18);
- Part D Conclusion – for the project described in Part B, and considering the results of the assessment summarised in Part C, this part provides a statement of commitments made by the proponent in relation to mitigation, management and monitoring of potential environmental impacts (chapter 19) and provides the project justification and conclusion to the environmental assessment (chapter 21).

Volume 2 – Appendices

Volume 2 contains the specialist technical/background reports prepared as part of the environmental assessment process and supporting planning correspondence:

- Appendix A – Director-General's Requirements (NSW Department of Planning)

- Appendix B – Air Quality Assessment (PAEHolmes)
- Appendix C – Traffic Impact Assessment (Cardno Eppell Olsen)
- Appendix D – Greenhouse Gas Assessment (GHD)
- Appendix E – Flora and Fauna Assessment (Eco Logical Australia Pty Ltd)
- Appendix F – Preliminary Hazard Assessment (GHD)
- Appendix G – Bushfire Assessment (Eco Logical Australia Pty Ltd)
- Appendix H – Noise Assessment (Heggies Pty Ltd)
- Appendix I – Heritage Assessment (AMBS)
- Appendix J – Landscape and Visual Assessment (MUSEcape Pty Ltd)
- Appendix K – Minister's Clause 6 (NSW Department of Planning)
- Appendix L – Commonwealth Referral (Department of Environment, Water, Heritage and the Arts)
- Appendix M – Waste Classification Report (Environmental Earth Sciences)
- Appendix N – Letter from Sutherland Shire Council

2. The Environmental Assessment Process

2.1 Approval requirements and the application of Part 3A

2.1.1 Permissibility of the project

The Sutherland Shire Local Environmental Plan 2006 (the LEP) applies to the site. The site falls within Zone 12 – Special Uses, with waste recycling indicated as the use of the land on the LEP maps.

The objectives of this zone as prescribed by Clause 11 of the LEP are:

> *'(a) to provide for a range of community facilities and services to meet the needs of the community,*
>
> *(b) to allow for development by public authorities,*
>
> *(c) to provide for a variety of development in accordance with local educational, religious or similar community demand,*
>
> *(d) to ensure the scale and nature of new development is compatible with the surrounding urban form and natural setting of the zone,*
>
> *(e) to recognise critical requirements, as identified by the Commonwealth, relating to the use of Commonwealth land for defence purposes.'*

The development consent provisions for Zone 12 are provided below.

> *'2 Development allowed without consent*
>
> *Development for the purpose of:*
>
> *bush fire hazard reduction work, drainage.*
>
> *Exempt development.*
>
> *3 Development allowed only with consent*
>
> *Development (other than development included in item 2) for the purpose of:*
>
> *the particular use indicated in respect of land by lettering on the map, advertisements, car parks, childcare centres, community facilities, educational establishments, public hospitals, recreation areas, roads, utility installations (except for gas holders or generating works), waste recycling and management centres.*
>
> *Demolition not included in item 2.*
>
> *4 Prohibited development*
>
> *Any development not included in item 2 or 3.*

As the project is consistent with the use indicated in respect of the land by the lettering on the LEP map, it would be permissible with consent.

2.1.2 Application of Part 3A of the Environmental Planning and Assessment Act 1979

Part 3A of the EP&A Act establishes an assessment and approval regime for development that is declared to be a Part 3A project by either a State Environmental Planning Policy or Ministerial Order (section 75B).

According to section 75D(1) the Minister for Planning is the approval authority for Part 3A projects.

The proponent is seeking project approval from the Minister for Planning for the project under Part 3A of the EP&A Act. Part 3A applies, because the project meets the definitions of a Part 3A project included within Schedule 1 of the *State Environmental Planning Policy (Major Projects) 2005* (the Major Projects SEPP).

The following Part 3A project definition is included in Schedule 1, Clause 27(3):

> *'(3) Development for the purpose of resource recovery or recycling facilities that handle more than 75,000 tonnes per year of waste or have a capital investment value of more than $30 million.'*

The project meets this definition as it would handle approximately 100,000 tonnes per annum of municipal solid waste and have a capital investment value of more than $60 million.

The application of Part 3A was confirmed by a Minister's clause 6 opinion provided by the Director General of the Department of Planning on 13 May 2008 (refer Appendix K).

Consideration is given to relevant State environmental planning policies and other relevant legislation in Section 2.3.

2.2 Environmental assessment requirements

The proponent was notified of the requirements for the environmental assessment of the project (the Director General's requirements) on 23 August 2008. This environmental assessment addresses these requirements. A copy of the requirements is included in Appendix A. The assessment requirements, together with the section of this document that addresses these requirements, are listed in Table 2-1.

Table 2-1 Summary of the Director General's requirements

Category	Summary of requirement	Document reference
General requirements	Executive summary	Executive summary
	Description of the Lucas Heights Waste and Recycling Centre	Chapter 3
	Project description	Chapter 6
	Environmental risk assessment	Chapter 7
	Assessment of the key issues specified below	Part C
	Statement of commitments	Chapter 20
	Conclusion justifying the project	Chapter 21
	Signed statement from the author	Front of document

Category	Summary of requirement	Document reference
Key issues	Waste management	Chapter 8
	Soil and water	Chapter 9
	Odour	Chapter 10
	Traffic and transport	Chapter 11
	Greenhouse gas	Chapter 12
	Biodiversity	Chapter 13
	Hazards	Chapter 14
	Air quality	Chapter 10
	Noise	Chapter 15
	Social and economic	Chapter 16
	Heritage	Chapter 17
	Visual	Chapter 18
Consultation	Need to consult with nominated agencies	Chapter 4

2.3 Other relevant environmental planning instruments and legislation

2.3.1 State environmental planning policies

State Environmental Planning Policy 33 - Hazardous and Offensive Development

SEPP 33 aims to identify proposed developments that have the potential for significant offsite impacts, in terms of risk and/or offence. If a development is likely to result in significant risks and/or offences to offsite receptors (for example as a result of storage of significant quantities of dangerous goods, noise and odour impacts), it is considered to be a hazardous and/or offensive development.

SEPP 33 requires that, in determining whether a development is hazardous or offensive, consideration must be given to current circulars or guidelines. The guidelines relevant to SEPP 33 is 'Applying SEPP 33 – Hazardous and Offensive Development Guidelines' (DoP, 1994).

Hazardous Developments (Risk Impacts)

SEPP 33 defines a 'potentially hazardous industry' as 'a development for the purposes of any industry which, if the development were to operate without employing any measures (including, for example, isolation from existing or likely future development on other land) to reduce or minimise its impact in the locality or on the existing or likely future development on other land, would pose a significant risk in relation to the locality: (a) to human health, life or property, or (b) to the biophysical environment, and includes a hazardous industry and a hazardous storage establishment.'

A potentially hazardous industry is one that would impose significant risks if it were to operate without measures to mitigate risk. To determine if a development is potentially hazardous and a preliminary hazard analysis is required, a preliminary risk screening is undertaken in accordance

with DoP's guidelines. A preliminary hazard analysis was undertaken for the project, and further information is provided in chapter 14.

Offensive Developments (Offence Impacts)

SEPP 33 defines a 'potentially offensive industry' as 'a development for the purposes of an industry which, if the development were to operate without employing any measures (including, for example, isolation from existing or likely future development on other land) to reduce or minimise its impact in the locality or on the existing or likely future development on other land, would emit a polluting discharge (including for example, noise) in a manner which would have a significant adverse impact in the locality or on the existing or likely future development on other land, and includes an offensive industry and an offensive storage establishment.'

A potentially offensive industry is one that would emit a polluting discharge in a manner that would have a significant adverse impact, if it were to operate without measures to mitigate these impacts.

As the project requires an environmental protection licence from the Department of Environment, Climate Change and Water (DECCW) under the *Protection of the Environment Operations Act 1997* (POEO Act) it is a 'potentially offensive development'. However, the level of offence would not be considered significant if the licence can be obtained. It is considered that an environmental protection licence can be obtained for the project, and therefore it is not an offensive industry as defined by SEPP 33.

Following consideration of potential air, odour, noise and water impacts (refer chapters 10, 15, and 9 respectively) it is concluded that, subject to the implementation of recommended mitigation measures, the project would not emit a polluting discharge leading to significant adverse impacts on the locality.

State Environmental Planning Policy No. 44 – Koala Habitat Protection

SEPP 44 aims to encourage the proper conservation and management of areas of natural vegetation that provide habitat for koalas in order to ensure a permanent free-living population over their present range and reverse the current trend of koala population decline.

SEPP 44 applies to local government areas listed in Schedule 1. The Sutherland LGA is not included in Schedule 1, therefore consideration of the potential application of SEPP 44 is not required. However, the biodiversity assessment (refer Chapter 13 and Appendix E) considers the potential impact of the project on koalas.

State Environmental Planning Policy No. 55 – Remediation of Land

SEPP 55 aims to provide a Statewide planning approach to the remediation of contaminated land, and in particular, promotes the remediation of contaminated land for the purpose of reducing risk of harm to human health or any other aspect of the environment.

SEPP 55 restricts consent authorities from issuing consent for development on land that may be contaminated.

The site has no history of use for landfilling and land contamination was not discovered in the area of the proposed AWT during the preparation of the 'Lucas Heights 1, Lucas Heights Waste Management Recycling Centre, Lucas Heights Conservation Area Environmental Impact Statement' (NEC 1999).

2.3.2 Relevant NSW legislation

Protection of the Environment Operations Act 1997

Activities required to obtain a licence under the POEO Act are detailed in Schedule 1 of the Act. The project satisfies the definitions under clause 34 (resource recovery). As a result, an environment protection license under the POEO Act will be required.

National Parks and Wildlife Act 1974

The *National Parks and Wildlife Act 1974* provides the basis for the establishment, preservation and management of national parks, historic sites and certain other areas, and the protection of certain fauna, native plants and Aboriginal relics.

A cultural heritage assessment was undertaken for the project (refer chapter 17). No sites of Aboriginal heritage significance were identified.

Threatened Species Conservation Act 1995

The potential impact of the project on matters covered by the *Threatened Species Conservation Act 1995* (TSC Act) is considered in chapter 13. The biodiversity assessment concluded that the project is unlikely to have a significant impact on threatened species or endangered ecological communities.

Heritage Act 1977

The purpose of the *Heritage Act 1977* (Heritage Act) is to protect and conserve non-Aboriginal cultural heritage, including scheduled heritage items, sites and relics.

The heritage assessment (chapter 17) did not identify any items on the site.

2.3.3 Commonwealth Environment Protection and Biodiversity Conservation Act 1999

The Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) prescribes the Commonwealth's role in environmental assessment, biodiversity conservation and the management of protected areas and species, populations and communities and heritage items.

The approval of the Commonwealth is required for:

- An action which has, will have or is likely to have a significant impact on 'matters of national environmental significance';
- An action by the Commonwealth or a Commonwealth agency which has, will have or is likely to have a significant impact on the environment;
- An action on Commonwealth land which has, will have or is likely to have a significant impact on the environment; or
- An action which has, will have or is likely to have a significant impact on the environment on Commonwealth land, no matter where it is to be carried out.

Matters of national environmental significance

Matters of national environmental significance are considered below:

- Listed threatened species and communities - The flora and fauna assessment (chapter 13) found that the project would be unlikely to have a significant impact on any threatened species listed

under the EPBC Act or their habitat, provided the mitigation measures identified are implemented.

- Listed migratory species - The project is not expected to have an impact on listed migratory species.
- Ramsar wetlands of international importance - The site is approximately 16 km west of the Towra Point Nature Reserve and lies within its catchment. The catchment of the proposed site drains to Bardens Creek to the north, which in turn drains to the Georges River. The project is not expected to result in any impacts to this wetland.
- The Commonwealth marine environment - No Commonwealth marine areas would be affected by the project.
- World Heritage properties - There are no world heritage properties in the vicinity of the site.
- National Heritage places - The site is approximately 4 km north west of the Royal National Park and 8.5 km from the Garawarra State Conservation Area (the closest national heritage places to the site. The project will not impact on the value of these places.
- Nuclear actions - The project would not involve nuclear action as defined under the EPBC Act.

Commonwealth land

As the Commonwealth Government owns the site, the project has the potential to impact on Commonwealth land. A referral (EPBC 2008/4357) was made to the Commonwealth Department of Environment, Water, Heritage and the Arts, to seek Commonwealth advice as to whether the project is a controlled action and approval from the Commonwealth Minister for the Environment, Heritage and the Arts is required. The referral concluded that the project would not result in a significant impact to the environment of Commonwealth land, and as a result, the project should not be considered a controlled action. On 5 December 2008, the Department confirmed that the project is not a controlled action, and that Commonwealth approval would not be required (refer Appendix L).

3. Site Description

3.1 Regional setting

The site of the project (referred to as 'the site' for the purposes of the environmental assessment) is located in the suburb of Lucas Heights, within the Sutherland local government area, approximately 30 km south west of the Sydney city centre (refer Figure 3-1).

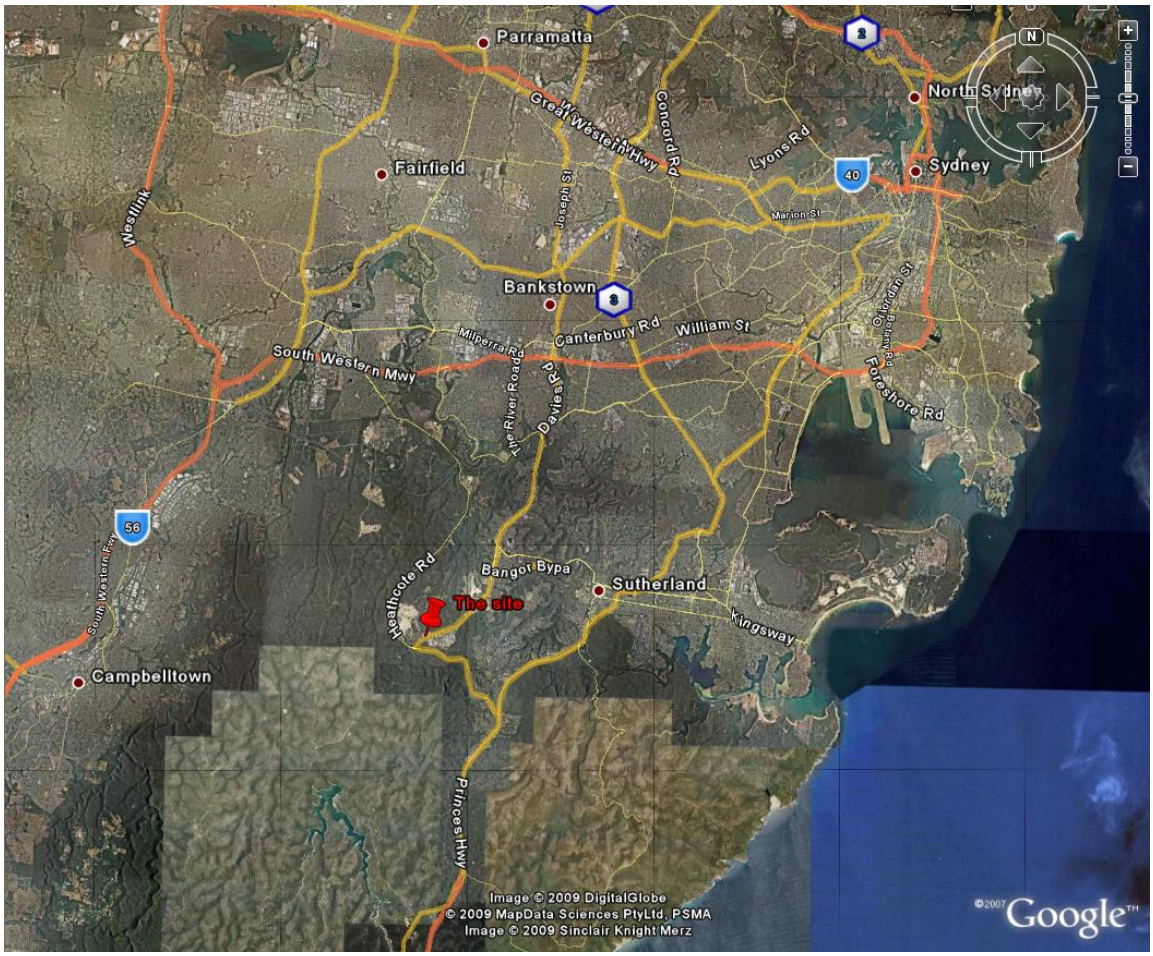


Figure 3-1 Regional setting

The Sydney Metropolitan Strategy ('City of Cities: A Plan for Sydney's Future') was released in 2005. The strategy arranges Sydney into ten subregions combining local government areas with similar issues and challenges. The Sutherland LGA falls within the South Subregion. The NSW Government placed the draft South Subregional Strategy, which forms part of the Metropolitan Strategy, on exhibition in November 2007.

The Subregional Strategy identifies that Sutherland is the second most populated LGA in NSW and covers an area of 334 km². It also notes that being the southern most LGA within the South Subregion, it is well connected to both Sydney and the Illawarra Region.

Major regional land uses in the vicinity of the site include:

- Waste processing - the LHWRC;
- Military - Holsworthy Military Reserve;
- Scientific - Australian Nuclear Science and Technology Organisation (ANSTO);
- Sporting - the Ridge Sports Complex at Barden Ridge; and
- Residential - suburbs of North Engadine and Barden Ridge.

3.2 Local setting

The site is shown on Figure 3-2. Access to the site is off New Illawarra Road to Little Forest Road. The site has access to several major roads, including New Illawarra Road, Heathcote Road and the M5 further to the north, which provides efficient access to the majority of the Sydney Metropolitan Region.

3.2.1 Zoning and property descriptions

The site comprises Lot 111 of DP 1050235 and Lot 1 of DP 233333, and covers an area of 11 ha in the south east corner of the LHWRC (as shown in Figure 3-3). It is bounded to the south by New Illawarra Road, to the north and east by Little Forest Road, and to the west by rehabilitated landfill at the LHWRC and a biogas power plant operated by EDL.

The site is owned by ANSTO and leased to the proponent. The site falls within ANSTO's 1.6 km radius exclusion zone, which provides a safety buffer for ANSTO activities.

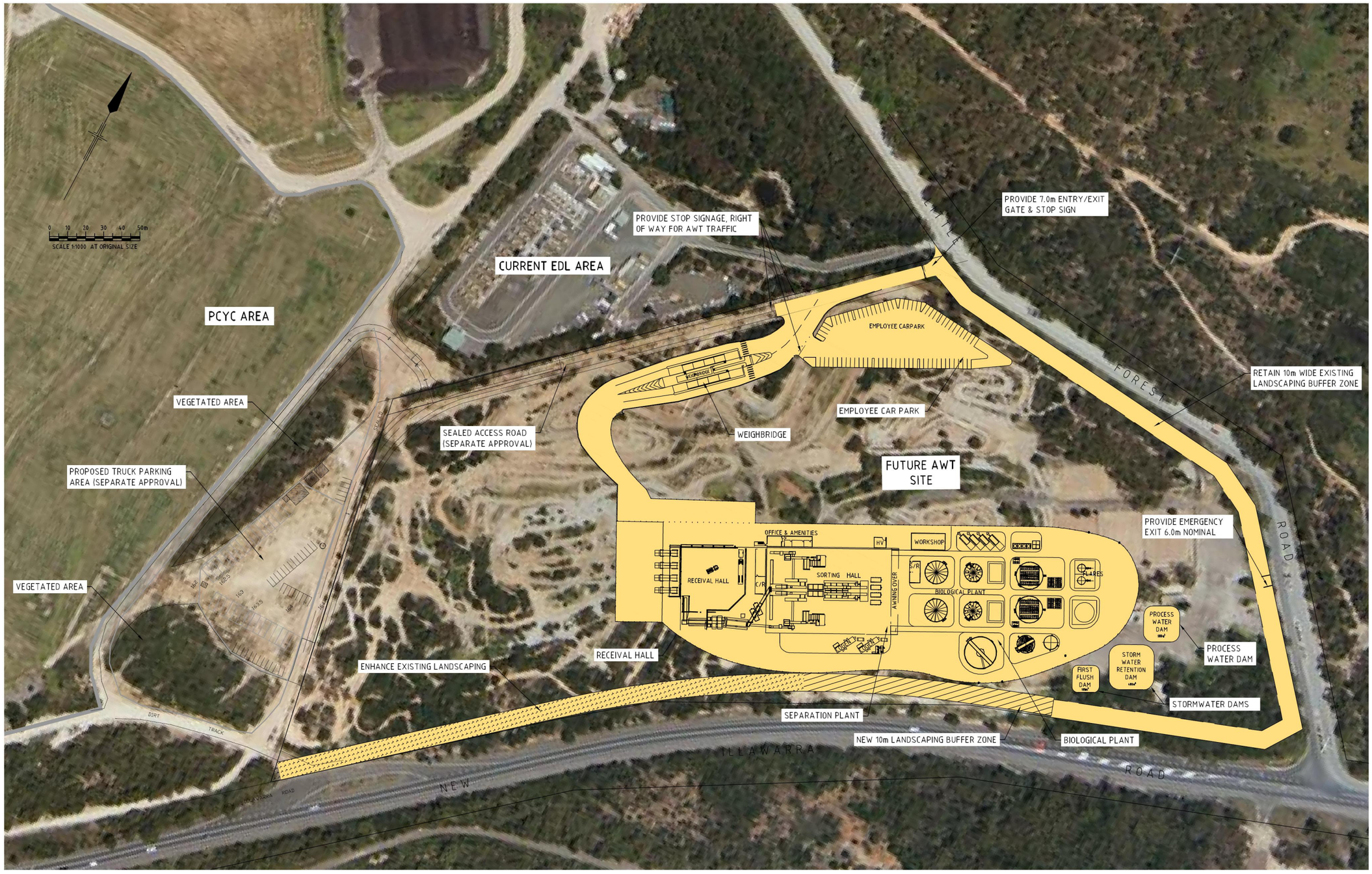


Figure 3-2 The site

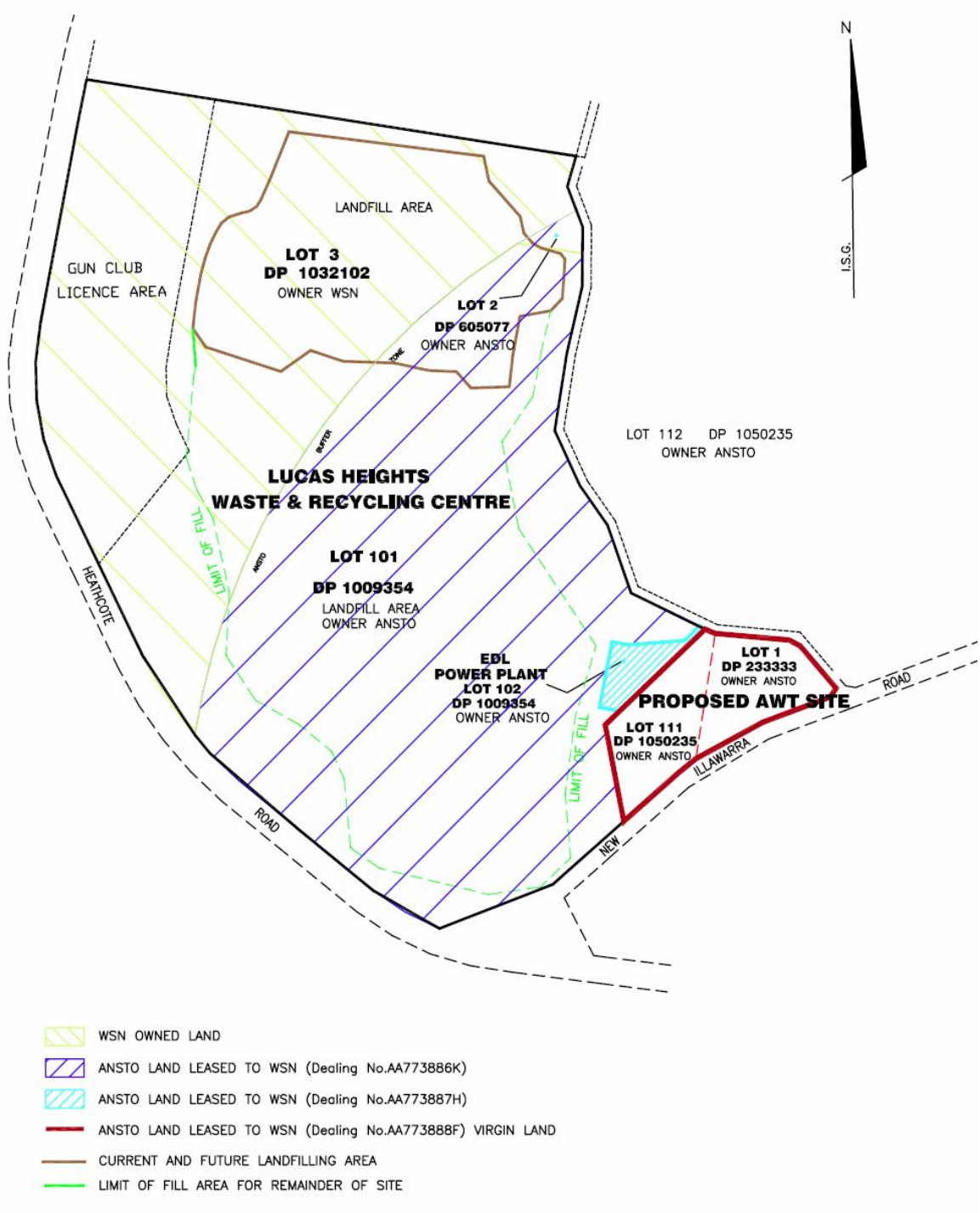


Figure 3-3 Site property boundaries

3.2.2 Surrounding land uses

As shown on Figure 3-4, the following land uses are located in the immediate vicinity of the site:

- The LHWRC (to the west);
- Bushland areas that form part of ANSTO's exclusion zone (to the north and south); and
- ANSTO's facilities (to the south on the opposite side of New Illawarra Road).

Land uses in the surrounding area include:

- Holsworthy Military Reserve (to the north, west and south);
- The Ridge Sports Complex, a major regional sporting facility being developed on the site of the former Lucas Heights Waste and Recycling Centre (approximately 2.5 km to the north east);
- Lucas Heights Conservation Area (approximately 2 km to the north west); and
- The suburbs of North Engadine (approximately 2 km to the east) and Barden Ridge (approximately 3 km to the north east).

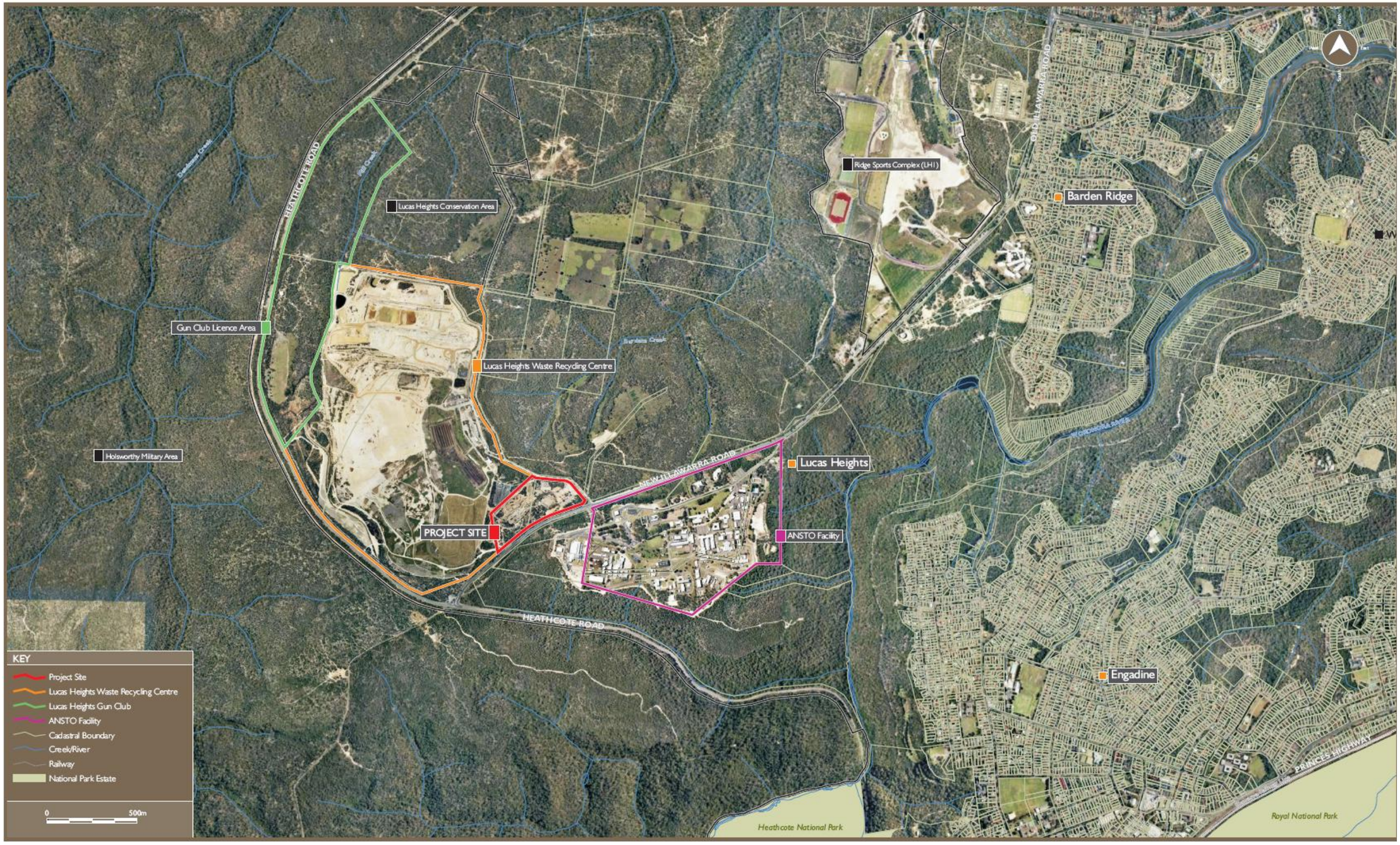


Figure 3-4 Surrounding land uses

3.3 Environmental context

3.3.1 Topography

The local region is characterised by gently undulating rises and low hills. The site slopes gently to the north east, with elevations ranging from 150 to 160 mAHD. To the north west of the site, two ridges run parallel to Heathcote Road and form a shallow valley in between. The ridges are higher to the south, forming the upper reaches to three creeks: Mill Creek, Bardens Creek and Lucas Heights 1 Creek (also known as Mill Creek Tributary and Pym's Creek). All three creeks flow in a northerly direction. Bardens Creek and Lucas Heights 1 Creek flow into Mill Creek, which in turn flows into the Georges River near Alfords Point and finally into Botany Bay. Mill Creek itself has a slope of 2% in the vicinity of the site.

3.3.2 Geology

The site is located on the dissected Hawkesbury sandstone of the Woronora Plateau, which was uplifted during the Triassic Period such that it now dips downwards in a northerly direction and forms part of the Sydney Basin.

The dominant surface geology is made up of Hawkesbury Sandstone, which is approximately 200 m thick in the Lucas Heights region. It is a medium to coarse grained sandstone and consists of a series of lenticular (and therefore laterally discontinuous) beds of quartz sandstones. The thickness of the individual beds varies up to a maximum of around 15 m with beds generally around 1.5 to 3 m thick. The sandstone formation dips in a northerly direction and contains two sets of tectonic joints, which control the drainage for Mill Creek and Bardens Creek.

Although the dominant lithology is Hawkesbury Sandstone, the formation also includes significant minor components of Wianamatta Shale and siltstone. The shales and siltstones generally occur in relatively thin units frequently interbedded with sandstones, but thicker units are present and are estimated to make up approximately 5% of the total thickness. The largest occurrence of shale, several metres thick, is in the Little Forest area, near the LHWRC.

3.3.3 Soils

The site is part of the Gymea Soil Landscape, with soils up to 150 cm deep. They are formed from sandstone and shale parent material, and consist of a surface layer of sand and subsurface layers of sandy clay and clay. The soils are highly permeable, with very low general fertility. Outcrops of Hawkesbury sandstone are found within the region. A small amount of sandstone bedrock is exposed within the site as a result of soil erosion.

3.3.4 Hydrology and drainage

The site lies within the catchment of Bardens Creek, and drains toward the north east. Bardens Creek is a semi-permanent tributary of Mill Creek, which originates within the LHWRC and flows north into the Georges River. Nearby watercourses include Deadmans Creek (approximately two kilometres west of the site), and Williams Creek (3.3 km to the west), which are also tributaries of the Georges River. To the south of the site, on the other side of Melinga Molong Ridge, Fire Creek flows east into the Woronora River. There are no water sources within the site itself.

3.3.5 Climate

The local climate is similar to that of the broader Sydney metropolitan region with warm to hot summers and cool to mild winters.

The mean daily maximum temperatures range from 26°C in summer to 16°C in winter, and the mean daily minimum temperatures range from 17°C in summer to 7°C in winter.

The Lucas Heights area experiences significant diurnal and seasonal variations in meteorological conditions.

According to meteorological data collected by ANSTO, the average rainfall in the region is 1,017 mm (Bureau of Meteorology). Average monthly rainfall ranges from between 53 mm and 112 mm, and the driest months are in winter and early spring, with the higher rainfalls experienced between November and March.

For much of the year, winds are of light to moderate strength, increasing in the afternoons. The winds are generally stronger during winter and spring, and lighter during summer and autumn. Wind direction is predominantly from the south west and south east, with south easterlies present in summer and autumn, and south westerlies present in winter. Winds occur from most directions in spring.

3.3.6 Vegetation and landscape

The existing vegetation on site can be seen in Figure 3-5 and discussed further in chapter 13.

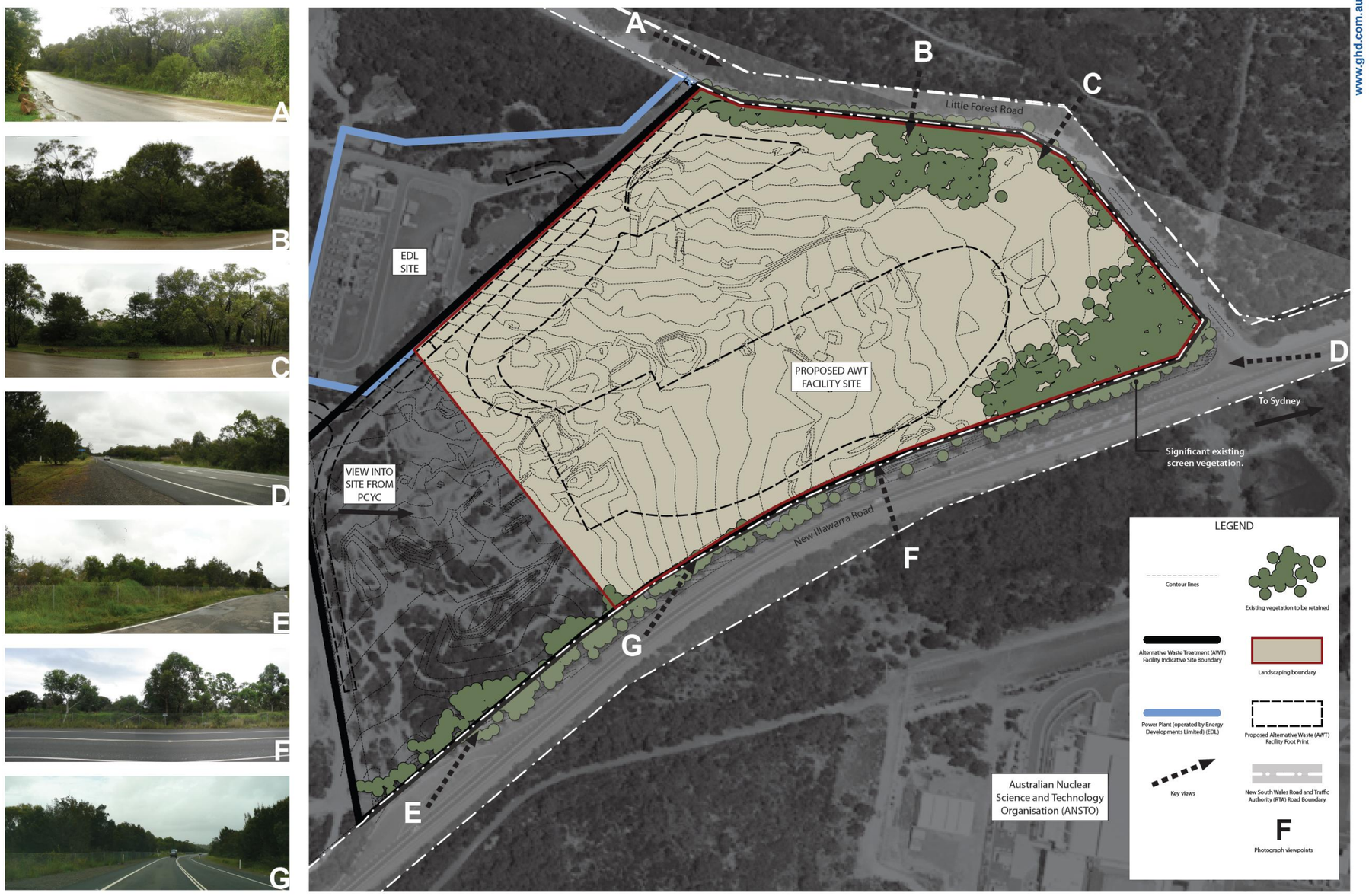


Figure 3-5 Existing vegetation and landscaping

3.4 Historical operations and activities

In 1987 disposal of waste at the Lucas Heights Waste Management Centre (now known as the LHWRC, within which the site is located) commenced. Prior to landfill activities, the LHWRC site was used for logging and laterite gravel extraction. Existing and approved operations and activities at the LHWRC is discussed in section 3.5.

3.5 Existing and approved operations and facilities

3.5.1 Existing operations and facilities at the site

The Sutherland Shire Police and Community Youth Club (PCYC) used the site since 1981 for mini-motorcycle training. A network of unsealed bike tracks covers the site. Elevated bike tracks and jumps have been created from fill brought onto the site from elsewhere. There are also a number of small buildings, associated with the mini-motorcycle activities, located on the site. These include sheds and a canteen. The site is currently being cleaned up (refer section 9.1 for details) and the PCYC is relocating to a rehabilitated landfill area within the LHWRC, west of its current location.

3.5.2 Existing operations and facilities at LHWRC

The LHWRC is approximately 205 ha in area and in two ownerships, with 89 ha owned by the proponent and 116 ha owned by ANSTO. Cleary Bros (Bombo) Pty Ltd manages the LHWRC on behalf of the proponent. An aerial photo of the LHWRC is provided in Figure 3-6.

Figure 3-6 Aerial view of the LHWRC

The LHWRC facilities include:

- Landfill (approved to receive 575,000 t/y mixed waste);
- Community recycling area and garden organics area (both approved to process a combined 55,000 t/y);
- Biogas power plant (operated by EDL);
- Several ancillary buildings and structures (e.g. weighbridge, machinery workshop, administration offices, stormwater and leachate dams);
- Leachate treatment plant (located at Lucas Heights 1); and

- 50 ha of rehabilitated landfill.

The following environment protection licences (under the POEO Act) apply to LHWRC:

- Licence 5065 – for waste activities and waste disposal;
- Licence 12520 – for composting and related reprocessing at the garden organics area; and
- Licence 6345 – for electricity generation by the biogas power plant.

Facilities on the LHWRC site are shown in Figure 3-7.

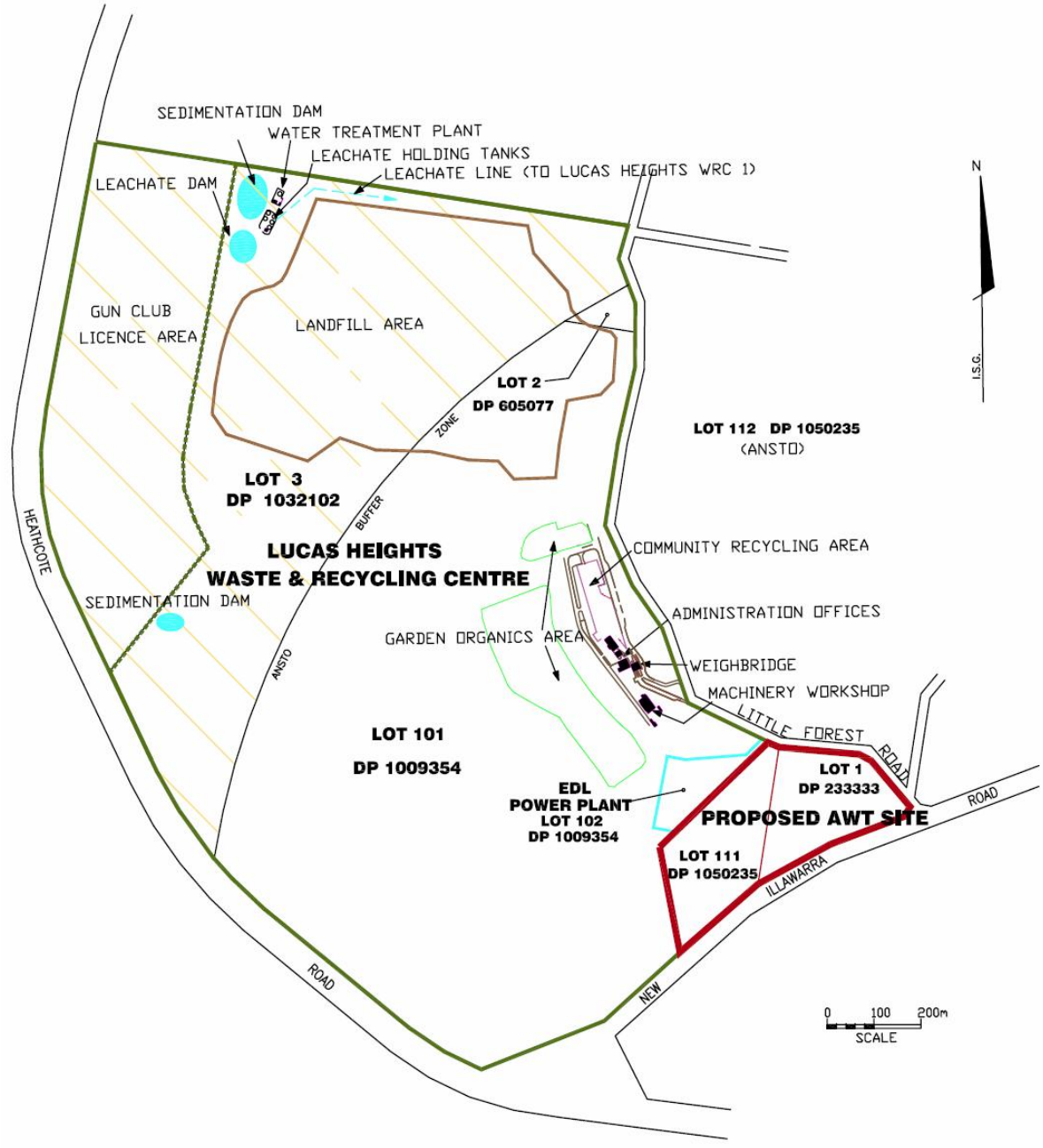


Figure 3-7 Existing operations at LHWRC

3.5.3 Approved operations and facilities at LHWRC

In 1985, Sutherland Shire Council granted approval for operation of the LHWRC (Consent No. 5482/85). Sutherland Shire Council approved the upgrading of the entrance in 1996 (DA No 951337). From 1999, the Minister for Planning determined all development requiring approval. In 2001 and 2005, the Minister for Planning granted modifications to the original development approval, with revisions to the composition and sourcing of waste.

On 12 November 1999 the Minister for Planning granted consent (DA No 11-01-99 consent ref R97/00029) for the following:

- The expansion of the LHWRC's capacity by 8.225 million tonnes and extension of the landfill life to 2024 with a limit of 575,000 tonnes per year (mixed waste - Class 1 and 2), to be landfilled and 55,000 tonnes per year to be recycled, recovered or composted;
- The development of composting and recycling facilities, including a green waste processing and composting facility and a biowaste facility (to process food wastes);
- The staged provision of a rehabilitated landform and the progressive development of a local and regional multi-purpose sporting and recreational complex at Lucas Heights 1 and the establishment of low intensity recreational uses at LHWRC; and
- The rehabilitation of 123.5 ha of bushland (known as the Lucas Heights Conservation Area) to the north of the LHWRC, to be transferred to NSW National Parks and Wildlife Service.

The landfill, green waste processing and composting facility, large areas of landfill rehabilitation and recreational developments progressed in accord with these consents. The Lucas Heights Conservation Area was subsequently rehabilitated and ownership was transferred to Sutherland Shire Council in 2002.

The biowaste facility did not proceed. The biowaste facility was proposed to be located in an area nominated by the 1999 LHWRC Master Plan (Figure 3-8) for 'recycling resource recovery'. It is now proposed to locate the project in this area. The project is consistent with the use nominated by the master plan.

The master plan indicates that the PCYC would be relocated to the west of the recycling resource recovery area (refer Figure 3-8). The proponent is currently reconstructing the PCYC's facilities in this area. The PCYC plans to relocate to this area once reconstruction is completed.

The life of the project would be 20 years. The operation of the project would exceed the current approved life (2024) of the landfill at the LHWRC. After this time residual waste from the project would be transported off site for disposal at an appropriate Class 2 landfill. Hence, no changes to the existing master plan are envisaged.

Consideration of potential impacts from offsite transport of residuals after 2024 has been provided in the relevant chapters of this environmental assessment.

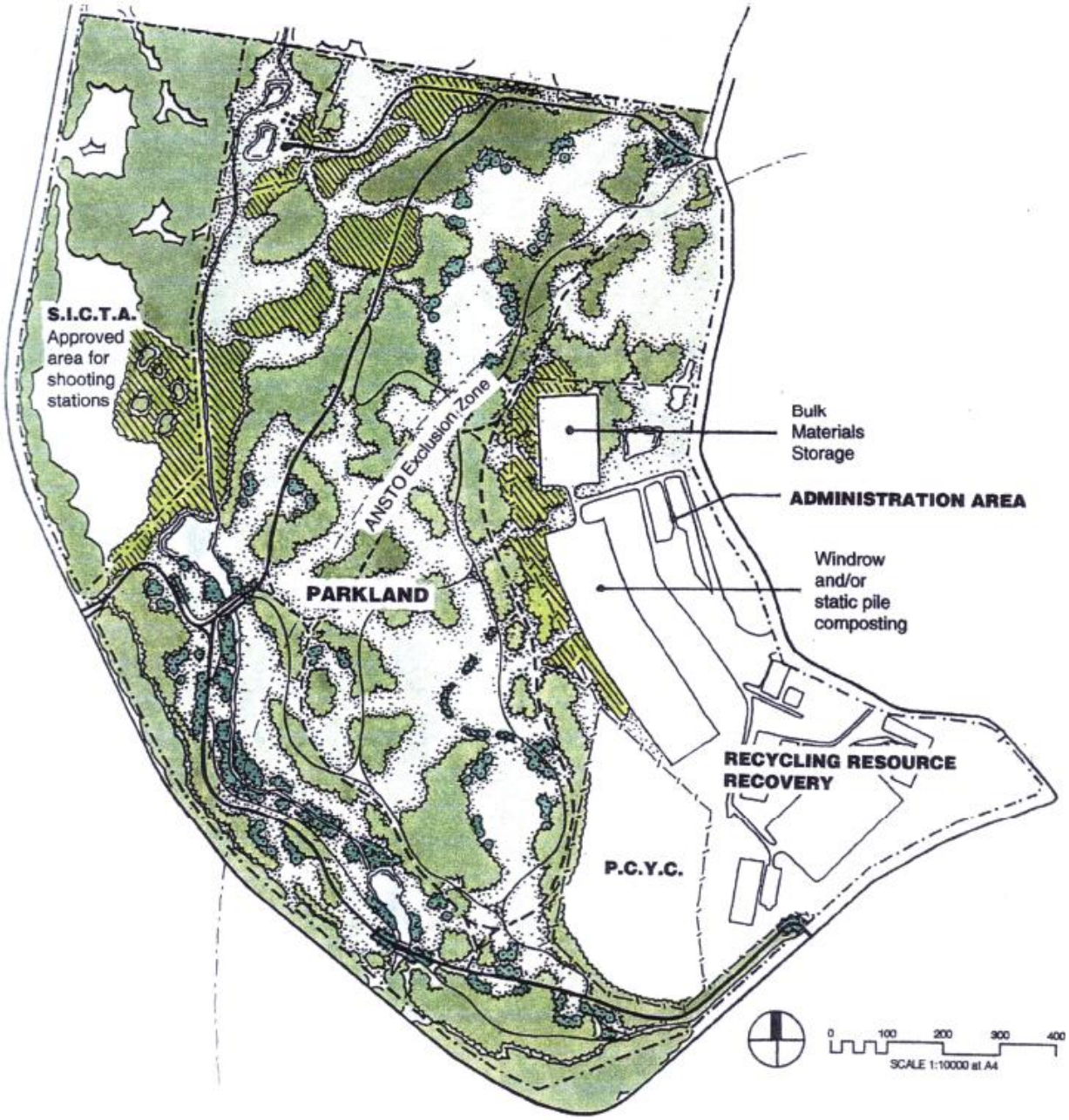


Figure 3-8 Existing LHWRC master plan

3.5.4 Connection between the former LH1 site (The Ridge) and LHWRC

In 1939, a new sanitary depot opened in Menai (at the location described as the former Lucas Heights I (LH1), now being developed as The Ridge, a major sport and recreation facility). This depot, which involved disposal of waste to landfill, mainly operated from 1966, and accepted waste from Sutherland Shire. In 1976, LH1 was made a regional waste depot, taking waste from a number of local councils in southern and western Sydney. Disposal of waste at LH1 ceased in 1987 and as such there is no DECCW Licence for this site.

The proponent progressively transfers management of land to Sutherland Shire Council upon completion of stages. The former LH1 land is owned by the Department of Lands (part of an Occupation Licence issued by the Department of Lands) but Sutherland Shire Council is the trustee that manages it. The proponent is contributing $83 million to develop the former LH1 into 'The Ridge' – a major sport and recreation facility due for completion in 2011.

Sutherland Shire Council currently operates/ manages the following facilities at the former LH1 (now The Ridge):

- Passive open space;
- 8 playing fields;
- Athletic and field events area;
- 12 x netball courts;
- Golf driving range; and
- 18 hole golf course (first 9 holes completed, the next 9 holes are due for completion in the next 12-18 months. Sutherland Shire Council currently manages the first 9 nine holes, the proponent is currently completing the remaining 9 holes).

In addition, the Jenko Pony Club currently operates on the former LH1 site (Ridge Sports Complex), but has its own Occupation Licence from the Department of Lands, and is not managed by Sutherland Shire Council or the proponent.

The proponent's responsibilities at the former LH1 site (now The Ridge) include:

- Environmental monitoring;
- Leachate management; and
- Landfill gas management.

The proponent currently owns and maintains the leachate treatment plant and associated ponds at the former LH1. The former LH1 is separate to the LHWRC and the project site, except for the fact that the leachate management infrastructure (leachate treatment plant) for the LHWRC is currently located at the former LH1 and leachate from LHWRC is pumped via a 4.5 km pipe to the leachate treatment plant for treatment prior to disposal to sewer.

3.6 Other planned operations at LHWRC

3.6.1 Truck parking area

The proponent is also seeking, separately to this project, to develop a truck parking area at the LHWRC. This would be subject to a separate development application. The proposed development application would enable construction and operation of a truck parking area and associated internal access road, administrative office and utilities for the proponent's collection business. The truck parking area would be used by up to 32 waste collection trucks. The majority of the trucks are yet to be purchased to service new council kerbside collection contracts commencing in 2009 and 2010. The trucks would collect and dispose of waste that is currently being disposed at the LHWRC.

Consideration of potential cumulative impacts associated with this proposed development has been provided in this environmental assessment.

3.6.2 PCYC relocation

It is proposed that the PCYC mini-bike facility would be relocated to a rehabilitated landfill area within the LHWRC (as mentioned in section 3.5.3), west of its current location. This would require construction of new mini-bike tracks and establishment of a new canteen/admin/amenities building.

Construction of a new canteen/admin/amenities building associated with the PCYC mini-bike facility is subject to a separate development application. Construction of the new mini-bike tracks was approved as part of the original master plan for LHWRC.

Consideration of potential cumulative impacts associated with this proposed development has also been provided in this environmental assessment.

3.7 Possible future projects at LHWRC

3.7.1 Future AWT facility

The proponent is currently considering options in terms of development of additional AWT facilities if demand indicates that they would be required. The site provides opportunities for the location of such facilities and the design of the project and site layout has ensured that it would not preclude any future development of the site for this purpose. Any future proposed AWT facilities would be subject to a separate development application and approvals process.

3.7.2 Future plastics processing plant

The proponent is also considering locating a plastics processing plant on the site in the future. The aim of the plastics plant would be to shred, wash and granulate (pelletise) the plastic film recovered from the incoming waste to the AWT facility ready for transport off site for recycling or reuse. The feasibility of implementing this would depend on the quantity and types of plastic film that would be recovered from the project. Any future plastics processing plant would also be subject to a separate development application and approvals process.

3.8 Existing environmental management and monitoring regime

Management of activities at the LHWRC is undertaken in accordance with the LHWRC environmental management plan, which specifies goals and principles; management strategies; management and monitoring activities and frequencies; performance indicators and targets; responsibilities and reporting and review requirements for:

- Surface water management;
- Leachate management;
- Landfill gas management;
- Odour control;
- Dust control;
- Litter control;
- Noise control;
- Pest, vermin and noxious weed control; and

- Emergency preparedness.

Monitoring activities incorporate surface water, leachate, landfill gas, groundwater, dust, noise and other environmental performance indicators in accordance with the site's environment protection licences and the LHWRC environmental management plan. The monitoring regime is shown in Table 3-1.

Table 3-1 Operational monitoring procedures at LHWRC

Aspects	Existing Monitoring Requirements for LHWRC
Air Quality	Subsurface gas monitoring is carried out at six locations on a quarterly basis.
	Surface gas and accumulation monitoring is carried out on a bi-monthly basis based on a 100 m spaced grid format.
	Dust monitoring is taken at six designated locations on a monthly basis.
Surface Water	Surface waster is monitored on a monthly basis at 6 designated locations. Surface water is externally monitored at 3 locations on a quarterly basis.
	Surface waster is monitored and lab sampled within 24 hours following wet weather at 9 designated locations.
	The surface water stored in the sediment dam 5 is monitored and lab sampled prior to controlled discharge. The licence discharge point is monitored and lab sampled during this discharge. Sediment Dam 5 is externally monitored on a quarterly basis.
Groundwater	Groundwater monitoring is carried out at 8 separate locations on/around site. Sampling is carried out on quarterly and yearly basis with varying parameters.
Odour	Odour is constantly monitored on site during daily inspections. Odour monitoring patrols are also initiated subject to complaints being received.
Leachate	Any discharge of leachate to surface water is against licence conditions. Leachate is transferred to Lucas Heights 1 (Closed Landfill) and treated and discharged to Sydney Water Corporation Sewer under Trade Waste Licence 13749.
	The leachate dam is externally monitored on a quarterly basis.
Noise	Noise monitoring is carried out on a monthly basis at 5 specified sites.
Pest, Vermin and Weed Control	Pest, vermin and weed control is carried out in conjunction with Sutherland Shire Council and privately on-site as required.

4. Stakeholder Consultation

4.1 Objectives of the consultation program

The proponent is undertaking consultation for the project in three phases:

- During preparation of the environmental assessment;
- During exhibition of the environmental assessment; and
- During construction and operation of the project.

4.1.1 Preparation of the environmental assessment

The objectives of the consultation program during the environmental assessment preparation phase are to:

- Create awareness in the community of the project; and
- Ensure that all issues of concern to the community were identified and addressed in the environmental assessment.

4.1.2 Exhibition of the environmental assessment

The objectives of the consultation program during the environmental assessment exhibition phase are to:

- Create awareness in the community of the project and an understanding of the technology and the benefits to the community;
- Provide the community with the opportunity to discuss the project with the proponent;
- Address any questions or concerns that the community has about potential environmental or community impacts of the project; and
- Advise the community of how they can make a formal submission about the project to the NSW Department of Planning.

4.1.3 Construction and operation

The objectives of the consultation program during the construction and operation phases of the project are to:

- Create awareness in the community of the project and an understanding of the technology and the benefits to the community;
- Keep the community informed about progress and performance; and
- Ensure that the community know how they can contact the proponent should they experience any adverse impacts due to construction or operational activities.

4.2 Community consultation activities

4.2.1 Environmental assessment preparation phase

Community Scan

A community scan was conducted to identify key stakeholders. This involved:

- Review of stakeholders identified as part of previous planning activities for the site;
- Discussions with the WSN Lucas Heights Community Advisory Committee;
- Discussions with Sutherland Shire Council;
- Discussions with ANSTO; and
- Discussions with existing Lucas Height steering, liaison and bushfire committees.

Community Advisory Committee Meetings

The proponent has been engaging with the local community through a Community Advisory Committee (CAC) since 1994. The CAC is a consultative forum where representatives of the community and the proponent's staff can discuss the operations of the LHWRC. The role of the CAC is advisory – the proponent considers comments and suggestions made by the group and responds. The CAC is asked to provide advice on a range of items brought forward by the proponent and may bring forward matters of importance to members. This assists the proponent to make robust decisions in relation to its facilities.

Participation in the CAC is voluntary and open to any interested person who lives, works or has an interest in the vicinity of the LHWRC. Members generally represent the following local groups:

- Residents;
- Businesses;
- Environmental groups and community groups (e.g. precinct committees and progress associations);
- Council staff;
- Councillors; and
- Members of Parliament.

CAC meetings are chaired by an independent facilitator and minuted by an independent minute-taker.

On 18 June 2008, the proponent's staff members advised the CAC that the proponent proposed to establish an AWT facility at Lucas Heights. On 20 September 2008, the proponent gave a presentation to the CAC about AWT.

The proponent discussed its plans for an AWT facility at the LHWRC with members of the CAC on 20 September and 3 December 2008.

At the meeting on 3 December 2008, the proponent's staff members presented an overview of the project.

Other CAC meetings were held 19 March 2009 and 18 June 2009. Further meetings are scheduled for later in 2009.

Feedback mechanisms

At the beginning of the environmental assessment process the following contact facilities were available to provide the community with a range of ways to contact the project team, gain access to information and provide comment.

- Information and feedback line: 1300 651 116
- Email: info@wsn.com.au
- Website: www.wsn.com.au
- Community Advisory Committee meetings
- Meetings with key stakeholders
- Resident feedback, contact and issues register / database

Distribution of project information

Information on the project was made available by the following means:

- Media release distributed to local newspapers;
- Advertisement placed in local newspapers; and
- CAC meetings.

4.2.2 Environmental assessment exhibition phase

Extensive community consultation would be undertaken during exhibition of the environmental assessment. Consultation activities at this time would include information sessions, weekend open days at the LHWRC and a letterbox drop of a newsletter outlining the proposal. The CAC would be a key consultation forum during this time and special meetings of this group would be scheduled if required.

These activities would be in addition to the formal public submission process coordinated by the Department of Planning.

Distribution of project information

Information on the project would be made available by the following means:

- Information brochure mailed to key stakeholders, distributed to residents in nearby suburbs, and made available at the Menai Marketplace shopping centre, Sutherland Shire Council offices and via the WSN website;
- Information stand at Menai Marketplace shopping centre;
- Media release distributed to local newspapers;
- Advertisement placed in local newspapers;
- CAC meetings;
- WSN website; and

- WSN information and feedback line.

4.2.3 Construction and operational phases

During the construction period, the local community and other key stakeholders would be kept up to date on progress through a information brochure distributed to households in nearby suburbs. The information brochure would highlight WSN contact details to ensure the local community knows how to obtain further information or register feedback.

The CAC will continue to be an important consultation method during construction and also once the project is operational. The CAC provides the opportunity for the community to ask questions about the project, or to register any concerns. The proponent will provide regular updates on the performance of the project and provide responses to any issues raised by community members.

Once operational, tours of the project can also be organised.

Distribution of project information

- Information brochure mailed to key stakeholders, distributed to residents in nearby suburbs, and made available at the Menai Marketplace shopping centre, Sutherland Shire Council and via the WSN website;
- Media releases distributed to local newspapers;
- Advertisements placed in local newspapers;
- CAC meetings;
- WSN website;
- WSN information and feedback line;
- Community event; and
- Site tours on completion.

4.3 Statutory consultation

The Director General's requirements specified that consultation with the following government authorities was required:

- DECCW;
- NSW Department of Water and Energy;
- NSW Roads and Traffic Authority;
- Commonwealth Department of Environment, Water, Heritage and the Arts; and
- Sutherland Shire Council.

In June 2008, the Department of Planning distributed the preliminary environmental assessment and requested that agencies identify key issues and assessment requirements for the project. A summary of the issues and requirements identified is provided in Table 4-1.

In addition, the proponent has held the following meetings with relevant stakeholders to discuss the project:

- NSW Roads and Traffic Authority on 30 September 2008;
- Sutherland Shire Council on 14 October 2008, 30 January 2009 (workshop and tour of MRRP AWT facility), 6 February, 19 March 2009 and 2 July 2009;
- ANSTO on 21 October 2008,19 January 2009 19 March 2009 and 11 August 2009;
- DECCW on 11 June 2009; and
- Department of Planning on 3 March 2009, 25 May 2009 and 19 June 2009 (tour of MRRP AWT facility).

Another meeting is scheduled with ANSTO on 24 September 2009.

Furthermore, as per the existing Deed of Agreement between Sutherland Shire Council and the proponent, Sutherland Shire Council were provided a copy of the environmental assessment prior to it being submitted to the Department of Planning (as it is a dual applicant for the development application). Sutherland Shire Council have given consent to the project (refer letter in Appendix N).

Table 4-1 Agency information requirements

Stakeholder	Information required	Document reference
DECCW	Waste management	Chapter 8
	Stormwater and wastewater management	Chapter 9
	Odour management	Chapter 10
	Dust management	Chapter 10
	Noise	Chapter 15
	AWT design (including leachate management, gas management and environmental monitoring)	Chapter 6 and Chapter 19
	Fire management	Chapter 14
	Quality and use of final output products	Chapter 6
RTA	Alignment with the achievement of NSW Government transport objectives	Chapter 11
	Proposed impact on daily and peak traffic movements	
	Proposed accesses and parking provisions	
	Proposed number car parking spaces	
	Details of service vehicle movements	
	Assessment of the implications of the proposed development for non-car travel modes.	
	Provision of a traffic management plan for all demolition/construction activities.	
Department of Water & Energy	Water supply source/s for the proposal	Chapter 9
	Any water licensing requirements under the Water Act 1912	
	Groundwater issues	

Stakeholder	Information required	Document reference
	The protection and rehabilitation of water courses and riparian corridors.	
Sutherland Shire Council	Commitment to the finishing date for landfill operations	Section 6.13

PART B
The Project

5. Project Need and Alternatives

5.1 Proponent's drivers

5.1.1 Proponent's objectives

The proponent provides waste receiving and disposal facilities to service the needs of a significant portion of greater metropolitan Sydney, which has a population of 4.1 million.

The objectives of the proponent are set out in the *Waste Recycling and Processing Corporation Act 2001* and include the requirement to:

- Protect the environment by managing waste in accordance with the principles of ecological sustainable development;
- Exhibit social responsibility by achieving international best practice of waste management;
- Minimise adverse health and environmental impacts in managing waste; and
- Be a successful business.

5.1.2 Proponent's business strategy

The proponent is committed to providing environmentally sound and sustainable waste management solutions that improve resource recovery, and reduce the quantities of waste being disposed to landfill. They will achieve this using appropriate alternative waste treatment processes and simple separation solutions such as material recycling facilities.

These facilities divert valuable resources from landfill, allowing the maximum recovery and recycling of resources from the waste stream.

The proponent operates in accordance with the NSW Waste Avoidance and Resource Recovery Strategy (WARRS) 2007, which contains four operating principles including:

- Avoiding and preventing waste;
- Increased use of renewable and recovered materials;
- Reducing toxicity in products and materials; and
- Reducing litter and illegal dumping.

The project is a strategic response aimed at implementing the key objectives of the WARRS 2007.

As noted in chapter 1, landfilling of putrescible waste remains the dominant method for waste disposal in Australia and worldwide. Its attraction lies in its superficial and short term cost advantages. It is now widely recognised that this method of waste disposal can result in significant environmental impacts that need to be managed in the medium to long term.

The proponent is currently transforming its business from one that is based mainly on the disposal of putrescible waste to landfill, to a more environmentally sound and sustainable business, using appropriate engineering solutions for waste management such as materials recycling facilities and AWT facilities.

Therefore this project meets the objectives and business strategy of the proponent.

5.2 Strategic planning drivers

The NSW strategic policy framework for waste management incorporates policy to drive waste reduction and resource recovery. The framework has most recently been strengthened with the addition of new legislation to streamline development of waste management infrastructure and a strategy that provides for increasing resource recovery and reducing toxicity in products. The following sections summarise the key strategic framework relevant to the project.

5.2.1 Waste Avoidance and Resource Recovery Act 2001

The *Waste Avoidance and Resource Recovery Act 2001* (WARR Act) governs the strategic direction for waste management and resource recovery in NSW. The main objectives of the WARR Act are:

(a) *to encourage the most efficient use of resources and to reduce environmental harm in accordance with the principles of ecologically sustainable development,*

(b) *to ensure that resource management options are considered in accordance with the following hierarchical order:*

  (i) avoidance of unnecessary resource consumption,

  (ii) resource recovery (including reuse, reprocessing, recycling and energy recovery), or

  (iii) disposal,

(c) *to provide for the continual reduction in waste generation,*

(d) *to minimise the consumption of natural resources and the final disposal of waste by encouraging the avoidance of waste and the reuse and recycling of waste,*

(e) *to ensure that industry shares with the community the responsibility for reducing and dealing with waste,*

(f) *to ensure the efficient funding of waste and resource management planning, programs and service delivery,*

(g) *to achieve integrated waste and resource management planning, programs and service delivery on a State-wide basis,*

(h) *to assist in the achievement of the objectives of the Protection of the Environment Operations Act 1997.*

5.2.2 Waste Avoidance and Resource Recovery Strategy 2007

Resource NSW (now part of DECCW) released the Waste Avoidance and Resource Recovery Strategy in February 2003. This strategy set targets for avoidance for the State. It was updated in 2006 through the release of the Waste Avoidance and Resource Recovery Strategy and Performance Report 2006.

The key result areas and targets identified in Waste Strategy 2003 were retained in the Waste Avoidance and Resource Recovery Strategy 2007 (WARRS 2007). They remain relevant in the current NSW economic, environmental and social climate and while they are ambitious, the targets are also realistic goals that will continue to provide an impetus for action across all sectors.

The four key outcome areas and their targets are shown in Table 5-1.

Table 5-1 Broad targets for each outcome area in the WARRS 2007

Outcome area	Target
Preventing and avoiding waste	To hold level the total waste generated for the next 5 years
Increasing recovery and use of secondary resources	By 2014, to: Increase recovery and utilisation of materials from municipal sector from the current 26% to 66% Increase recovery and utilisation of materials from the commercial & industrial sector from the current 28% to 63% Increase recovery and utilisation of materials from the construction & demolition sector from the current 65% to 76%.
Reducing toxic substances in products and materials	By 2014 or earlier: To phase out priority substances in identified products as a first choice or if not possible to achieve maximum recovery for re-use and; where identified products containing these priority substances require disposal as a last resort, the permitted "leachability" of the substances will be reduced to the levels that are permitted for inert waste.
Reducing litter and illegal dumping	Reduce total volume and tonnages of litter reported annually. Reduce the total tonnages of illegally dumped material reported by regulatory agencies and RID squads annually.

5.2.3 Sydney Metropolitan Strategy 2005

As noted in section 3.1, the Sydney Metropolitan Strategy ('City of Cities: A Plan for Sydney's Future') was released in 2005. The strategy is a broad framework to facilitate and manage growth and development over the next 25 years.

One of the aims of the strategy is to reduce the amount of waste produced by Sydney:

> *'4. Protect the environment*
>
> *Protect Sydney's unique environmental setting and reduce the city's use of natural resources and production of waste.'*

5.2.4 Compatibility of the project with State targets and strategies

The project is consistent with an increasing focus on sustainable waste management at a local, State and National level. The project would assist councils to meet the objectives of the WARR Act and targets for resource recovery set by the Waste Avoidance and Resource Recovery Strategy 2007, including the 66% resource recovery target.

As well as meeting State targets for waste management, the proponent forecasts that the community will demand ongoing improvement in waste management, and higher standards of environmental performance, sustainability and resource recovery. The project would satisfy community expectations for improved waste management practices.

Although councils for the largest waste-generating local government areas (LGAs) offer kerbside recycling services for paper and containers as well as garden organics collections, the diversion rate for municipal waste in 2003 was estimated to be only 26%. Although this has probably increased since then, as more councils offer garden organics collection services, the diversion of domestic waste at kerbside through recovery of recyclable paper, containers and vegetation is unlikely to improve significantly. The only substantial increases in diversion would occur by the recovery and diversion of food waste from landfill, which comprises between 40% and 50% of the domestic garbage stream. The only way councils will achieve the 66% diversion target is to recover the organic component (food) through an alternative waste management system.

The project would also meet the aims of the Sydney Metropolitan Strategy 2005.

5.3 Council waste contracts

Councils are now looking for environmentally responsible and sustainable alternatives to landfilling. Alternative waste technologies provide a secure, sustainable, and economically viable disposal and processing solution for recyclable, garden organic and mixed solid waste streams.

The Parramatta and Bankstown Councils have signed contracts to deliver their waste to the project. These two councils are expected to deliver about 65,000 tonnes per year of waste by 2014, which will be two thirds of the capacity of the project. This timeframe can be achieved by obtaining environmental approvals by late 2009 and building the proposed facility at the LHWRC, which could take 2-3 years to complete.

5.4 Landfill availability

In a few years, disposal of putrescible waste to landfills in close proximity to Sydney will no longer be an option for Sydney councils. Increases in overall waste generation rates are projected for the next few years due to population growth in Sydney. Whilst recycling rates are increasing, the impending closure of a number of existing putrescible waste landfills such as Belrose and Eastern Creek means that several AWT facilities will be required to process the increasing quantities of putrescible waste in Sydney that will require disposal.

The proponent understands that the NSW Government has commissioned an independent review of the landfill capacity and demand for landfill capacity in the Sydney region by Mr Tony Wright. At the time of writing, this review was not publicly available.

Transport of waste and disposal to landfill are the two main greenhouse gas-generating activities associated with waste management. Localised solutions are preferred from a sustainability perspective than long-hauling of waste to distant facilities. With the looming shortage of landfill capacity in the Sydney metropolitan area, the development of the project is a first step in accommodating the waste from this and other regions in the future using non-landfill based solutions.

The project would meet the strong demand by local government and private clients for sustainable waste management and resource recovery. It would meet the requirements of local councils and businesses as they move towards more sustainable waste management solutions.

5.5 Financial drivers

The NSW Government applies a levy to every tonne of waste sent to landfill. This levy increases every year. In 2007-2008 it was $38.60 per tonne in the Sydney region and will rise to $46.70 per tonne in 2008-2009. Additional rises were recently announced. The levy is designed to make landfilling expensive and enhance the viability of alternatives such as alternative waste technologies. Councils delivering waste to the project would be achieving real cost reductions compared to those that are reliant on landfilling for waste disposal.

DECCW provides payments to councils that meet improved waste management and resource recovery standards. One way this can be done is by sending waste to an AWT facility where diversion is higher. The development of the project should allow councils such as Parramatta and Bankstown, which would use the new facility, to claim these payments.

5.6 Alternatives to the project

5.6.1 Location

The proponent has identified other locations at the LHWRC that could also be used for siting an AWT facility. However the proposed site is relatively far from existing residential areas and has good proximity to major roads. The site provides opportunities for the location of additional AWT infrastructure if demand increases. The design of the project and site layout would ensure that it would not preclude any future development of the site for this purpose. It should be noted that this project, environmental assessment and development application is for only one AWT facility - any future AWT infrastructure would be subject to a separate development application and approvals process.

5.6.2 Technology selection

The proponent undertook its own review of alternative waste technologies before commencing this project. The proponent identified that the type of technology selected needed had to have a relatively small footprint, minimal odour emissions, produce high quality byproducts, and be able to deal with a highly variable waste stream, because of the number of councils that would potentially be contributing waste to the project.

The conclusion was that the best technical and commercial solution was to use the ArrowBio technology that is currently being implemented at the MRRP as it offered such possibilities and the design and construction of this facility could be optimised from experience gained during building and commissioning of the MRRP.

A comparison of various technology options that could have been considered for this project is provided in Table 5-2.

Table 5-2 Comparison of technology options

	Mixed waste separation and composting	Ecolibrium Arrow Bio (wet separation and digestion)	Mixed waste dry anaerobic digestion	Plasma arc*
Inputs and requirements	Mixed municipal and light commercial wastes	Mixed municipal and light commercial wastes	Mixed municipal and light commercial wastes	Claimed to able to treat mixed municipal and light commercial wastes
Technology maturity	Mature technology – many facilities in place in France, and Italy. Facilities in Germany mainly used to stabilise waste prior to landfill disposal.	One plant built and operating at the MRRP.	Mature technology – many facilities in place in Europe (mainly Germanic countries)	Unproven on a commercial scale at this point in time. Plasco operates a plant in Ottawa Canada
Foot print required	Approximately 3 ha	Approximately 2.5 ha	3-4 ha	6 acres (2.5 ha) for 400 tpd (100 tpa) plant
Products and product uses	Low quality mixed waste compost product, plus some glass, plastics and metals	Low quality mixed waste digester sludge, plus some glass, plastics and metals, renewable energy	Low quality mixed waste digester sludge, plus some glass, plastics and metals	Syngas, construction aggregate, water, salt and sulphur based fertiliser
Uses of end products	Compost only suitable for landfill daily cover, and site rehabilitation. Recyclables to market, Residuals to landfill.	Digester sludge which needs to be dewatered prior to landfilling. Recyclables to market, Residuals to landfill. Possibility of fertiliser production from sludge (as currently done in Israel).	Digester sludge which needs to be dewatered prior to landfilling. Recyclables to market, Residuals to landfill.	Waste is converted to syngas for energy production, construction aggregate (15% of input), water, salt (10%) and sulphur based fertiliser (10%).
Material diverted from landfill	About 40- 50%, if end product is used for landfilling	Approximately 70%, allowing for sludge to be disposed of to landfill	Approximately 70%, allowing for sludge to be disposed of to landfill	Claimed to be 100%, but could be as low as 60% if aggregate, salt and sulphur based fertilisers were impure and had to be landfilled.
Capital cost for 100,000 tpa plant	Approximately $50M	Approximately $60M	Approximately $80M	Not known as very few operating plants in existence.

* http://www.plascoenergygroup.com/?Technology_Overview

By the time that the project is commencing construction (early 2010), the ArrowBio facility at MRRP will have been operating for approximately 12 months. Operational experience from this operating facility will be able to benefit the proponent in the final design of this LHWRC plant.

There are other reasons why the proponent considers the ArrowBio process to be more suitable for its needs than other technologies that are currently available in Australia.

The water-based component of the ArrowBio process is supplemented with an innovative materials separation facility at the front end of the plant, to remove large incompatible items from the process (for recycling or disposal). These include garden wastes, large pieces of cardboard, carpets, hard waste and items such as hoses.

The use of buoyancy in the water-based process to separate heavy materials such as glass and metals from lighter materials such as paper, cardboard and plastics is quite effective in that it mimics natural forces. Processes that mimic nature use less energy and are less prone to failure than those that oppose natural forces, as the forces are applied in the direction that the materials would tend to go if unassisted.

A major advantage of such a wet process over a dry process of separation is that the recyclable materials such as steel, aluminium and plastics are relatively clean after extraction from the water. This improves their market value and also reduces the tendency of extracted materials to be odorous, due to their previous contact with organic material in the waste stream. The fact that water is a good solvent also means that the maximum amount of organic matter is removed from the incoming waste stream in the early part of the process. It also aids the anaerobic digestion process, since it is more efficient to digest liquids than solids, or semi solids.

Performance

The residence time of material in the methanogenic reactor is longer than in conventional anaerobic digestion systems (typically 80-90 days). Most of the currently used processes have a solids retention time (SRT) of only 30-40 days, and hence produce significantly less methane than the ArrowBio process. The estimated production of biogas from the ArrowBio process is 100m^3 per tonne of waste processed. This gas is captured and used to generate electricity. Approximately 2 MW of electricity is estimated to be produced from the 100,000 tonnes per annum waste throughput.

The energy requirements of the plant are approximately 1 MW during the day, when material is being received and processed, and 0.5 MW at night, when only the tank farm is operating. It therefore exports about 50% of the energy that it produces during the day, and at night, the plant exports up to 75% of the energy that it produces.

Diversion of materials from landfill is a key performance indicator for AWT processes. The fact that the process efficiently dissolves organics from the waste stream and extracts recyclable materials with relative ease means that approximately 70% of materials entering the plant can be diverted from landfill, subject to the daily composition of the waste stream.

Emissions and impacts

Low odour emissions are one of the main features of the ArrowBio process that makes it very attractive for an AWT facility located within the metropolitan area. The main reason for this is that the wastes are immersed in water very early in the process. Continuous circulation of water within the

vat prevents anaerobic activity in the wastes and thereby reduces the production of volatile organic compounds, which tend to be quite odorous.

A major benefit of the use of a water-based process compared to conventional dry methods is that it minimises the amount of dust generated when the waste materials are handled. This leads to a reasonably pleasant working environment in the processing area and minimises OHS issues.

The ArrowBio process is less noisy than many dry waste processes. Most of the noise sources in the plant are pumps (which are relatively quiet pieces of equipment). Noise measurements taken by GHD within the plant in Israel showed that the maximum noise level within the plant was well below 85 dBA, the industrial standard. This means that workers would not need to wear hearing protection within the work environment, resulting in a more beneficial workplace for both the plant operator and the workers.

6. Description of the Project

6.1 The project

The project involves construction and operation of an AWT facility to process up to 100,000 tonnes per year of municipal solid waste. The project would involve development of the following facilities:

- Receival hall;
- Separation plant;
- Biological plant;
- Energy generation plant;
- Laboratory;
- Weighbridge;
- Parking area for 72 vehicles;
- Internal road network; and
- Staff facilities;
- Site access.

Waste processing would be undertaken by the following:

- A separation plant, which uses material separation technologies to recover recyclable materials from the municipal waste stream; and
- A biological plant, which uses anaerobic digestion to process the organic fraction of the waste.

The project life would be 20 years and the project would be very similar to a plant that is currently being commissioned at the Ecolibrium™ Mixed Waste Facility at the MRRP, which has a similar capacity (shown in Figure 6-1).

Figure 6-1 ArrowBio plant at the MRRP

6.2 Operation of the project

6.2.1 Overall layout and appearance of onsite facilities

The project would consist of two main areas – the separation plant to the west and the biological plant in an open area to the east. Figure 6-2 and Figure 6-3 (pages 6-4 and 6-5) show 3-dimensional images of the facility.

The overall layout is illustrated in Figure 6-4 (page 6-6).

The building housing the separation plant would be steel framed structures, clad with coated steel sheeting, with some transparent sheeting on the roof to provide natural lighting during daylight hours. The building would be approximately 47.8 m wide by 129.6 m long, in two main parts (both sharing a common roof height of 15.4 m):

- the receival hall which would be 54.3 m in length, 18.4 m high with a step down of 3 m; and
- the process hall which would be 75.3 m in length and 15.4 m high.

The building would be oriented in an east-west direction, which would maximise the sunlight falling on the lighting panels and minimise artificial lighting requirements for the plant during the day. The building would be architecturally designed to show a modern and streamlined appearance that is often associated with high technology facilities.

Sealed roads would permit truck and other vehicle access for removal of inert waste residuals and recyclable materials. Operational areas of the site that would experience heavy use, such

as the waste drop-off area would be paved with concrete. Non-operational areas would be covered with gravel or hot mix.

The proposed landscape plan for the site is shown in Figure 6-5 (page 6-7) which includes details of existing vegetation to be retained, areas for vegetation / screening enhancement and new landscaping zones.

Further details of proposed landscaping is provided in chapter 18.

Figure 6-2 Close up 3-dimensional image of the facility

Figure 6-3 Aerial 3-dimensional image of the facility

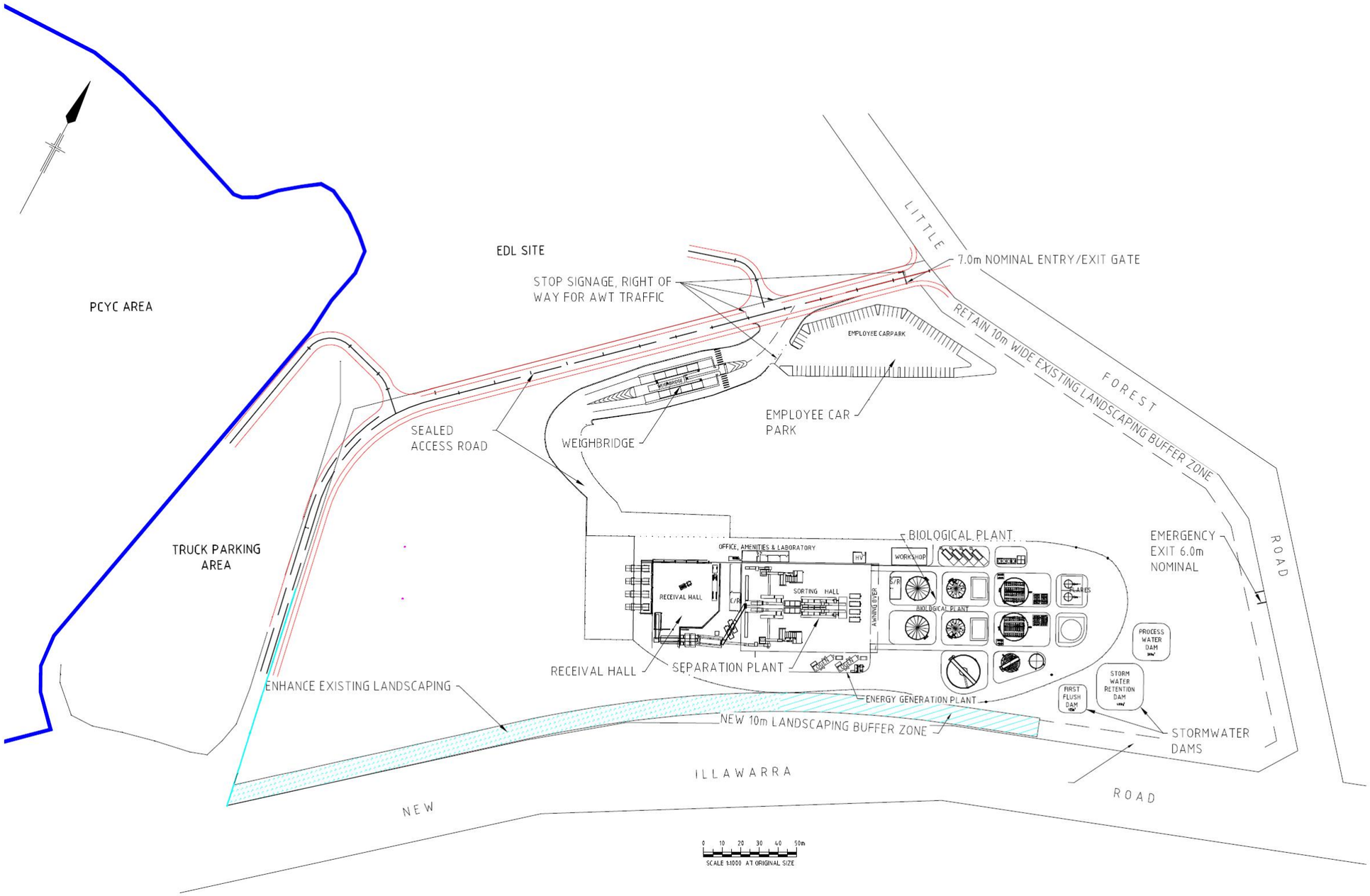
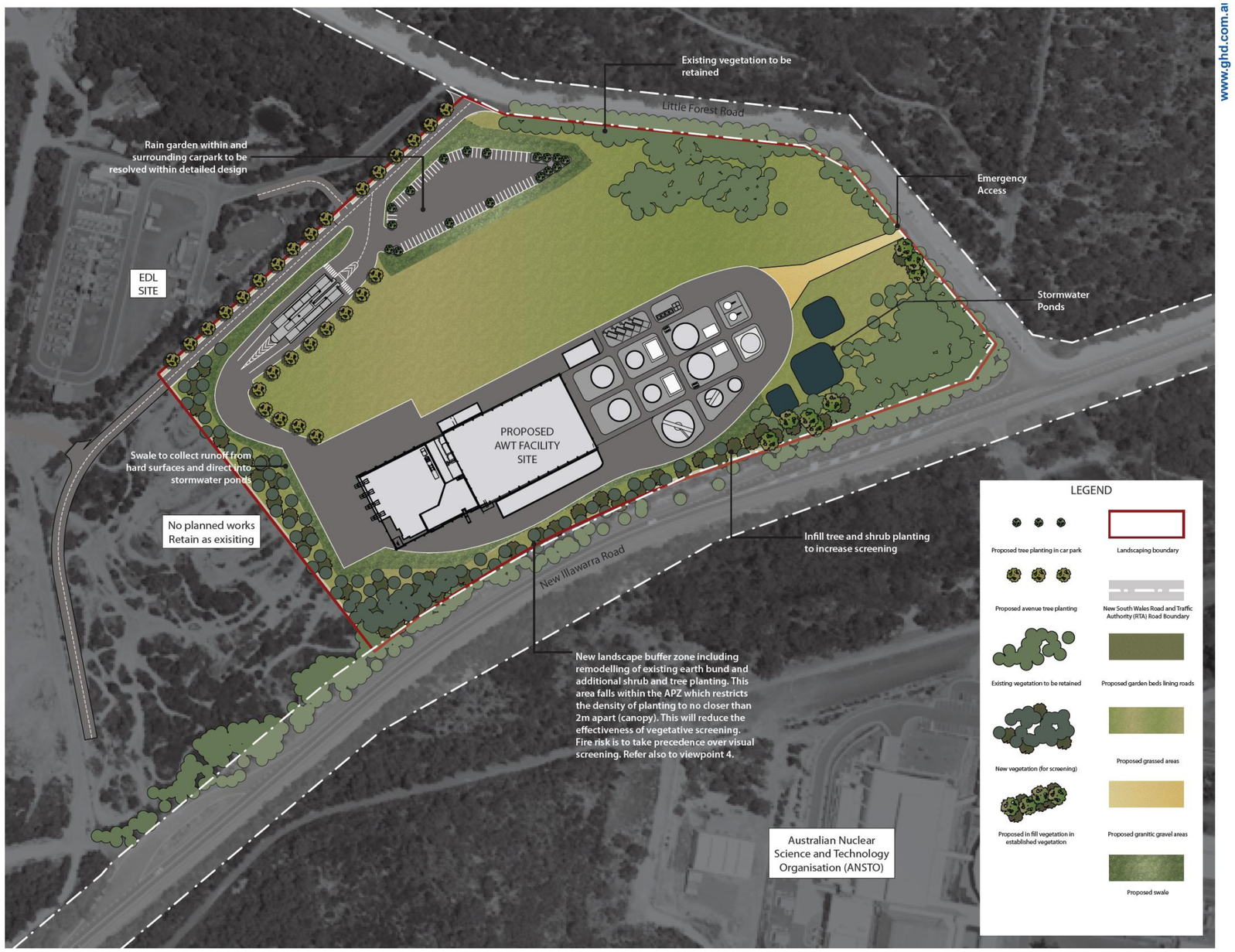


Figure 6-4 Site layout



General Notes

1. Consider the appearance and placement of any signage, fencing and lighting to reduce its visibility / integrate with the existing environment. If required, luminaries to meet minimum standards in car parking areas, walkways & buildings utilise solar energy (if possible), and be placed in sensitive locations that minimise light spill, sky glow & glare.
2. Habitat connectivity to surrounding existing & proposed land uses is to be considered in planting strategy.
3. In sourcing plants and landscape materials, local suppliers are to take precedence over non-local suppliers and products.
4. Use of native / endemic and indigenous planting is to be used to promote benefits including pest resistance; reducing watering requirements and the need for fertilizers; promoting biodiversity, and; local sense of place.
5. A site inspection determined that the condition of the soil would be detrimental to plant establishment and it is recommended to either import top soil that meets AS 4419 or condition and blend the soil on site using compost and gypsum to achieve a more desirable soil.
6. Site infrastructure to be screened by strategically placed tree planting.

Water Sensitive Urban Design

1. The stormwater management approach should seek to mimic the pre-development site's hydrology.
2. Landscape design is to improve water quality and may include techniques that infiltrate, filter, store, evaporate, detain and treat run-off close to its source. This includes small cost-effective water management landscape features including rain gardens, swales, infiltration trenches and porous surfacing / hard standing.
3. Avoid conveying and treating storm water in large, end of pipe facilities located to the bottom of drainage areas and design appropriate overland drainage system in conjunction with civil engineering design.
4. Achieve best practice WSUD principles as a minimum.
5. Design a road-side drainage strategy to control & filter high rainfall event run-off, to enhance water quality and enhance visual amenity of the site.

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ENVIRONMENTAL SOLUTIONS

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3.0 PROPOSED LANDSCAPE PLAN
LUCAS HEIGHTS AWT FACILITY

Figure 6-5 Proposed landscape plan

6.2.2 Access

Access to the site would be via a new access way off Little Forest Road. There would be a separate weighbridge for vehicle entry to the project site. Vehicles access the site would travel via the new internal road off Little Forest Road, turning left at the proposed AWT access, some 90 m west of Little Forest Road. Light vehicles would turn left into the car park prior to the weighbridge. All heavy vehicles would proceed ahead through the weighbridge before driving along a sealed internal road to the waste processing facility.

Outbound heavy vehicles would travel past the weighbridge, turn right into the new internal road and then right into Little Forest Road to the intersection with New Illawarra Road. Light vehicles would give-way to heavy vehicles before turning right onto the internal access road. In this way, all vehicles would enter and exit the site in a forward direction.

The weighbride would be located approximately 35 m from Little Forest Road, and hence can provide queuing for up to three 10 m trucks in addition to two vehicles on the weighbridge. This is expected to be sufficient for the needs of the AWT facility, given that the weighbridge would have a capacity of approximately 60 trucks per hour. Furthermore, additional queuing capacity would be provided after the weighbridge prior to the delivery area.

Further details of access and egress arrangements and interactions with the EDL site, relocated PCYC mini-bike facility and proposed truck parking area (separate development applications) is provided in section 11.2.

6.2.3 Hours of operation

Some facilities, such as the biological plant and electricity generation plant, would operate automatically 24 hours per day, seven days per week, while others only operate during the periods when new waste is being delivered, and when material separation is occurring.

The project would receive waste from 6 am to 4 pm Monday to Friday and 6 am to 2 pm on public holidays. It is anticipated that waste processing would occur for up to 16 hours per day (5 am to 9 pm) from Monday to Friday.

6.2.4 Operation workforce

It is estimated that approximately 69 people would be employed when the project is fully operational, covering three shifts.

6.2.5 Onsite power generation

A power generation plant also forms part of the project. Biogas produced by the anaerobic digestors would be captured and used to generate electricity, with minimal releases to the environment. Approximately 2 MW per annum of electricity would be produced.

The energy requirements of the plant are estimated to be approximately 1 MW per annum during the day, when material is being received and processed, and 0.5 MW per annum at night, when only the tank farm is operating. The project would therefore export about 50% of the energy produced by the power plant during the day. At night, the plant would export up to 75% of the energy that it produces.

6.2.6 Emissions

Low odour emissions are one of the main features of the ArrowBio process. The main reason for this is that the wastes are immersed in water very early in the process. Continuous circulation of water within the vats would prevent anaerobic activity in the wastes and thereby reduce production of potentially odorous volatile organic compounds.

The building would be partially enclosed, with side sheeting used to shield workers from extremes of temperature and inclement weather, and prevent escape of windblown litter. Some vents and openings would enable fresh air to enter the building. The receival hall would be mechanically ventilated to improve worker comfort and meet occupational health and safety requirements relating to the use of front-end loaders and other fueled vehicles within the building. The ventilation system for the receival hall would either discharge through a biofilter or another odour scrubbing device. Alternatively, other methods such as ozone injection may be used to minimise odour emissions from the building.

The process hall, where most waste would be submerged in water, would also be partially enclosed, and would largely rely on natural ventilation, assisted by localized fume extraction systems to maintain comfortable working temperatures and meet occupational health and safety requirements. Natural lighting would be a feature of both areas.

The use of a water-based process minimises the amount of dust generated when waste materials are handled. This should lead to a more pleasant working environment in the processing area and minimize dust generation.

Odour emissions are discussed in detail in chapter 10.

Noise sources in the plant include pumps with steady (but low) noise emissions, and conveyor systems, which are relatively quiet. Noise associated with material handling is controlled by careful selection and design of the equipment.

Noise measurements taken within the plant in Tel Aviv, Israel by GHD indicated that the maximum noise level within the plant was below 85 dBA, the industrial standard. This means that workers would not need to wear hearing protection in most areas. This would benefit both the plant operators and workers.

Noise emissions are discussed in detail in chapter 15.

6.3 Process description

The project involves two parallel processing lines, which can be operated independently during periods of low demand. The main stages are as follows:

- Receival hall
  - Receival of municipal solid waste and pre-treatment (removal of large items not suitable for processing
- Process hall
  - Water based and mechanical material separation and recovery of recyclables
- Biological plant
  - Biological treatment

– Biogas production and electricity generation
– Stabilised sludge production

The functions and components of each stage are described in Figure 6-6 below.

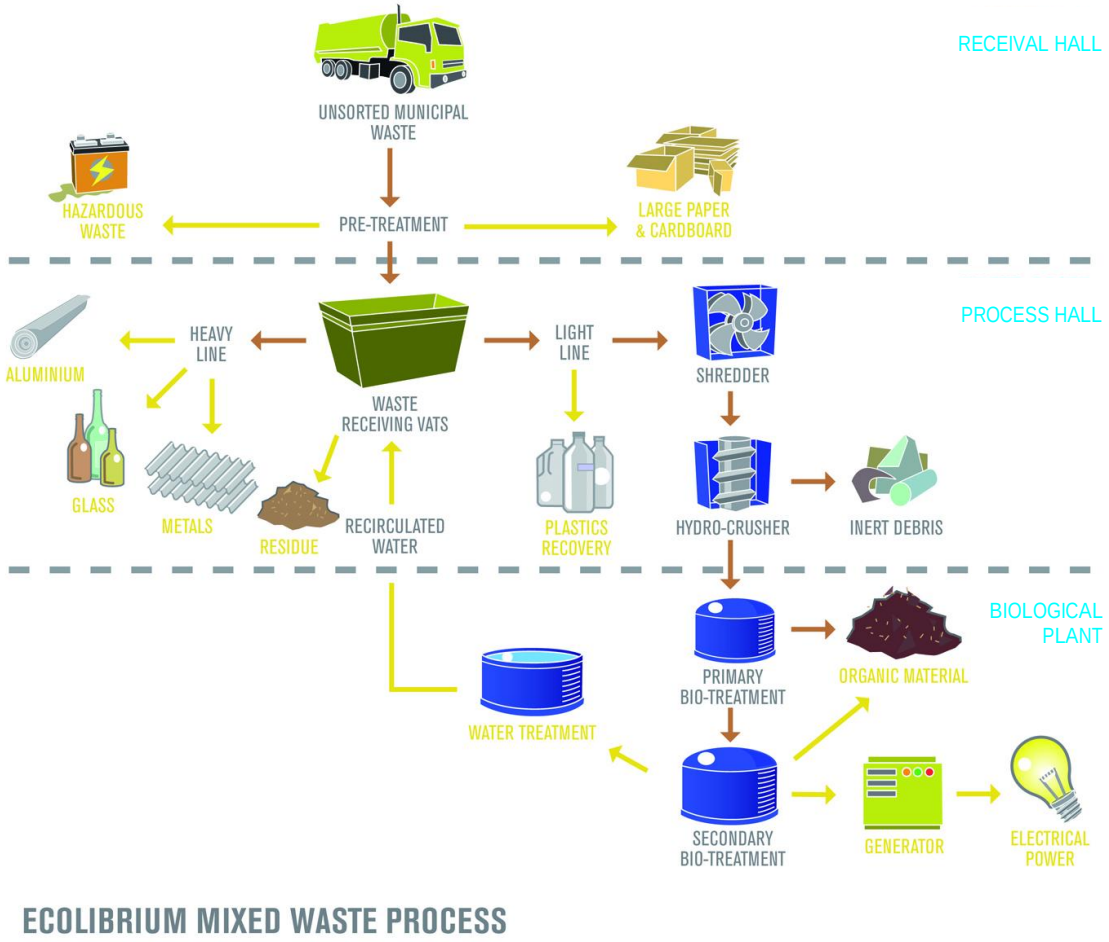


Figure 6-6 ArrowBio municipal waste process flow diagram

6.3.1 Receival hall

Most waste would be delivered to the receival hall by council or contractor garbage compactor trucks. These would reverse and stop just short of the roller doors, which will be opened to enable the loads to be discharged onto the tipping floor. The tipping floor level would be approximately 3 m below road level, to prevent waste from blowing out of the roller door opening when they are opened.

Once the waste has been tipped, the doors would automatically close. Any waste that has spilled out of the truck onto the road surface during tipping would be swept up by the worker supervising the drop-off procedure.

Waste deliveries would depend upon council domestic waste collection times, which generally occur in the mornings, on weekdays. As such, waste would often be received more quickly than it can be

processed, especially during peak times. However, any waste delivered to the receival hall would normally be processed within 8 hours of being delivered.

Within the receival hall, a front end loader would be used to remove large items from the waste prior to putting it into a hopper that feeds the first plant conveyor. Where possible, large inorganic/non-recyclable items (such as car batteries) that are not suitable for processing would be identified by the front-end loader operator and segregated from the rest of the waste, prior to loading. The front-end loader would deposit these in a large rejects bin. The bin would be emptied into larger roll-on roll-off bins located outside in the transfer annex, for eventual disposal in landfill.

Figure 6-7 Receival hall (MRRP)

The remaining waste on the floor would be scraped up by a front-end loader, and put into a loading chamber or hopper. A slow conveyor would then transfer the material past a manual sorting bay, where car batteries, cardboard and other large items would be removed. The balance of the material would pass through a trommel, which would break open some of the plastic bags and spread the waste more evenly along the loading conveyor for the main processing and separation stage.

Waste could be transferred direct to landfill in the event of unscheduled plant down-time.

Figure 6-8 Sorting line (MRRP)

6.3.2 Process hall

In the process hall, the waste would be immersed in one of two vats of water. This would assist in separation of organics from the non-organic materials, such as recyclables.

The organics would mainly dissolve in water to form a watery slurry, which would be preconditioned and pumped to the tank farm for biological treatment. The water used in the process would be recirculated throughout the system.

The main items of plant in the separation stage would be as follows:

- Receival trough, sorting conveyor and inspection stations;
- Primary sorting pool and immersion paddle;
- Light and heavy stream conveyors;
- Coarse trommel, fluidisation duct and compactor;
- Magnetic separator and eddy current separator;
- Secondary vat;
- Light and heavy stream conveyors;
- Shredder and hydrocrusher;

- Fine, medium and coarse separation screens;
- Sand and glass settlers, and
- Liquid slurry pumps to biological processing.

Water released from the incoming waste would increase the volume of water in the process each day. To offset this, approximately 40 kL of water would be removed from the process each day to prevent excessive build up of salts. Fresh water would be gradually added to the system to replenish the process water drained from the system. This water would be sourced from the first flush stormwater dam. Water stored in the stormwater retention dam would also be available. In low rainfall periods, potable water may need to be used.

In the vats, the heavy and light components of the recyclable stream would separate under the influence of gravity, and organics such as food particles would dissolve in the water, to create a slurry or light liquid.

Heavy inorganic components like glass, batteries, stones, aluminium and steel cans would sink to the bottom of the vat. A conveyor would then transfer these materials to the heavy materials line where a number of physical separation mechanisms including magnets (to recover ferrous metals), eddy current separators (to recover aluminium) and manual sorting (to recover glass) would be applied. The balance of the material would be collected in waste bins for landfill disposal.

Light components like paper, cardboard, plastics, biodegradable organics (including food scraps) and unopened plastic bags would float in the vat and be scraped off the surface onto an inclined conveyor. Plastic bags would pass through a shredder/bag opener, and through a trommel, and the material that was inside the bags would re-enter the vats for processing.

Paper and plastics would be continuously extracted using an air classifier. A number of screens, settling tanks and traps would remove sand, stones, small batteries and glass pieces. These would be disposed of to landfill.

The organic slurry from the vat would enter a hydrocrusher, to be pulverised into very fine pieces. The slurry containing mainly biodegradable material, such as organic matter, paper and other substances, would be pumped to the biological plant for biological treatment.

6.3.3 Biological plant

The main function of the biological plant would be to convert the readily biodegradable putrescible waste into biogas and stabilised sludge and to dewater the stabilised sludge and other organic biomass. This biogas is provided to the gas power plant. A flare unit would burn the gas should there be excess gas, insufficient gas to run the generators or the power plant is unavailable.

Two parallel biological processing streams would operate within the biological plant. This allows for temporary shutdowns of a single line, during periods of low demand, or to meet operational and maintenance requirements. The main components of the biological plant are as follows:

- Four acidogenic tanks;
- Medium and fine screens;
- Two belt filter presses;
- Two methanogenic tanks;

- Two plate and frame filter press;
- Biogas storage (double membrane);
- Biogas engine and generators (2 MW);
- Two flares; and
- Heat exchangers, water heater, chillers, condensers and moisture separators.

Figure 6-9 Biological plant (MRRP)

In addition, there would be small wastewater treatment plant, which would treat process water from the plant, to reduce its biological content. The main components of the water treatment plant would be as follows:

- Balance tank;
- Polishing tank;
- Treated water tank; and
- Pumps, blowers and air compressors.

Biological treatment

The slurry would undergo two processes in the biological tanks, orchestrated by naturally occurring micro-organisms. In the first acidogenic tank, fermentation would be used to transform complex organic material into simpler organic acids and fatty acids. In the second acidogenic tank, the matter would be heated to 35-40ºC, using hot water generated from exhaust gases from the on-site gas engines.

The slurry would be transported to the methanogenic fermentation tank for anaerobic degradation of the organic materials. This reactor would be an upflow anaerobic sludge blanket design. In this type of system the suspension is introduced from the bottom of the digester, upward through a sludge blanket composed of biologically formed granules. Treatment occurs as the suspension comes into contact with the granules.

In the methanogenic digester, pH and temperature would be closely controlled to optimise the conversion of the products from the first stage to biogas rich in methane. The optimum conditions (such as pH and temperature) for methanogenesis are different from those required for hydrolysis and acidogenesis, and the reactions are much slower. This is why the ArrowBio process separates the two reaction steps.

The products from this methanogenic stage would be:

- Biogas;
- Wastewater, a portion of which is recycled to the waste pre-preparation tank (some is disposed of to the wastewater treatment plant); and
- Stabilised sludge.

Biogas production and electricity generation

The biogas produced on-site would be stored in an inflatable buffer tank, and is used for generating electricity in two 1 MW on-site gas engines. An on-site flare would burn any excess gas that cannot be used by the engines. The waste heat from the engine exhausts would pass through a heat exchanger, where it would be used to heat water. The water would then be used to heat the second stage acidogenic tank, as part of the co-generation cycle.

In the event that the biological plant shuts down, and during initial start-up, the acidogenic tank would need an external source of heat to bring it up to temperature. This would be provided by a hot water boiler, fired by either gas or diesel (subject to natural gas availability). The boiler may also operate at other times, depending upon heating requirements.

Stabilised sludge production

The solid digestate component would be dewatered in a solid/liquid separator and the water component recirculated back into the initial pre-sorting water vat. The digestate would then be dewatered in a filter press or belt press. There is potential for this dewatered material to be blended in compost materials or sold as a quality stabilised sludge product subject to future approval. Initially, it would be disposed of to landfill, until appropriate testing has been undertaken and regulatory approval obtained for alternative uses.

Any remaining water would be treated in the wastewater treatment plant in a sequencing batch reactor, and stored in separate tanks for industrial uses. This water could then be used for irrigation, firefighting purposes or for washing waste transport vehicles. Off-site markets for this water could also be explored, once water quality parameters are established.

6.4 Mass balance

The project would produce a number of products, broadly categorised into biogas, recyclable materials, stabilised sludge and water. When the facility is operational, more than 70% of the total incoming municipal solid waste stream would be recovered and diverted from landfill.

This is summarised as follows:

Municipal solid waste received	100,000 tonnes/yr

Equals:

Recyclables recovered	20,000 tonnes/yr
Residuals/rejects landfilled	30,000 tonnes/yr
Stabilised sludge produced	18,000 tonnes/yr
Water produced	12,000 tonnes/yr
Methane produced	5,000 tonnes/yr
CO_2 and moisture loss	15,000 tonnes/yr

Residuals and stabilised sludge would be landfilled at the LHWRC, while recovered recyclables would be sent to market.

6.5 Recyclables recovered

Approximately 80% of available recyclable material would be recovered. This would comprise paper, plastics, glass, ferrous and non-ferrous metals.

6.6 Quality of final products

The quality of biogas and stabilised sludge is discussed below. Process water quality is described in section 6.7.

Biogas

Table 6-1 shows the results of analysis on the biogas provided by Arrow Ecology Ltd from the Tel Aviv plant[1] to demonstrate the relatively low concentrations of volatile organics produced by the anaerobic digestion process.

Table 6-1 Summary of biogas analysis from the Tel Aviv plant

Analyte	Concentration in Biogas
Methane %	81
Carbon dioxide %	17.5
Hydrogen sulphide (ppm)	90
Oxygen (ppm)	<0.5
Ammonia (ppm)	1.3
Chlorine (ppm)	<1
Fluorine (ppm)	<1
Bromium (ppm)	<1
Benzene Toluene Ethylbenzene Xylene (ppm)	<1
Mercaptons (ppm)	0.9

[1] A similar plant is currently operating in Tel Aviv, Israel, which has a capacity of approximately 30,000 tonnes per year, or 100 tonnes/day.

Analyte	Concentration in Biogas
Sulphur (ppm)	<1
Methylsulphide (ppm)	<1
Vinyl Chloride (ppm)	<1
Chloroform (ppm)	<1
Carbon tetrachloride (ppm)	<1
Chlorobenzene (ppm)	<1
Ethane (ppm)	<5
Butane (ppm)	<5
Ethylene (ppm)	<5
Ethanol (ppm)	<1
Isopropyl Alcohol (ppm)	<1
Acetone (ppm)	<1

The results indicate that approximately 99% of the gas produced by the anaerobic digestion process is methane or carbon dioxide, with very low concentrations of odorous compounds such as hydrogen sulphide and mercaptons.

Stabilised sludge

Sludge samples were collected from the acidogenic and methanogenic tanks of the Tel Aviv plant in October 2007 and tested for 11 priority metals and 46 trace organic compounds. The 90th percentile results of the sludge analysis for the 11 priority metals are shown in Table 6-2, none of the organic constituents tested were detected and are therefore not shown.

Table 6-2 also shows the criteria for the two highest levels (Grade A and Grade B) from the NSW Biosolids Guidelines. The biosolids guidelines provide some interim guidance in respect of potential beneficial uses for organic materials for land application. Guidelines for the use of organics derived from municipal solid waste treatment processes are not yet in existence, however some work is currently being done by the Waste Management Association of Australia to determine the contaminants of concern, and propose limits for these contaminants. Currently there is a need to seek regulatory approval from DECCW to beneficially re-use any municipal waste derived organic material.

An additional nine metals were also tested (with no regulatory levels set for them), as well as the moisture content for the two types of sludges. The results of these tests are shown in Table 6-3.

Table 6-2 90th percentile composition of metals in various sludges

	Acidogenic (ppm)	Methanogenic (ppm)	Regulatory Grade B [in () Grade A] (ppm)	Source for Regulatory Limit (ppm)
Arsenic (As)	2.50	3.3	20 (20)	a
Beryllium (Be)	0.07	0.13	2 (2)	b
Boron (B)	90.20	45	200 (100)	c
Cadmium (Cd)	1.45	1.5	5 (3)	a
Chromium Total (Cr)	24.66	42.2	250 (100)	a
Copper (Cu)	127.80	180	375 (100)	a
Lead (Pb)	46.00	60.4	150 (150)	a
Mercury (Hg)	1.50	1.5	4 (1)	a
Nickel (Ni)	19.14	39	125 (60)	a
Selenium (Se)	1.50	2.5	8 (5)	a
Zinc (Zn)	461.60	578.8	700 (200)	a

a - NSW EPA (October 1997, Amendment July 2001) *Environmental Guidelines: Use and Disposal of Biosolids Products*

b - NSW EPA, *Environmental Guidelines: Assessment, Classification & Management of Liquid & Non-Liquid Wastes*, Tables A2 & A3

c - Australian Standards , *AS 4454 – 2003: Composts, soil conditioners and mulches*, Table 3.1

Table 6-3 Composition of additional nine metals and moisture contents in sludges

Metal / Moisture content	Acidogenic (Average) (ppm)	Methanogenic (Average) (ppm)
Antimony	1.40	1.85
Cobalt	2.41	3.35
Manganese	102.08	154.87
Molybdenum	3.13	4.08
Phosphorus (total)	3620.77	4969.93
Sulfur (total)	4919.15	6226.07
Tin	10.75	12.75
Vanadium	4.50	6.65
Moisture content (%)	97.08	92.92

Results indicate that concentrations of regulated metals were consistent within regulatory standards/levels. Consequently, in line with the Biosolid Guidelines, the methanogenic and acidogenic sludges meet quality standards for metals (Contaminant acceptance threshold, Grade B) and pathogen reduction and vector attraction reduction (Stabilisation Grade B). Overall, both sludges fall under 'Classification Restricted Use 2', which allows (subject to specific requirements) land application use for the following purposes:

- Agriculture
- Forestry
- Soil and site rehabilitation
- Landfill disposal
- Surface landfill disposal (e.g. alternate daily cover)

Any improvement in concentration levels for copper, mercury and zinc (for example, through improvements to pre-treatment sorting techniques), could lead to a re-classification to 'Restricted Use 1', which in turn may allow for land application use on public contact sites and for Urban landscaping.

The proponent intends to implement a testing and sampling regime for the stabilised sludge material as part of seeking future approval to permit the material to be applied to land on or off-site as a soil conditioner. In the interim period, while guidelines for such materials are being developed and data is being collected, the proponent proposes to dispose of this material in the LHWRC landfill.

6.7 Water management

6.7.1 Potable water supply

Potable water required for showers and drinking water would be provided to the site from the existing water main that currently supplies the LHWRC. The estimated quantity of potable water required for the plant is 10 kL/day, based on 69 workers over 3 shifts.

6.7.2 Sewage disposal

Sewage collected from 'domestic' sources (i.e. workers sinks, showers and toilets, etc) would be discharged to sewer.

From the 69 workers, the estimated domestic wastewater produced is estimated at 9 kL/day.

6.7.3 Process water balance

The process water balance for the project, based on processing 100,000 tonnes per year of municipal solid waste is outlined in Table 6-4.

Table 6-4 Process water balance

Inputs:		
Moisture from input waste	100 kL/d	
Water produced by anaerobic digestion	50 kL/d	
	TOTAL INPUTS	150 kL/d
Outputs:		
Moisture in recycled material	20 kL/d	
Moisture in stabilised sludge	40 kL/d	
Evaporation	50 kL/d	
	TOTAL OUTPUTS	110 kL/d
Net water produced:		
Process water surplus		40 kL/d

The net process water produced by the project would be approximately of 40 kL/day, on average. This is because of accumulation of the moisture contained in the incoming waste, and water produced by the biological treatment processes. Some of this excess water would be lost as evaporation, and as moisture in recycled materials and sludge. However, to balance the continual water inflows, an equivalent volume of water to that being accumulated (40 kL/day) would be discharged from the process daily.

This water would be treated in the on-site wastewater treatment plant, which would use a sequencing batch reactor process to reduce biological activity in the water to the levels illustrated in Table 6-7, so that it meets the requirements for sewer disposal under a Sydney Water trade waste agreement.

Indicative water quality data for the project, based on a similar facility in Tel Aviv[2], and a comparison with Sydney Water trade waste acceptance standards is provided in Table 6-5.

Table 6-5 Water quality characteristics of process water

	Characteristics (mg/L except for pH)	Sydney Water trade waste acceptance criteria (mg/L except for pH)
pH	7.7	7-10
COD	618	
BOD	66	
General oil	< 5	
Mineral oil	< 10	
Sulphides	1 5	
Suspended Solids	5	600
Boron (B)	0.1	2

[2] A similar plant is currently operating in Tel Aviv, Israel, which has a capacity of approximately 30,000 tonnes per year, or 100 tonnes/day.

	Characteristics (mg/L except for pH)	Sydney Water trade waste acceptance criteria (mg/L except for pH)
Chromates	< 0.05	
Cyanides	< 0.1 1	
Silver (Ag)	< 0.05 5	
Aluminium (Al)	0.2	100
Arsenic (As)	< 0.1	1
Barium (Ba)	0.6	100
Beryllium	< 0.01	
Calcium (Ca)	226	
Cadmium (Cd)	< 0.01	1
Cobalt (Co)	0.02	5
Chromium (Cr)	0.01	3
Copper (Cu)	< 0.05	5
Iron (Fe)	1	50
Mercury (Hg)	< 0.05	0.03
Potassium (K)	144	
Lithium (Li)	< 0.05	10
Manganese (Mn)	0.2	10
Molybdenum (Mo)	< 0.05	100
Nickel (Ni)	< 0.05	3
Phosphorus (P)	10	
Lead (Pb)	< 0.1	2
Sulphur (S)	11	
Selenium (Se)	< 0.05	5
Strontium (Sr)	0.8	
Titanium (Ti)	0.02	
Vanadium (V)	0.01	
Zinc (Zn)	< 0.05	5
Ammonia	< 30	50
Grease	< 30	110
Sulphite	< 20	30
Petroleum hydrocarbons (non-flammable)	None	30
Petroleum hydrocarbons (flammable)	None	10
Phenolic compounds (nonchlorinated)	<< 10	10
Polynuclear Aromatic Hydrocarbons	<< 5	5
Volatile Halocarbons	None	2
TSS	5	mg/L
TDS	<500	mg/L

6.7.4 Water re-use

Stormwater

The first 10 mm of stormwater falling on the paved areas would be collected in a first flush dam. This has been sized at approximately 105 kL using the RAFTS analysis program. Excess stormwater that bypasses the first flush dam would then overflow into a stormwater retention dam, which would be designed to prevent rates of discharge of stormwater from the site exceeding current rates of discharge. Simulation of the current site stormwater flows has been used to calculate a size for this retention dam of approximately 400 kL.

Within the base of the retention dam, there would be some capacity to store stormwater, which would enable retained stormwater to be used for irrigation of revegetated areas of the larger LHWRC site, during dry weather conditions. During wet weather, the revegetated areas produce significant rainfall runoff, which is collected in a stormwater pond elsewhere on the larger LHWRC site for later re-use. Therefore excess stormwater would need to be permitted to flow offsite into the natural catchments during these wet weather periods.

The contents of the first flush tank would be directed back to the ArrowBio plant, which would enable it to be reused as process water. This inflow of water would cause an equivalent amount of process water to be discharged from the system. The fate of this water is discussed below.

Rainwater collected from the roofs of the site buildings is considered to be uncontaminated, and would therefore be directed to rainwater tanks alongside the building for internal use for non potable amenities e.g. toilet flushing, and for fire fighting. Overflow from the rainwater tanks and from areas of the roof not served by rainwater tanks would be discharged to the firefighting water tanks, which would overflow to the site stormwater drains, which drain to the site stormwater retention dam referred to above.

Table 6-6 Stormwater dam sizing

Stormwater basin sizing		
Catchment areas		
Roof	0.56	ha
Bunded	0.64	ha
Other area to be collected	1.05	ha
Total	2.25	ha
Volumes		
10mm first flush volume	105	kL
Retention dam volume	400	kL

Process water

After being treated by the onsite wastewater treatment plant, to the standard required for sewer disposal as trade waste, most excess process water would be temporarily stored in a process water dam on the site. Some of this water would be further treated and disinfected and stored in a tank within the plant so that it can be used for daily washing of equipment and floors. This dirty washwater would be collected in a sump and pumped into the waste separation process. Excess water from the process would be pumped to the on-site wastewater treatment plant.

The process water dam would have a high permeability liner system to protect the underlying groundwater. Some of the treated process water may be able to be used for irrigation of revegetated areas, and dust suppression. However this water may need to be further treated before these types of uses are contemplated to ensure that it meets health and environmental requirements.

The proposed water management system (subject to final design requirements) is described below and illustrated in Figure 6-10.

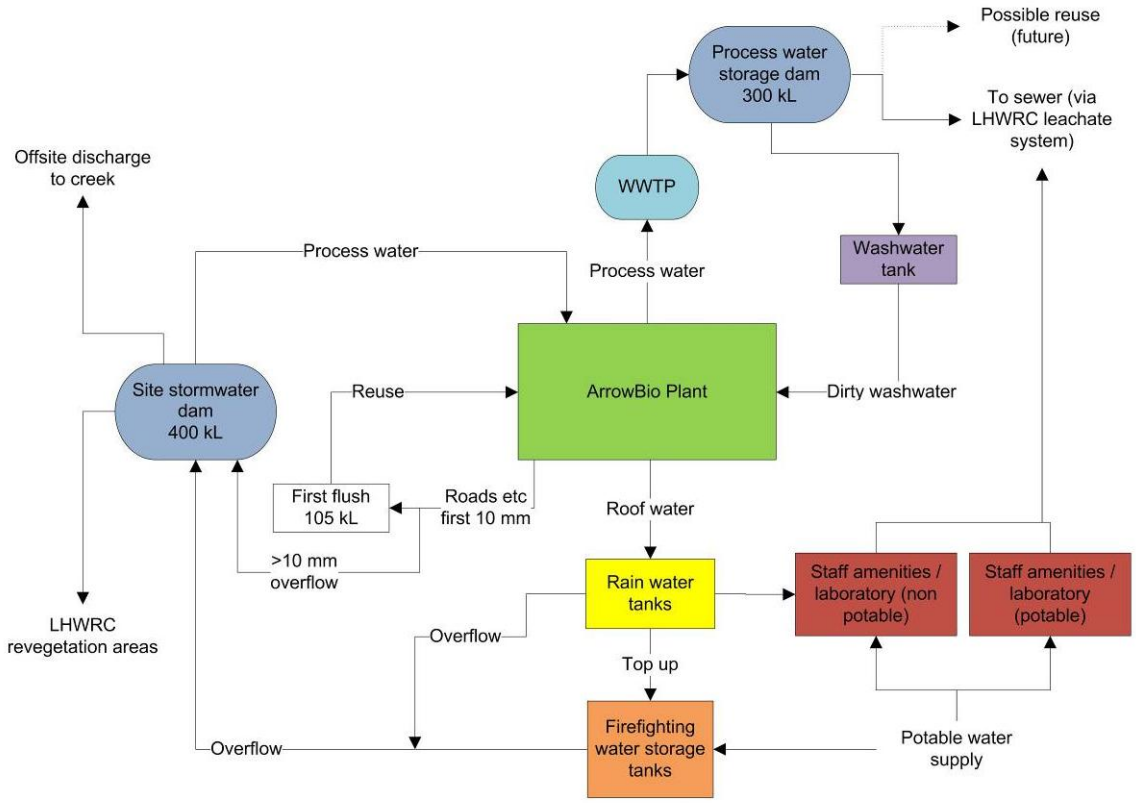


Figure 6-10 Proposed water management system

Excess process water would be pumped from the process water dam and disposed of to sewer via the existing LHWRC leachate system, which has sufficient hydraulic capacity to accommodate this wastewater, outside of wet weather periods. The process water dam would have approximately 300 kL capacity, which would enable it to store up to one week of process water during an extended wet weather period. In some extreme weather events, this process water (estimated at 40 kL/day) may be required to be tankered off site to an approved wastewater treatment facility.

While there are a number of other potential future off-site reuse options including municipal irrigation (e.g. golf course or public spaces) and agricultural / industrial uses, they are not integral to the proposal, and have not been examined as part of this environmental assessment.

Any off-site reuse option carries a degree of risk as it allows for exposure by third parties. Therefore, in addition to any treatment required to meet the applicable discharge / reuse criteria, the water may require specific treatment to minimise risks.

Until the characteristics of the wastewater are better understood, any excess process water that could not be re-used on site (especially during wet weather periods) would therefore be discharged to sewer. Criteria for future beneficial reuse are provided in Table 6-7.

Table 6-7 Relevant wastewater and effluent re-use criteria

Parameter	Beneficial reuse – recreational[1] (controlled access) mg/L	Residential reuse (non-potable)
pH	6.5 – 8.5	6.5 – 8.5
BOD	20 <40 (is classified as a low strength effluent)	
TSS	30	
TDS	Note 2 (<500 is classified as a low strength effluent. For effluents >1500 only salt tolerant plants can be irrigated).	
Total Phosphorous	Note 2 (<10 is classified as a low strength effluent)	
Total Nitrogen	Note 2 (<50 is classified as a low strength effluent)	
Level of treatment required	Secondary plus pathogen reduction	Tertiary and pathogen reduction (1 mg/L Cl_2 residual after 30 min or equivalent)

1 Includes consideration of: NSW Guidelines for Urban and Residential use of Reclaimed Water, National Water Quality Management Strategy, Guidelines for Sewerage Systems, Reclaimed Water, NSW Health Department

2 Generally dependent on-site specific conditions or determined through nutrient balances etc.

6.8 Spill containment

The project would include various outdoor tanks containing liquids in various stages of biological treatment, as well as vats and tanks within the process hall. These have the potential to leak or rupture and such events must be allowed for in terms of bunding of specific areas that present the highest risk.

The processing building floor would be marginally above road level. Any leakage from the vessels in the building would be captured by the floor drainage system, which would drain to local sumps within the building. Water from these sumps would be pumped into the process. Any catastrophic failure of a vessel in the building would be captured by the site's first flush system, which would have a capacity of approximately 105 kL.

Surface rainwater from the first flush (10 mm) would be pumped into the biological plant. This return pumping would occur over a two day period. Rainwater from the building roof would be captured in a stormwater tank and reused as process and washdown water at the site. Some of this water would be used to fill the fire fighting tanks located onsite. Surface rainwater in excess of the first flush volume would drain directly to the site stormwater retention dam via gravity, for on site reuse.

To contain a tank spill, a mini bunded area at the biological plant would be constructed using rollover kerbs, which would provide the necessary containment volume (1110% of the largest tank volume). Normal light rain would soak into the ground at the site.

6.9 Fire fighting system

A dedicated fire fighting system is proposed, which would comprise two dedicated fire water only storage tanks (300 m^3 total volume), an electric fire pump and a diesel fire pump, and a fire hydrant main covering the whole site, hose reels and fire engine connection point as required.

A minimum required level in the tanks (four hours of water storage for fire fighting) to satisfy the Australian Standard would be provided by potable water from the town. This type of system would satisfy AS 2419.1 "Fire Hydrant Installations", AS 2941 "Fixed Fire Protection installations – Pumpset Systems" and the Building Code of Australia. Rainwater from the roof would be used to top up the fire water tanks.

There would be two fire pumps - an electric fire pump and another diesel powered pump that can be used in the event of a power failure (due to a bushfire for example).

6.10 Power supply

The site would require approximately 1 MW of electricity in order to run all of the processing equipment, plant lighting and the offices and amenities. Whilst the on-site generators would provide this power once the plant is fully operational, and would export energy to the grid, sufficient power there would need to be provided from the grid to run the plant when the generators are not operating.

A new connection to the grid would likely be from New Illawarra Road. Arrangements to provide power to the site are currently being made by the proponent. Final details would not be available until the detailed design and procurement phase of the project is completed.

6.11 Gas supply

Natural gas or diesel may be required to run booster hot water boilers at the plant. These would be used for maintaining optimum operating temperatures in the digesters, during the colder months. Diesel is used to fire the boilers at the ArrowBio plant at MRRP because of the absence of a natural gas main. Once the duty requirements for booster heaters at the MRRP plant are established after commissioning, this will enable the feasibility of providing a permanent natural gas supply to be investigated and compared with the option of using diesel. This would be done as part of the detailed design and procurement phase of the project.

6.12 Construction of the project

6.12.1 Construction program

A 18 month construction program is envisaged, involving approximately 6 months of earthworks to prepare the site and install site drainage and temporary roads, followed by another 12 months for construction and installation of site buildings, process tanks, generators and other major site infrastructure such as external electrical supply and transformers.

Installation of processing plant and tank farm pipework and dry commissioning of equipment would take another 12 months. Additional time (an estimated 6 months) would be required for commissioning the plant with waste (wet commissioning).

6.12.2 Plant construction sequence and staging

Construction of the project would generally involve the following construction activities and sequence:

- Preparation of a construction environmental management plan;
- Pre-construction identification and marking of sensitive areas as identified in the environmental assessment and in the construction environmental management plan;
- Implementation of the construction communication plan, including the construction hotline;
- Establishment of permanent and temporary fencing, work compounds and access;
- Construction and line marking of construction roads and installation of traffic controls;
- Installation of temporary erosion, sediment and water quality controls;
- Clearing of vegetation;
- Stripping, stockpiling and management of topsoil;
- Utilities provision (electricity, water, sewerage);
- Bulk earthworks and platform construction;
- Installation of permanent drainage lines;
- Subgrade preparation and pavement works on the platform;
- Building and tank farm construction;
- Installation of mechanical equipment and wiring; and
- Commissioning of equipment.

In parallel with installation and commissioning of equipment, other site works would be undertaken including:

- Landscaping of site (as per Figure 6-11);
- Completion of site access road;
- Linemarking and signposting of road and facility;
- Installation of lighting; and
- Finishing works.

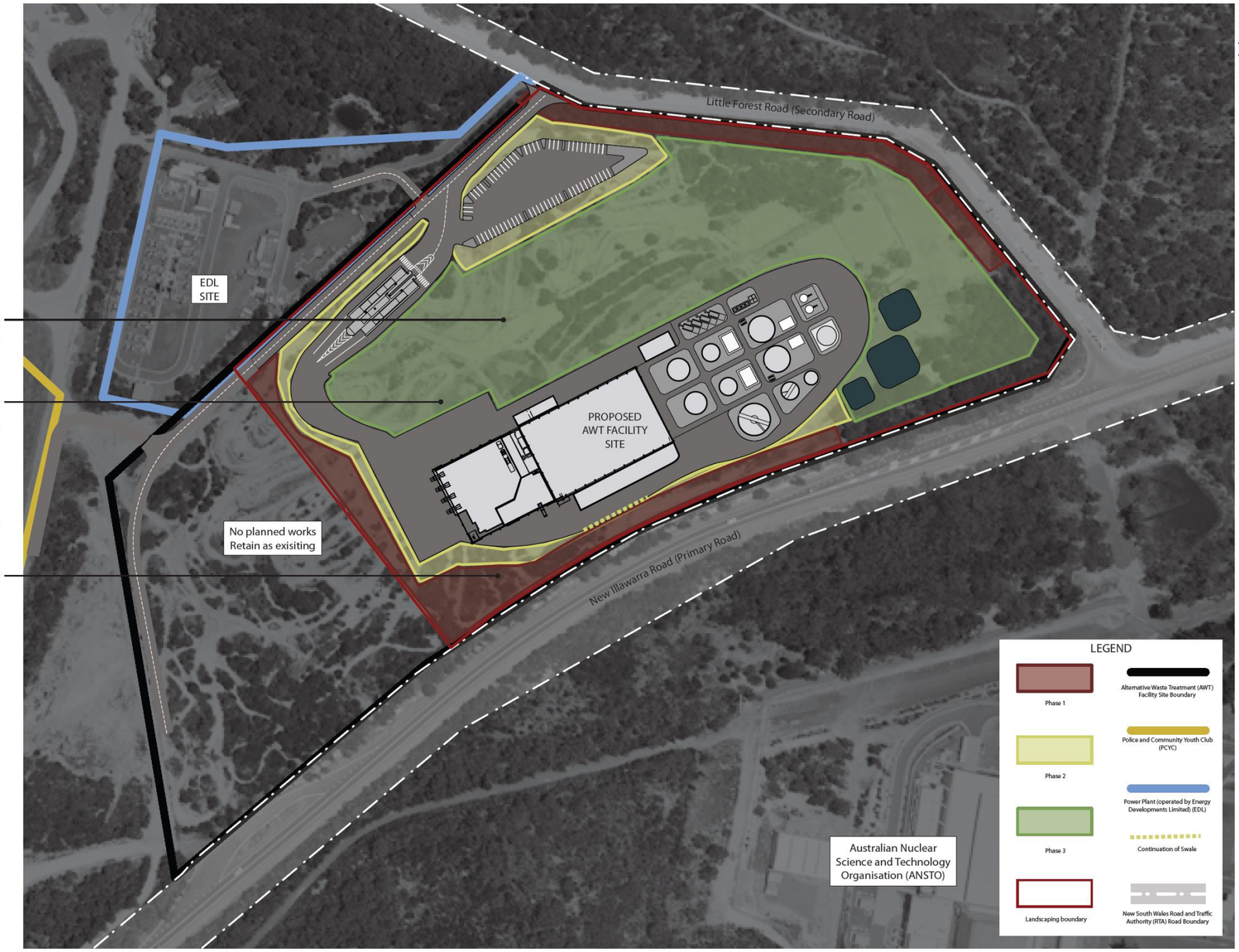


Figure 6-11 Proposed landscape phasing & prioritisation

The exact construction methods would be determined by the contractors at the time of construction, but would generally follow the sequence outlined above. All works would be undertaken in accordance with the following:

- The WSN General and Technical Specifications for Waste Management Centres/Facilities;
- The statement of commitments presented in this environmental assessment;
- Project approval conditions; and
- The contractor's environmental management plan.

6.12.3 Equipment used

Equipment used during construction would include the items listed below.

- Bulldozers
- Concrete mixers
- Compactors
- Backhoes
- Excavators
- Mobile cranes
- Loader
- Paving machine
- Grader
- Water trucks
- Concrete trucks
- Dump trucks

6.12.4 Construction hours

Construction activities would be restricted to between 7.00 am and 6.00 pm Mondays to Fridays and 7.00 am to 1.00 pm on Saturdays. No construction work would be undertaken on Sundays or public holidays.

Construction work may be permitted outside of the hours specified above, however, this would be subject to consultation with the NSW DECCW and Sutherland Shire Council.

6.12.5 Construction workforce

It is anticipated that the peak construction workforce on the site is likely to be approximately 50 people. The average size of the workforce over the construction period is expected to be about 30 people. The workforce size would be determined by the contractors and would depend on the way in which work is scheduled and staged.

6.12.6 Sources of construction materials

All construction materials would be sourced locally where possible from commercial suppliers and manufacturers within the Sydney and Illawarra Regions.

6.12.7 Construction facilities

In addition to the physical footprint of the permanent works, the construction contractor would require the use of land adjacent to the permanent works for a range of construction related activities such as a site compound and storage areas. A description of the various ancillary construction facilities that could be required is provided below.

Site compounds and work areas

The contractor would require a site compound and work area for offices, plant, maintenance and storage of mobile plant and construction materials. The compound and work area would need to be fenced for safety and security, and would include site offices, ablution and toilet facilities, hard-stand areas for plant and vehicles as well as material storage.

Liquid and solid waste would be removed by tanker or trucks and disposed of off-site at an approved facility. Fuel and chemical storage areas would be bunded and protected in accordance with NSW DECCW requirements. A works compound site would be established within the site.

Stockpile areas

Stockpile sites would be located within the site. Stockpiles will be protected from erosion by mulching stockpile surfaces, erecting erosion and sedimentation fencing around the base of each stockpile, etc.

Spoil disposal areas

Balancing of cut and fill would avoid the need to establish large designated disposal areas. However, disposal of material that is determined unsuitable for use in embankments, as landscaping material or is in excess of required fill volumes would be required to be disposed of either on-site or off-site. According to preliminary geotechnical investigations most materials excavated would be reusable.

6.12.8 Potential future projects

The proponent is currently considering options in terms of development of other AWT facilities if demand indicates that they would be required. This site provides opportunities for the location of such facilities and the design of the project and site layout has ensured that it would not preclude any future development of the site for this purpose. Any future proposed AWT facility would be subject to a separate development application and approvals process.

The proponent is also considering locating a plastics processing plant on the site in the future. The aim of the plastics plant would be to shred, wash and granulate (pelletise) the plastic film recovered from the incoming waste to the AWT facility ready for transport off site for recycling or reuse. The feasibility of implementing this would depend on the quantity and types of plastic film that would be recovered from the project. Any future plastics processing plant would also be subject to a separate development application and approvals process.

6.13 Operation of LHWRC beyond 2024

The life of the project would be 20 years. The operation of the project would exceed the current approved life (2024) of the landfill at the LHWRC. After this time residual waste from the project would be transported off site for disposal at an appropriate Class 2 landfill. Consideration of potential impacts from offsite transport of residuals after 2024 has been provided in the relevant chapters of this environmental assessment.

PART C
Environmental Assessment

7. Environmental Risk Assessment

7.1 General environmental risk analysis

The Director-General's environmental assessment requirements for the project (Appendix A) establish the requirements for preparation of the environmental assessment under Part 3A of the EP&A Act.

The Director-General's requirements nominate the following as key issues for the assessment:

- Waste management;
- Soil and water;
- Odour and air quality;
- Traffic and transport;
- Greenhouse gas;
- Biodiversity;
- Hazards;
- Noise;
- Social and economic; and
- Visual.

Discussion of these issues is provided in the following chapters of this environmental assessment.

Table 7-1 provides a general environmental risk analysis relating to the project.

Table 7-1 General environmental risk analysis

Issue	Potential impacts	Comments
Land use and property	The project represents a conversion of land use from sporting (mini-bike tracks) to waste processing.	The mini-bike tracks will be relocated to the north west of the recycling resource recovery area on the LHWRC site.
	All construction works would be restricted to the site. The project would not have an impact on adjoining lands (e.g. ANSTO opposite) and would not impact on the Lucas Heights Conservation Area.	Not considered to be a key issue for the project.
	There would be no direct land use impacts on adjoining lands during operation of the project as the design includes sufficient land to be included within the site for operational purposes. The land is zoned for the use proposed.	Addressed in the Statement of Commitments (see chapter 20).
	Potential environmental amenity impacts on surrounding land uses involving noise is discussed in chapter 15.	
Topography and geology	The project would not adversely impact on the topography or geology of the site, as the project has been designed not to require deep excavations.	Not considered to be a key issue for the project.

Issue	Potential impacts	Comments
Soil and water	Construction impacts would result in a disturbance of soils, as cut and fill methods of levelling would be undertaken and some shallow excavation would be required. As a result, there is the potential for sediment movement. The project is not expected to have any acid sulphate soil impacts or impacts on local salinity. During the operational phase, impervious surfaces have the potential to result in changed storm water runoff characteristics. Potential impacts would be managed by implementation of environmental management measures as outlined by a soil and water management plan which would be a component of the construction and operational environmental management plans, and by the water management features that form part of the design (described in section 6.7)	The Director-General's Requirements identifies this as a key issue. This issue is addressed in chapter 9.
Odour and air quality	Construction of the project has the potential to result in minor air quality impacts (e.g. particulate matter disturbance). The impact on local air quality would depend on materials used, equipment and local weather conditions. Potential impacts would be managed by implementation of environmental management measures as outlined by the construction environmental management plan. The project is a potential source of odour, however off-site odour levels are expected to be able to be maintained at acceptable levels for the existing developments in the area. The design of the project includes a number of measures to minimise odour and air quality impacts such as the receival hall and processing building being partially enclosed. These features are described in section 6.2.6 None of the potential odour and air quality impacts are likely to affect local amenity in residential or commercial areas due to the distance of the site from nearby sensitive receivers.	The Director-General's Requirements identifies this as a key issue. This issue is addressed in chapter 10.
Traffic and transport	During construction, additional traffic movements would occur for delivery of construction materials and site construction personnel. Operation of the project would result in increases in traffic with delivery of waste to the facility. The project is located on a sub-arterial road, which provides easy access to the arterial road network. Although the project would result in additional traffic visiting the site (approximately 39 trucks per day on average), the traffic would access the site via the arterial road network and would be accommodated by the existing external road network and intersections.	The Director-General's Requirements identifies this as a key issue. This issue is addressed in chapter 11.

Issue	Potential impacts	Comments
Greenhouse gas	Greenhouse gas emissions (scope 1 and 2) associated with construction of the project would predominantly be from fuel use in construction equipment and electricity use from site amenities. Operation of the project would also generate greenhouse gas emissions, from mobile plant and equipment, site electricity consumption and transport of residuals to the adjacent landfill. However the project is also expected to export power to the electricity grid – offsetting coal-fired power generated electricity (a greenhouse gas credit), and this would outweigh the emissions that occur during the construction period. Where practicable, the detailed design of the project would be undertaken with energy efficiency in mind. For example, the efficiency of the motors used for the equipment would be assessed prior to purchase.	The Director-General's Requirements identifies this as a key issue. This issue is addressed in chapter 12.
Biodiversity	The project would require an area of approximately 3.5 ha to be cleared. However it is highly unlikely that the project would have a significant adverse impact on threatened species, endangered ecological communities or their habitat, given that the project will be located in an area that is already heavily disturbed and no threatened species or communities have been recorded on site.	The Director-General's Requirements identifies this as a key issue. This issue is addressed in chapter 13.
Hazards	A preliminary hazard analysis (PHA) was undertaken for the project which concluded that the SEPP 33 threshold screening value for dangerous goods is not exceeded by any of the proposed dangerous goods to be stored. Additionally, the transportation screening thresholds are not exceeded by any of the dangerous goods. The qualitative risk assessment/hazard identification study identified hazard scenarios, and concluded that only one scenario presented an unacceptable risk – fire or explosion of biogas – but the PHA found that this scenario does not exceed risk criteria and operation and engineering controls would minimise the risk to as low as reasonably practical. Furthermore, implementing a comprehensive safety management system would ensure that hazards associated with the site are identified and managed, so that all activities are undertaken in a safe manner. A bushfire assessment was also undertaken which concludes that the project would meet the aims and objectives of Planning for Bushfire Protection (RFS 2006) and that reasonable overall bushfire protection outcomes may be achieved by implementing appropriate mitigation measures.	The Director-General's Requirements identifies this as a key issue. This issue is addressed in chapter 14.

Issue	Potential impacts	Comments
Noise	Potential noise impacts of the project during construction and operation are expected to be minimal and would comply with design goals at nearby sensitive receivers.	The Director-General's Requirements identifies this as a key issue. This issue is addressed in chapter 15.
Social and economic	The project is not expected to result in significant social and economic impacts. Amenity impacts such as noise, air quality, traffic, visual and hazards are discussed separately in this risk analysis. It is anticipated that the health of the community would not be adversely impacted by the project. In terms of economic impacts, the project would provide employment for up to 50 workers during construction and up to 69 personnel during operation. This would have flow on (indirect) benefits to the local and wider community.	The Director-General's Requirements identifies this as a key issue. This issue is addressed in chapter 16.
Heritage	It is considered that there is a low potential for the recovery of in situ Aboriginal objects on site. No Aboriginal archaeological sites, objects or places have been identified in the site. Furthermore, no historic heritage items or places identified on or near the site have been identified. The project is not expected to impact on cultural heritage (Aboriginal or non-Aboriginal heritage).	The Director-General's Requirements identifies this as a key issue. This issue is addressed in chapter 17.
Visual	The main potential impact is on the views of passing traffic along New Illawarra Road. On site landscaping (including that along the boundary of the site) as outlined in the site landscaping plan, would assist in ameliorating potential visual impacts. In addition, the design of the project would, where practicable, incorporate measures (such as the use of low reflective building materials) to reduce the potential visual impacts.	The Director-General's Requirements identifies this as a key issue. This issue is addressed in chapter 18.
Utilities and infrastructure provisions	The project is designed such that there would be net energy production during operation. It would be operated using 'green' energy generated from processing of the waste. Excess energy in the form of electricity would be fed back into the electricity grid. The project would require potable water and sewerage connections for operation of on site amenities. However as a whole, it would be a net water producer (refer section 6.7). Excess water would be treated and either reused on site or disposed of via the existing sewerage system. No new public roads would be required, however some new internal roads would be constructed as part of the project.	Not considered to be a key issue for the project. Addressed in the Statement of Commitments (see chapter 20).

Issue	Potential impacts	Comments
	The project would connect to the existing road, water, electricity and sewerage infrastructure that currently services the LHWRC. Potential additional demand on existing utilities would be minimal.	

8. Waste Management

This chapter discusses strategies that would be employed for the management of solid wastes during both construction and operation of the project. Wastewater management is discussed in chapter 9. Details on waste inputs and outputs from the project and the process outputs and quality are discussed in chapter 6.

The proponent is committed to the principles of waste avoidance and resource recovery and the project will deliver outcomes consistent with state legislation and strategies for sustainable waste management. The strategic role of the project in the context of broader waste management strategies is discussed in chapter 1.

8.1 Construction

Wastes generated during construction would include the following:

- Soil and vegetation;
- Construction materials; and
- General waste and recyclables from construction workers.

8.1.1 Soil and vegetation

Any soil and rock excavated on-site would be utilised on the site for filling and other purposes where possible. Any vegetation cleared from the site would be diverted to the garden organics processing area that exists adjacent to the site, where it would be processed ready for beneficial reuse as mulch or compost material.

Topsoil excavated from the site would be segregated from underlying material and less fertile soils, and would be stockpiled for use in landscaping.

8.1.2 Concrete

Waste concrete generated by construction activities would be stockpiled on-site for off-site crushing and conversion into road-base or other building products.

8.1.3 General waste and recyclables

General waste generated by construction workers would be disposed of to landfill at the LHWRC. Paper and cardboard packaging from construction administration activities would be separately collected for recycling and put into the resource recovery bins at the LHWRC. Recyclable food and beverage containers such as aluminium, plastic, steel and glass would be transported to the relevant existing bins in the resource recovery area of the LHWRC.

8.2 Operation

Waste generated during the operation of the project would include:

- General waste and recyclables from site personnel; and

- Residual wastes from waste processing.

8.2.1 General waste and recyclables

The site operational personnel would not produce general waste in significant quantities. Garbage and recycling bins would be provided at various locations within the building and generally around the site.

Garbage bins would be emptied into the receival hall, for processing through the plant. The small amount of general mixed waste unable to be processed by the project would be disposed of in the adjacent landfill. Recyclable food and beverage containers such as aluminium, plastic and glass would be transported to the relevant existing bins in the resource recovery area of the LHWRC.

8.2.2 Residual wastes from the ArrowBio plant

The project is designed to process up to 100,000 tonnes of mixed solid waste per annum. Up to 70% of the total incoming waste stream would be recovered and diverted from landfill. This represents a significantly high proportion of total incoming mixed solid waste being diverted from landfill.

Approximately 20,000 tonnes of recyclables would be recovered from the waste stream by the project each year and sent offsite to be recycled, and the residuals would be disposed of in the adjacent landfill. Approximately 30,000 tonnes of residual and rejects would be sent to landfill.

Further details on the outputs from the operation of the project is given in section 6.6.

8.3 Impact assessment

8.3.1 Construction

The majority of construction waste would be reused on-site, disposed of at the adjacent landfill, or transported from the site to nearby re-processors and recyclers. Construction activities at the site are not expected to impact significantly on the waste management operations and waste minimisation goals of the region.

8.3.2 Operation

Waste generated during operation of the project would be reused and recycled where possible. The remaining waste would be disposed of at the adjacent landfill. The project would provide high levels of resource recovery and diversion of waste from landfill.

Operation of the project is expected to assist councils to reach their waste minimisation goals by diverting up to 70% of incoming municipal solid waste from landfill. The strategic role of the project in the context of the broader waste management strategies for NSW is discussed in chapter 1.

8.4 Mitigation measures

A waste management plan would be prepared for the project as part of the environmental management plans for both construction and operational phases.

An asbestos identification protocol would be developed for the identification and removal (by a suitability qualified contractor) of asbestos should it be discovered during the earthworks and construction activities.

9. Soil and Water

This chapter discusses assesses the potential soil and water impacts due to operation of the project, including, contamination, acid sulphate soils, erosion, salinity and flooding. Details of the proposed water management system (including stormwater) are provided in chapter 6.

9.1 Existing environment

Geology

The site is part of the Gymea Soil Landscape, with soils up to 150 cm deep. The natural site soils are formed from sandstone and shale parent material, and consist of a surface layer of sand and subsurface layers of sandy clay and clay. The soils are highly permeable, with very low general fertility. Outcrops of Hawkesbury sandstone are found within the region. A small amount of sandstone bedrock is exposed within the site as a result of soil erosion.

Hawkesbury Sandstone is generally well-cemented by authigenic quartz and siderite and is infilled with varying proportions of clay. The unweathered sandstone has a very low primary or intergranular permeability. The formation has a complex aquifer system due to sub-vertical joints and sub-horizontal bedding planes and the lithology associated with variable weathering. There are 20 to 25 m of low permeability medium and high strength sandstone above the fracture zone (Douglas Partners, 1994).

Soil surface condition

The PCYC mini bike club previously occupied the site for approximately 20 years. Fill material was imported onto site for the construction of tracks and jumps. This fill comprises sandy clays with shale gravel and crushed sandstone, and is commonly found at depths of up 1.2 m, but more commonly to 0.9 m. Firm clays overlay weathered sandstone and shale from depths of as little as 0.3 m.

During a recent study at the site, some fragments of asbestos material were found at the surface. This prompted a more detailed investigation (53 samples) of the imported fill material to be undertaken in order to provide information on the site's condition prior to construction of the project, and determine if the previous land use as a mini bike club has had an impact on the site. During this limited site assessment in October 2008, a small bundle of non-bonded asbestos fibres was found in one of the samples, asbestos containing material (bonded asbestos) was also found in six samples.

Heavy metals, polycyclic aromatic hydrocarbons, monocyclic aromatic hydrocarbons (including benzene, toluene, ethyl-benzene and xylenes), petroleum hydrocarbon concentrations (C_6-C_{36}) and organochlorine pesticides tested for as part of the same investigation were found to be either non-detectable or below site criteria for human health.

Following the limited site assessment, further investigations were undertaken in order to classify the stockpiled material at the site for disposal. Ten stockpiles were inspected over the site (previously identified as containing bonded asbestos and one case of friable asbestos). Samples were taken in order to assess the material waste classification in accordance with the DECC (2008) *Waste Classification Guidelines. Part 1: Classifying Waste*. Based on the results of testing on the samples and application of the waste classification criteria, the material in the ten stockpiles was pre-classified as *Special Waste – asbestos* (refer Appendix M). This requires that the material is

disposed offsite to waste facilities licensed to accept Special Waste. The other contaminants of concern analysed as part of the waste classification met the criteria for general solid waste. Hence, the material was considered to be classified as special waste/general solid waste for offsite disposal to an appropriately licensed facility.

The proponent has arranged for cleanup works to be carried out by an appropriately licensed contractors which includes dismantling of the relevant jump/stockpiles and disposal offsite to the LHWRC landfill. The cleanup works would be undertaken prior to commencement of construction of the project.

Acid sulphate soils

The site is located in an area with extremely low probability of acid sulphate soils according to the Australian Soil Resource Information System National Acid Sulphate Soils maps.

Hydrology

The site lies within the catchment of Bardens Creek, and drains toward the north east. Bardens Creek is a semi-permanent tributary of Mill Creek, which originates within the LHWRC and flows north into the Georges River. It is currently unsealed, and much of the rain falling on the site currently soaks into the ground.

Groundwater

The hydrogeological environment at the LHWRC includes perched water tables, 'leaky' aquifers and pressurised zones due to the discontinuous shale and clay layers. Weathering has produced spatially and vertically variable aquifer material which influences the groundwater flow paths and hydraulic conductivity in different layers and areas.

Table 9-1 shows the groundwater quality and depths for the LHWRC from monitoring data over the period 2006-2008 and progressive graphs from 1995 to 2008. Figure 9-1 shows the locations of groundwater the monitoring bores at the LHWRC referred to in Table 9-1.

Table 9-1 Groundwater quality and depth at LHWRC

Location	Monitoring bores (screened)	Surface water level (SWL)	Comments
Upstream (South)	MB008 (1.5 – 51)	15 m No trend (pre 2000 @ 17m)	No trends in results pH < 6 Na/Cl ratio ~ 40/80 Ammonia at or near LOD Metals at LOD or occasional low result. Al, Ba, Mn, Zn more common. OPPs, OCPs, PAHs etc at LOD
	MB044 (41 – 47)	19 m No trend	
	MB045 (17.5 – 23.5)	15 m No trend	
Downstream (North at site boundary)	MB032 (32 – 38)	8 m Up from 13 m	No trends in results pH<6 Na/Cl ratio ~50/100 Ammonia from LOD to 0.2 mg/L Metals - only 2 sets of results. First round has
	MB033 (11.5 – 14.5)	<1 m No trend	
	MB034 (25.5 – 30.5)	4 m No trend	

	MB035 (4.8 – 8.8)	3 m No trend	more metals above LOD – 2nd round is similar to bores monitored for more than 5 years. OPPs, OCPs, PAHs etc at LOD (unusual PAH result for MB034 in March 08 – not repeated and suspect lab contamination)
Downstream (Immediately downstream of current cell excavation / filling)	MB040 (19 – 25) MB041 (6 – 12)	11 m No trend 6 m No trend	Less than 24 mos results. pH <6 (MB040) pH<5 (MB041) Na/Cl ratio ~ 50/100 (MB040) Na/Cl ratio ~ 40/80 (MB041) First round has more metals above LOD – 2nd round is similar to bores monitored for more than 5 years. OPPs, OCPs, PAHs etc at LOD MB040 is similar to the downstream bores whereas the shallower MB041 could be showing an impact from rainwater being held in the excavation for a number of months over the last two years.
Downstream (near midway along Cell 5 / at recommended location to monitor fracture zone	MB038 (20 – 27) MB039 (9 – 13.5)	18 m No trend 6 m No trend	Less than 24 mos results. pH < 6 Na/Cl ratio – 80/160 First round has more metals above LOD – 2nd round is similar to bores monitored for more than 5 years. OPPs, OCPs, PAHs etc at LOD These bores show similar impacts to other bores installed nearer the ridge, slightly saltier and more metals than bores closer to Mill Creek.
Midstream on southern side, could also be considered downstream of the Gun Club and ridge / Heathcote Road	MB305 (38 – 41) MB306 (14.4 – 18.9)	8 m No trend 5 m No trend	MB305 seems to have a slight decreasing trend in anions. Ammonia is low since 2006. pH<6 Na/Cl ratio ~ 50/100 Ammonia at or near LOD Metals at LOD or occasional low result. Al, Ba, Mn, Zn more common. OPPs, OCPs, PAHs etc at LOD

Figure 9-1 Locations of groundwater monitoring bores at LHWRC

As the landfill footprint and infrastructure have moved further north over the last 10 years the downstream monitoring bores at the LHWRC have been sealed and new bores installed further downstream but as close to the landfill as possible.

The original downstream bores MB001 and MB017 (50 m deep), MB004 and MB005 (5 - 15 m deep) were either artesian or had groundwater levels 0 - 1 m above ground. The artesian flow would diminish and stop if there were extended dry spells, MB017 before MB001. These bores were replaced with MB101 and MB104 and the groundwater level progressively increased to close to ground level before they were sealed.

These bores were replaced with MB032 to MB035. There is only a few years' data but there is a similar trend of increasing groundwater levels but no real change in quality monitoring results.

9.2 Impact assessment

9.2.1 Construction

Contamination

An asbestos identification protocol would be developed for the identification and removal (by a suitability qualified contractor) of asbestos should it be discovered during the earthworks and construction activities. The protocol would include:

- Collection and analysis of soil samples to enable classification per the DECC (2008) *Waste Classification Guidelines* to determine the disposal options for the material;
- Statutory notification to WorkCover NSW on Asbestos removal works;
- Preparation of site OH&S and safe work method statements, as required;
- Removal of material by a suitably qualified contractor;
- Depending on the waste classification of the material, disposal at the LHWRC landfill or another appropriately licensed facility;
- Site re-instatement works; and
- Provision of a clearance certificate by a qualified hygienist at the completion of works stating that the subject area is considered safe for normal activities to proceed prior to construction works recommencing.

The construction of the project would be designed to minimise the likelihood of contamination of soil and water. The potential for contamination would be managed as part of the construction environmental management plant that would be developed for the project and include procedures for the management of accidental spills. Therefore, the project is not expected to have any soil or water contamination impacts.

Acid sulphate soils

The excavation requirements of the project are not expected to occur in areas of acid sulphate soils and the project is therefore not expected to have any acid sulphate soils impact.

Stormwater / potential for erosion

Control of erosion and sedimentation would be required during the construction period, including temporary works. This includes erosion and sediment controls to prevent sediments from being carried into the stormwater systems, including cut-off drains, silt fences and other erosion controls. A site sediment and erosion control plan would be prepared, in accordance with requirements of the Blue Book (*Managing Stormwater: Urban Soils and Construction*, Department of Housing). These controls would be implemented before any construction commences.

A 90th percentile 5 day rainfall duration was used to determine the volumes of the temporary sediment dams, along with an upper limit of 50 mg/L for total suspended solids in any pumped discharge of stormwater.

The project environmental management plan and contract documents would address the requirements based on controls and mitigation measures described in Chapter 19. With implementation of the proposed controls and mitigation measures, the project would not have significant stormwater / erosion impacts.

Groundwater

The project construction of the project is expected have negligible impact on groundwater quality.

There are no bores installed within the footprint of the proposed AWT facility. Hence there is no requirement to decommission existing bores in order to enable construction activities to occur.

9.2.2 Operation

Salinity

Process water would not be irrigated without prior testing to ensure its suitability for application to land. The project is not expected to have any impacts on local salinity.

Contamination

The project is not likely to lead to the contamination of soils, groundwater or surface waters. The project has been designed to minimise the likelihood of any accidental spills migrating off site.

Flooding

The stormwater management system and project design would minimise the likelihood of flooding on site during operation.

Stormwater management system

Infrastructure required to collect stormwater runoff from the plant and transfer the first 10 mm of rain to storage tanks for first flush stormwater, and the rest of the stormwater to either the site stormwater retention dam (surface runoff), or the fire-fighting water tanks (roof water), or staff amenities water storage tank (roof water), for non-potable use, form part of the project design. Further details on the proposed water management system are provided in chapter 6.

Groundwater

As discussed in section 6.7.3, process water would be treated in the on-site wastewater treatment plant, which would use a sequencing batch reactor process to reduce biological activity in the water. Most treated process water would be stored in a process water dam on the site which would have a high permeability liner system to protect the underlying groundwater.

Most treated process water would be disposed of to sewer via the existing LHWRC leachate system. However, some treated process water may be able to reused for irrigation of revegetated areas and dust suppression. Water quality testing would be undertaken before reuse for these purposes to ensure it meets health and environmental requirements.

Only non-putrescible waste would from the project (residuals) would be landfilled at the LHWRC (until the end of 2024). This waste does not pose the same degree of risk to groundwater as putrescible waste, however potential impacts from landfilling operations at LHWRC (separate operation from the project) would be managed through the landfill leachate system and regular groundwater monitoring.

One additional groundwater monitoring bore would be installed downstream of the AWT facility and included in the groundwater monitoring program for the site. Existing groundwater monitoring bores would continue to be monitored as part of the LHWRC monitoring program. Chapter 19 outlines the proposed monitoring for the site.

Considering the above, the project is expected to have negligible impact on groundwater quality.

9.3 Mitigation measures

9.3.1 Construction

An asbestos identification protocol would be developed for the identification and removal (by a suitability qualified contractor) of asbestos should it be discovered during the earthworks and construction activities.

The proponent would implement all practicable measures to minimise soil erosion and discharge of sediments from the site.

The erosion and sediment control plan prepared as part of the construction environmental management plan would ensure:

- Sediment and erosion control measures, such as sediment fences, are installed and maintained, with particular attention where the drainage is towards a surface water body;
- Stockpiles are stabilised and remain covered and appropriate sediment and erosion control measures are installed down slope of all stockpiles; and
- Spill kits are made available to construction vehicles.

The construction environmental management plan would also set out procedures for the management of accidental spills to minimise potential contamination during construction.

9.3.2 Operation

Areas containing storage tanks would be fully bunded to contain accidental spills and the proponent would investigate opportunities for beneficial reuse of excess process water.

The project design features already incorporate measures to manage stormwater and minimise the likelihood of localised flooding during storm events. A permanent stormwater collection dam and first flush dam would be implemented during the operational phase of the project.

9.4 Summary of resulting impacts

Potential impacts on water would be mitigated by the water management features of the design, These include site grading and channelling of stormwater away from active construction zones and unsealed areas, early construction of all weather access roads and hardstand areas, and the use of sedimentation dams during construction works, The resulting impacts on surface water and groundwater quality would be minimal.

10. Air Quality and Odour

The information presented in this chapter is based on the findings of the air quality assessment undertaken by PAEHolmes. The air quality assessment report is included in Appendix B of this environmental assessment.

10.1 Assessment methodology and relevant characteristics of the project

10.1.1 Potential air quality issues and project features

Potential air emission sources from the project include:

- Odour from the operation of the facility – in particular emissions from the receival hall;
- Emissions from the two 1 MW power generators which would use biogas as fuel. The main emission of concern is nitrogen dioxide (NO_2);
- Dust impacts during construction and operation; and
- Toxic emissions or pathogens released by the processing of waste.

Potential cumulative emissions associated with the relocation of the PCYC facilities and proposed truck parking area (separate development applications) have also been considered in the assessment.

Air quality parameters considered in the air quality impact assessment include:

- Odour;
- Oxides of nitrogen; and
- Dust.

Emissions of toxic substances, pathogens and dust have been considered qualitatively.

The project would incorporate features that would reduce the potential for air quality impacts, in particular odour emissions:

- Wastes would be immersed in water very early in the process;
  - Continuous circulation of water within the vat prevents anaerobic activity in the waste, thereby reducing the production of volatile organic compounds, which tend to be quite odorous; and
  - The water based process minimises the amount of dust generated when waste materials are handled.
- The receival hall would be partially enclosed and exhaust fans would be used to maintain the area at conditions that meet OH&S requirements for workers; and
- Air extracted from the receival hall and processing building would be deodorised using appropriate odour management technology such as ozone treatment, prior to being discharged.

Further information of the design of the project is provided in chapter 6.

10.1.2 Methodology

The assessment was undertaken in accordance with the 'Approved Methods and Guidance for the Modelling and Assessment of Air Pollutants in NSW' (DECC 2005) and the technical framework and notes for the *'Assessment and Management of Odour from Stationary Sources in NSW (*DECC 2006). A computer based dispersion model, CALPUFF, was used to model the potential air quality impacts of the proposal.

Background NO_2 air quality data for the period 2000-2006 was sourced from the closest representative NSW DECCW air quality monitoring stations. Dispersion modelling was conducted for odour and NO_2.

Odour levels have been predicted over an area 4 km by 4 km (50 m spacing) and local terrain has been taken into account. The modelling was performed using local meteorological data and estimates of potential emissions from the project.

Use of the model for the odour assessment involved predicting the 1-hour average odour levels corrected to nose response times (expressed in odour units) at each receptor. The 1-hour averaging times were also used for consistency with the NSW DECCW odour criteria.

Odour sources were located according to the site layout. For the presentation of results, plots of odour levels at the 99th percentile were compiled, showing the extent to which odours are predicted to occur for 99% of the time.

10.2 Existing environment

10.2.1 Nearest sensitive receptors

The document 'Approved Methods and Guidance for the Modelling and Assessment of Air Pollutants in NSW' (DECC 2005), defines a sensitive receptor as a location where people are likely to work or reside, including dwellings, schools, hospitals, offices or public recreational areas. The nearest potentially affected residential properties for the purposes of the air quality assessment are as follows:

- Residences at North Engadine – approximately 2 km from the site; and
- Residences at Barden Ridge – approximately 3 km from the site.

10.2.2 Meteorological conditions

The CALPUFF model was used. This requires information on the dispersion characteristics for the area.

Therefore a wind field was generated by CALMET for each hour of the calendar year 1 July 2001 to 30 June 2002 using the surface wind data collected from the Lucas Heights automatic weather station.

Wind roses prepared from that data are shown in the appendix to the air quality assessment (Appendix B). On an annual basis the winds are predominantly from the south west and south east. The south easterlies are present in summer and autumn and the south westerlies are present in winter. Winds occur from most directions in spring.

Additional meteorological data was obtained from the proponent. This data consisted of 15-minute averages for the period March 2007 to February 2008 and was used to compile the windroses shown in the appendix. There are a few differences between the two data sets, most noticeably the dominance of winds from the south-southeast in all seasons except winter. Winds during winter are very similar to the 2001, being predominantly from the south western quadrant.

10.2.3 Background air quality

The region is subject to ongoing air quality monitoring by DECCW. To determine existing NO_2 levels, background air quality was established using historical data from the nearest DECCW monitoring stations at Liverpool and Campbelltown/Macarthur.

The background NO_2 levels adopted for this assessment are:

- Maximum 1 hour value - 166 µg/m^3
- Annual average - 37 µg/m^3

10.3 Impact assessment

Project air quality goals have been established to assess the potential impacts of the project and were selected on the basis of preventing health effects and nuisance impacts associated with the relevant air quality parameters.

10.3.1 Dust

Construction

The project has the potential to generate dust emissions during construction. The main source of dust for this project will be that generated through construction of the facility, predominantly the earthworks involved in preparing the building surface. There are a number of activities involved in this process but the main sources are likely to be the use of equipment such as dozers, excavators and dump trucks as well as wind erosion from exposed areas. The use of a water cart on site during the construction phase will aid in reducing these emissions significantly.

In order to get an estimate of what emissions may be expected, emissions have been calculated and are summarised in Table 10-1.

Table 10-1 Estimated emissions due to earthworks at the proposed AWT site

Source	Emission factor[3]	Total emissions (kg)
Three dozers working 9 h/d for 80 days each	14 kg/h	30,240[4]
Excavators moving material	0.00152 kg/t	80[5]
Trucks dumping material	0.00152 kg/t	80[5]

[3] Using equations from US EPA, 1985 and updates

[4] Assuming each dozer works for 80 days

[5] Assuming a total of 51,000 m^3 of material is handled over the construction period. This source is wind speed dependant so when winds are light the emissions will be low.

Source	Emission factor[3]	Total emissions (kg)
Wind erosion over approximately 3.5 ha of exposed area	0.4 kg/ha/h	255[6]
Total emissions over the 6 months earthworks construction period		*30,655 kg*

There will be other sources such as heavy vehicle movement on unsealed roads, but these are not as easily quantifiable due to the highly variable distances travelled. The use of a water cart will assist to greatly reduce these emissions.

Dust emissions of this scale are unlikely to cause any adverse impacts at the nearest residential areas. There are major dust producing industries such as coal mines[7] and quarries which emit dust at rates significantly greater than this and still comply with both health and nuisance criteria. There may be short-term nuisance impacts at locations adjacent to the site and these will generally occur on days where wind speeds are elevated.

As explained in section 3.6, a truck parking area is proposed to be constructed adjacent to the southwestern boundary of the site to accommodate waste collection trucks overnight (part of a separate development application). Some dust associated with the construction of the truck parking area is expected, as shown in an assessment carried out for that operation (PAEHolmes 2009). However these emissions are not considered to be significant and have not been included in the dust modelling. It may be possible to ensure that the construction at the two sties does not occur at the same time in order to keep emissions to a minimum.

Operation

There is the potential for dust in the workplace to be inhaled by workers and cause respiratory problems. The recommended maximum exposure level for dust is 10 mg/m^3 time weighted average measured as inspirable dust over an 8 hour day, 5 day working week (NOHSC 1995). This is for unclassified dust with no specified toxic components.

Measurements undertaken on two weeks over an 8-hour shift by Hibbs and Associates (GHD 2006) at the MRRP materials recovery facility indicated dust levels of 1.4 and 1.5 mg/m^3, well below occupational health criteria of 10 mg/m^3.

There is also potential for dust emissions during operation as a result of the sorting and compacting of waste. This would be controlled through water sprays within the receival hall and is unlikely to be a significant source of off-site emissions.

Potential dust emissions from the PCYC activities have not been including in the modelling, as they are existing activities and will have been captured in the onsite dust monitoring, both deposition and concentration. The monitoring data were summarised in a report assessing the impacts of modifications to the conditions of consent (PAEHolmes 2009). These data showed that measured levels, which include activities at the PCYC, are well below the DECCW criteria.

[6] Assuming the total 3.5 ha is exposed for a total of 6 months

[7] *For example, some coal mines in the Hunter Valley can potentially emit over 500,000 kg over a similar time frame as this construction period, almost 15 times more than those estimated for this project.*

10.3.2 Odour

The DECCW framework documents include some recommendations for odour criteria. They have been refined by the DECCW to take account of population density in the area. Table 10-2 lists the odour certainty[8] thresholds, to be exceeded not more than 1% of the time, for different population densities.

Table 10-2 Odour performance criteria for the assessment of odour

Population of affected community	Odour performance criteria (nose response odour certainty units at the 99th percentile)
Single residence (≤ ~2)	7
~10	6
~ 30	5
~ 125	4
~ 500	3
Urban (~ 2000)	2

The nearest residences are approximately 2 km away. The population density in those residential areas are such that they are considered an urban environment for assessment purposes. As there are other odorous industries in the area there is the potential for a cumulative impact. On this basis, the most stringent odour criterion of 2 ou has been applied to the project.

There are two main sources of odour in the area of the project. These are the project itself and the landfill site to the north west. These sources have been assessed individually, to show the relative contributions from each operation, and combined for a cumulative assessment.

Odour emission rates from different parts of the landfill and project site vary and are summarised in Table 10-3.

Air from the receival and process halls will be treated to reduce odour. The likely method of odour control will be an ozone injection system to reduce odours from the air before being discharged to the atmosphere through a vent on the side of each building at an airflow rate of 14,160 L/s or 14.16 m^3/s. It has been assumed for the purposes of this assessment that the concentration of odour in the air after treatment will be of the order of 150 ou, which corresponds to an emissions rate of 2,124 $ou.m^3/s$ from each vent as listed in Table 10-3.

A conservative assessment has been achieved by assuming some additional odour emissions from the pre-processing area, and the sorting pools to account for times when doors may be opened or damaged. This will not happen all the time, so the assumption is conservative.

The pre-processing area refers to the area just inside the processing building after the raw material has been conveyed and sorted by hand inside the receival hall. The primary and secondary sorting pools are inside the processing building where the raw material is wet and further sorting takes place.

[8] In the process of odour measurement, the odour certainty threshold is, by definition, the minimum concentration at which the panellist is certain they can detect the odour.

Table 10-3 Estimated odour emission rates for each site (ou.m^3/s)

Source	Emission rate (ou.m^3/m^2.s)	Area (m^2)	Total emissions (ou.m^3/s)
Project			
Balance tank at WWTP[1]	0.1	150	15
Storage tank at WWTP[1]	0.1	30	3
SBR tank at WWTP[2]	0.4	55	22
Dewatered sludge[3]	0.5	2	1
Pre processing area[4]	5.0	64	320
Primary sorting pool[5]	1.0	16	16
Secondary sorting pool[5]	1.0	36	36
Acetogenic tank cleaning[4]	5.0	4	20
Treated air vents	**Odour concentration (ou)**	**Flow rate (m3/s)**	**Toal emission (ou.m^3/s)**
Treated air from the receival hall	150	14.16	2,124
Treated air from the process building	150	14.16	2,214
Landfill site[6]			
Green waste	0.238	18,700	4,450
Green waste Dam	0.145	2,100	305
Green waste windrows	0.238	33,100	7,880
Intermediate cover	0.084	172,000	14,450
Leachate area 1	0.2	1,000	200
Leachate area 2	0.28	1,300	364
Area 4	0.91	30,000	27,300
Active tipping face	2.05	11,800	24,200
Greenwaste Stockpile	0.164	7,500	1,230

Notes:

1. These values were based on emission factors for clarifiers at various WWTPs
2. This value was based on about half the emissions for aeration tanks at various WWTPs
3. These values were based on emission factors for sludge dewatering at various WWTPs
4. This value was based on reduced emission factors for inlet works at various WWTPs. In reality it is likely that the emissions will be lower and more in line with those from the active tipping face at the landfill site. However, as shown Figure 10-1 and Figure 10-2, the odour concentrations off-site are not predicted to cause any adverse impacts at nearby residences even with these conservative emission estimates
5. These values were based on GHD emission factors for aeration tanks at various WWTPs
6. Based on measurements from an odour audit at the site (Holmes Air Sciences, 2006)

There may be some additional odour from trucks associated with the proposed truck parking area (separate development application), however this is not considered to be a significant source in relation to the AWT facility itself and indeed the landfilling and greenwaste operations. As such, it has not been incorporated in the modelling.

The results of the CALPUFF dispersion modelling using the emissions data summarised in Table 10-3 are presented as contour plots in Figure 10-1 and Figure 10-2.

Figure 10-1 shows the predicted 99th percentile odour levels for the project only. It can be seen that the 2 ou contour is predicted to extend slightly beyond the southern boundary across New Illawarra Road and just onto the western corner of the ANSTO site. There are no predicted exceedances of the 2 ou goal at any sensitive receptor in the area, such as residences or schools.

The predicted 99th percentile odour levels for the landfill site alone are shown in Figure 10-2. It can be seen that the 2 ou contour extends beyond the landfill boundary, but does not encroach on any residential areas.

When assessing the project in conjunction with the landfill site, the cumulative impacts are predicted as shown in Figure 10-3. Figure 10-2 shows that the landfill is the dominant odour source and that the effects of the project are relatively minor. It can be seen that even though the 2 ou contour extends beyond the landfill boundary, it does not impact upon any sensitive receptors.

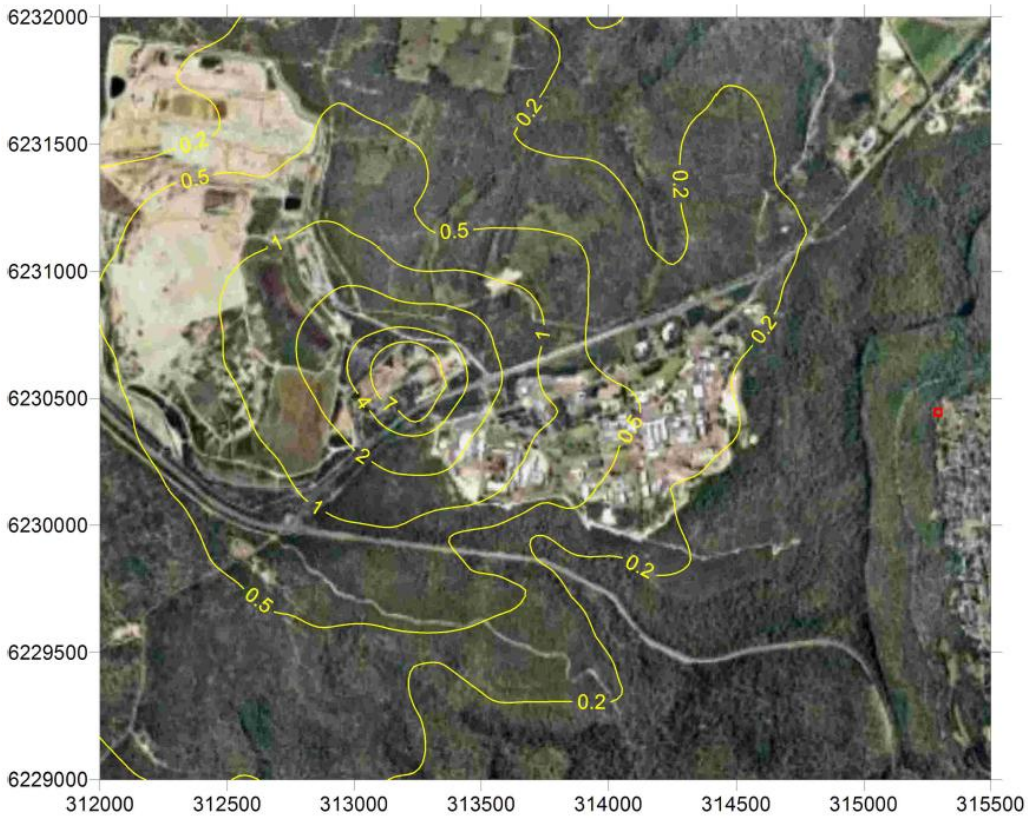


Figure 10-1 Predicted 99th percentile odour levels for the project only under general operating conditions

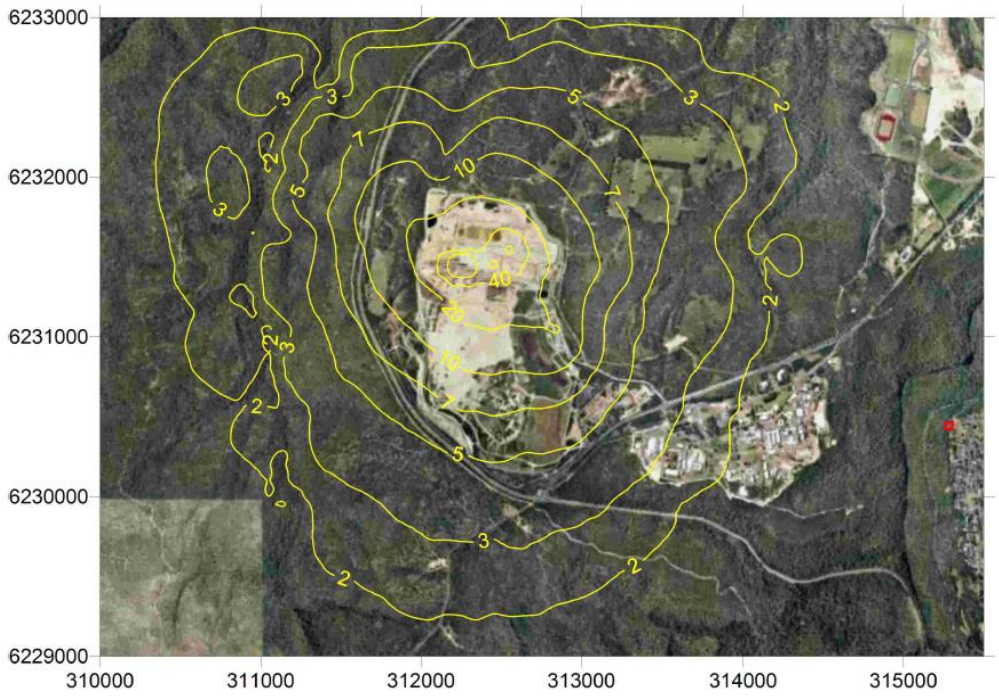


Figure 10-2 Predicted 99th percentile odour levels for the landfill only

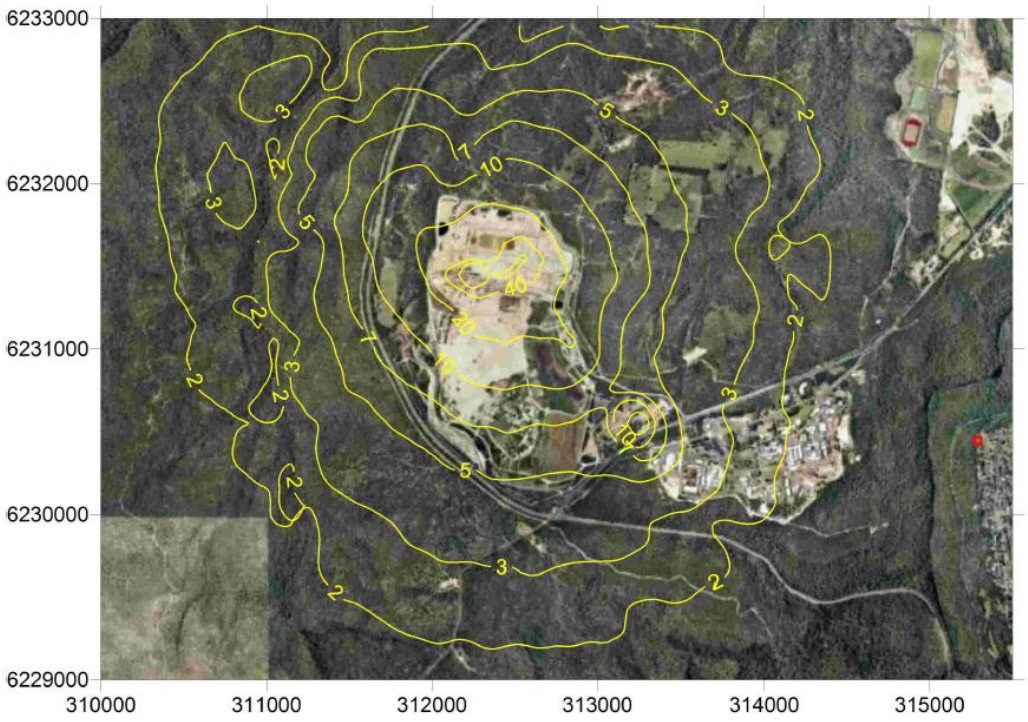


Figure 10-3 Predicted 99th percentile cumulative odour levels during general AWT facility operating conditions

There will be occasions every 2 to 3 years, when the acetogenic tanks require cleaning. This would involve removal of a panel from the side of the tank to enable cleaning equipment, such as a bob-cat, to enter the tank and clean it. Figure 10-4 shows the predicted maximum odour concentrations due to the project only with this additional source. It can be seen that even the 1-hour maximum value (100th percentile) does not exceed 2 ou at the nearest residence.

When combined with emissions from the landfill as shown in Figure 10-5, it can be seen that there is little difference between these predictions and those with the AWT under general operating conditions (Figure 10-3). This is because the landfill is the dominant odour source in the area, as discussed previously and also that the cleaning of the tanks is a relatively minor source at the site given its small area. The 2 ou level is not predicted to be exceeded at the nearest residence during the cleaning process.

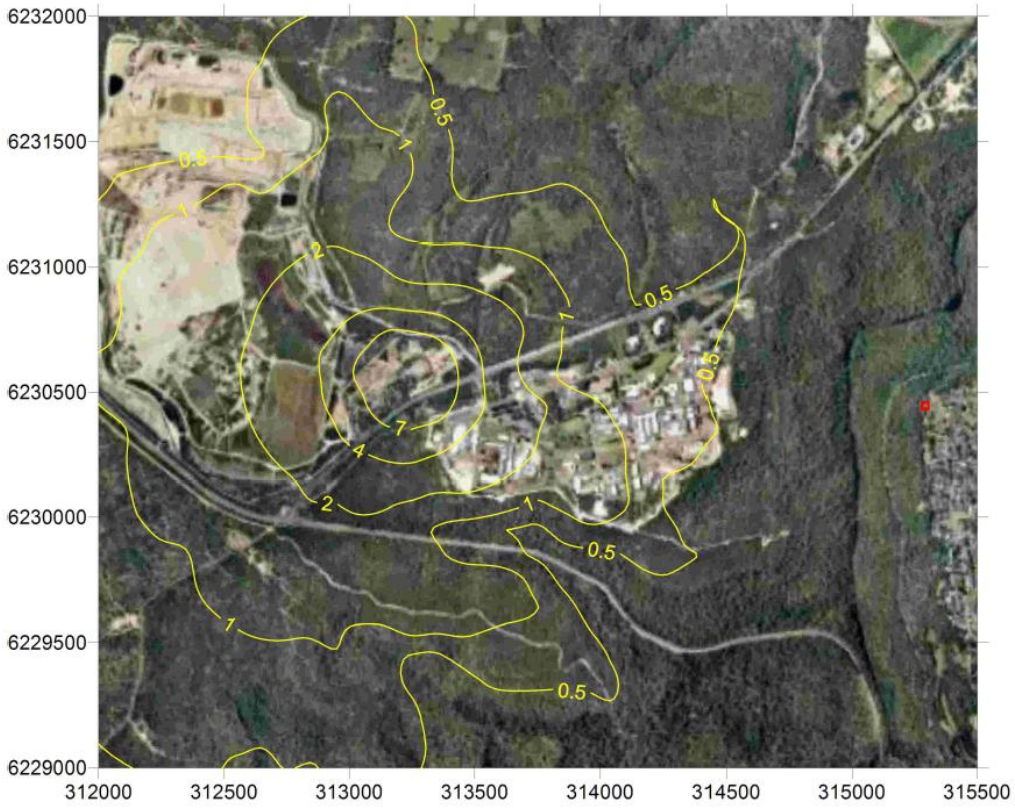


Figure 10-4 Predicted maximum odour concentrations due to emissions from the project under cleaning operations

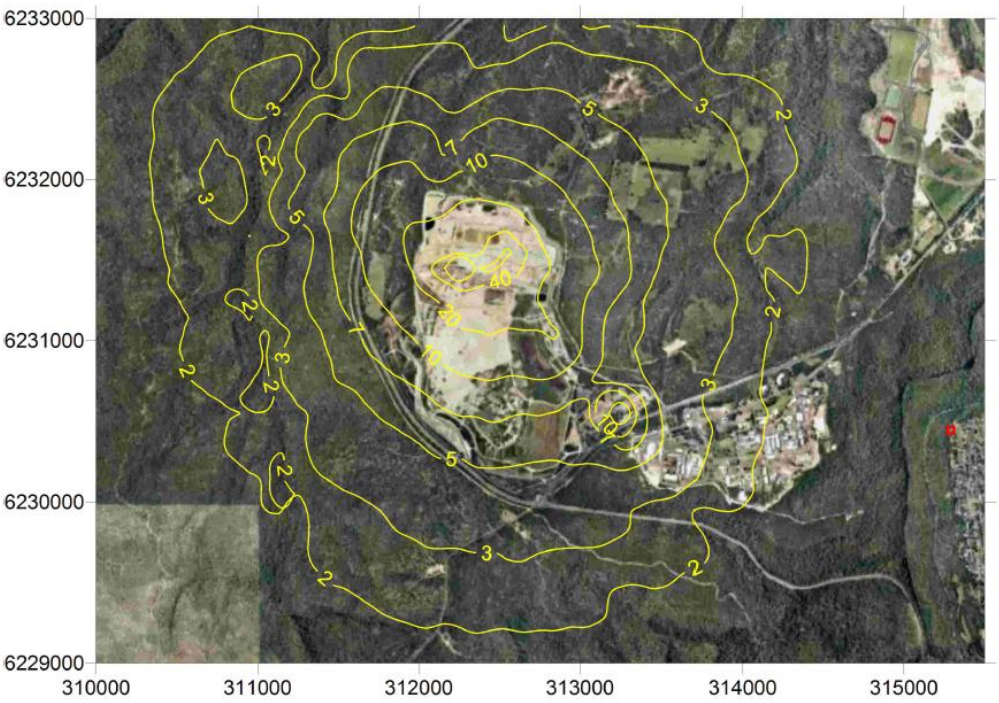


Figure 10-5 Predicted 99th percentile cumulative odour levels during cleaning conditions

10.3.3 NO_2

Table 10-4 lists the air quality goals for nitrogen dioxide noted by NSW DECCW (DECC 2005) and National Environment Protection Measures (NEPM) that are relevant to this study. The primary air quality objective for most projects is to ensure that the air quality goals are not exceeded at any location where there is a possibility of human exposure.

Table 10-4 Air quality goals for nitrogen dioxide

Pollutant	Goal	Averaging period	Agency
Nitrogen dioxide (NO_2)	0.12 ppm or 246 μg/m^3	1-hour maximum	NSW DECCW, NEPM
	0.03 ppm or 62 μg/m^3	Annual mean	NSW DECCW, NEPM

Background levels for the region did not exceed the air quality goals.

It is proposed that the biogas generated by the project would be used to fuel two 1 MW power generators. The emissions from a similar generator have been assessed at Eastern Creek (Holmes Air Sciences, 2005) and at the MRRP (Holmes Air Sciences, 2006). The assumed emissions from two such units each of 1 MW capacity are summarised in Table 10-5.

Table 10-5 Emissions data assumed for each 1 MW unit

Stack locations (MGA co-ordinates)	Stack 1 – 313263, 6230548 Stack 2 – 313272, 6230553
Height	7 m
Stack tip diameter	0.36 m
Base Elevation	155 m
Temperature	140 °C
Exit velocity	31.3 m/s
NOx emission rate	0.8 g/s

The results of dispersion modelling are shown in Figure 10-6 and Figure 10-7.

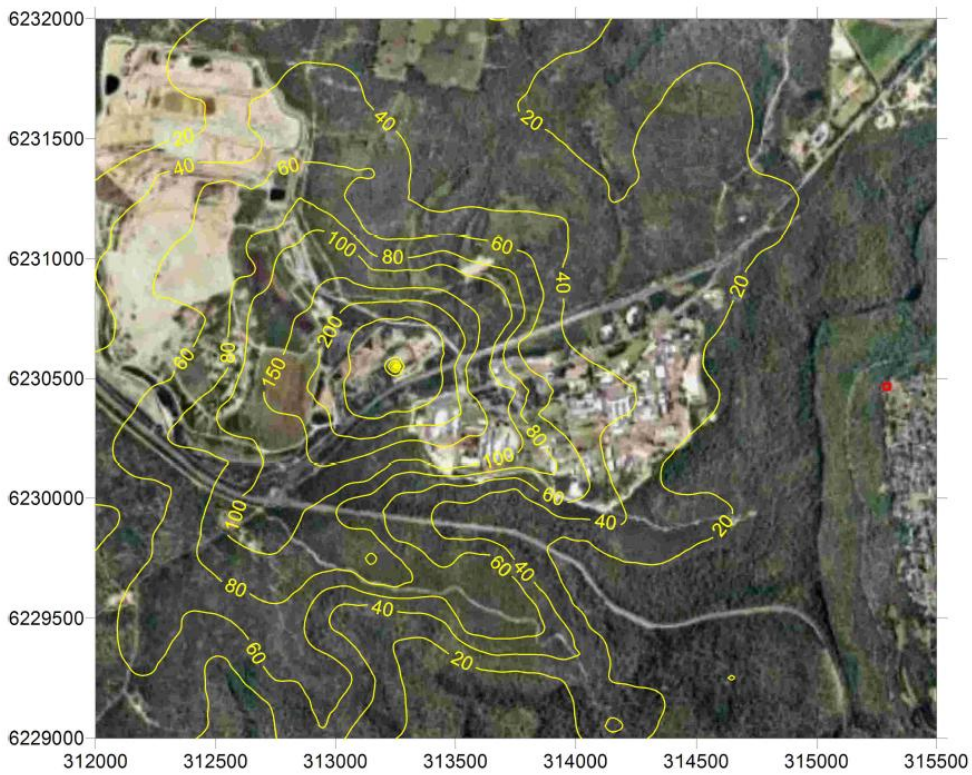


Figure 10-6 Predicted 1-hour maximum NO_2 levels

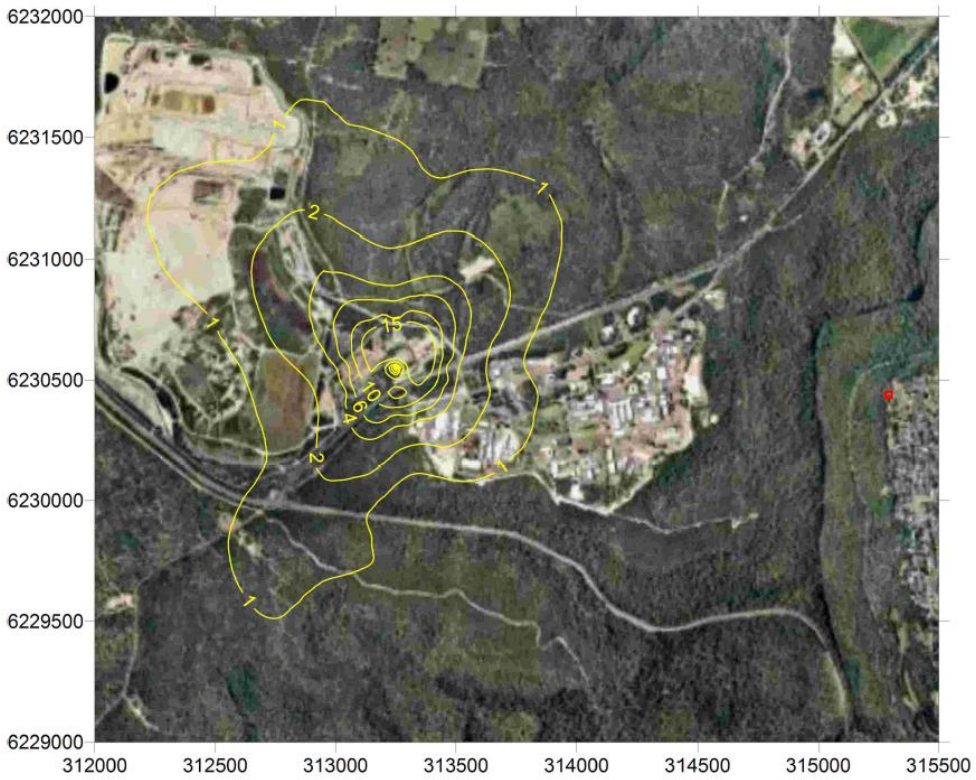


Figure 10-7 Predicted annual average NO_2 levels

Figure 10-6 and Figure 10-7 show the predicted 1-hour maximum and annual average NO_2 levels, respectively, due to emissions from the biogas power generation units. Even if the estimated background levels are added to the modelling results, there are no predicted exceedances of the NO_2 goals at any nearby sensitive receptors.

In order to determine the cumulative NO_2 impact of the project and the adjacent EDL site an assessment was done on a pro-rata basis. The air quality assessment (Appendix B) report predicts that the cumulative concentration of NO_x would be in the order of 50 µg/m^3 (pro-rata) at the nearest residence. If it is assumed that all NO_x is converted to NO_2 (a very conservative assumption) and then added to the maximum 1-hour background NO_2 measurement of 166 µg/m^3, the resulting concentration would be below the 246 µg/m^3 goal.

Hence it is unlikely that there would be any adverse cumulative impacts due to NO_2 emissions from the project and EDL generators.

10.3.4 Air toxics and pathogens

The received material would be municipal waste and would not contain any substantial quantities of potentially toxic chemicals such as could be present in industrial waste. The level of carcinogenic or other toxic emissions would therefore be extremely low. However as there would be putrescible material processed through biological treatment, there is potential for emissions of pathogenic organisms.

As the project would not be accessible to the general public, the main potential health issue relates to exposure of workers to health risks associated with operation.

While there is potential for staff to come into contact with pathogens in the material and those formed during the wastewater treatment process, the level of hazard would not be significantly different from those in existing facilities operated by the proponent, for example transfer stations, material recovery facilities and for wastewater treatment plants. There is no evidence to suggest that this poses an unacceptable risk to the workplace provided normal precautions are taken. These precautions would include normal industrial hygiene procedures such as washing hands before eating and smoking.

10.4 Mitigation measures

10.4.1 Construction

A dust management plan would be prepared as part of the construction environmental management plan detailing measures for the control of dust generation, including:

- Site management measures to limit dust emissions from work sites, including:
  - Managing stockpiles to suppress dust emissions;
  - Watering of unsealed haul roads and disturbed surfaces (including construction areas);
  - Restricting the size of disturbed surfaces as much as practicable;
  - Prevention of truck over-loading and covering dusty loads; and
  - Vehicle movement controls, particularly entrance to and exit from construction work sites (and washing down trucks before they leave the site – if necessary).
- When conditions are excessively dusty and the dust emissions criteria from operations cannot be maintained, then all dust generating activities must cease until dust suppression can be adequately carried out; and
- Dust monitoring would be undertaken during construction. Monitoring would comply with the DECC (2007) *Approved Methods for the Sampling and Analysis for Air Pollutants in NSW*.

10.4.2 Operation

The specifications provided to prospective equipment suppliers would dictate the technical and environmental performance the equipment would be expected to meet, based on the proponent's operational requirements and the conditions of consent for the project.

Measures to reduce odour are already incorporated into the design of the facility and have been included in the odour modelling. Given the results of atmospheric dispersion modelling, it is anticipated that no additional mitigation measures from an air quality perspective would be required.

10.5 Summary of resulting impacts

Construction of the project has the potential to result in minor air quality impacts at various times (e.g. dust disturbance). Impacts on local air quality would depend on equipment usage and local weather conditions. Potential impacts would be managed by implementing environmental management measures such as watering of unsealed areas, as outlined by the construction environmental management plan.

Whilst the facility is a potential source of odour, off-site odour levels are expected to be minimal, and the current amenity of existing developments in the area should not be altered by site operations.

The design of the project includes a number of measures to minimise odour and air quality impacts. These include partial enclosure of the receival hall and processing hall, and deodorisation of air prior to discharge, using a treatment system such as ozone injection. None of the potential odour and air quality impacts are likely to affect local amenity in residential or commercial areas due to the distance from such receivers.

11. Traffic and Transport

The information presented in this chapter is based on the findings of the traffic impact assessment and supplementary assessment of the site access / egress arrangement undertaken by Cardno Eppell Olsen. The assessment report and results of supplementary assessment are included in Appendix C of this environmental assessment.

11.1 Existing environment

11.1.1 Road network and access

The road network in the immediate vicinity of the site consists of New Illawarra Road, Little Forest Road and Heathcote Road. The site is located adjacent to Little Forest Road and New Illawarra Road. Little Forest Road intersects New Illawarra Road approximately 1 km north east of the intersection of New Illawarra Road and Heathcote Road.

The existing access to the site is located along Little Forest Road, approximately 30 m from the intersection with New Illawarra Road. A new internal road network would be constructed on the LHWRC site to provide access to the project site via a new access way off Little Forest Road.

Little Forest Road is a public road which connects with New Illawarra Road at an unsignalised T-intersection. Little Forest Road is a sealed single carriageway road with a gravel shoulder, which provides one traffic lane in each direction. The posted speed limit is 40 km/h.

New Illawarra Road performs the functional role of an arterial road and is designated as a state road and a B-Double route, under the care and control of the RTA. In the vicinity of the site, New Illawarra Road has one traffic lane in each direction on a single undivided carriageway with a speed limit of 70 km/h.

Heathcote Road performs the functional role of an arterial road and is designated as a state road and a B-Double route, under the care and control of the RTA. Heathcote Road forms an important link between Sydney's west and the Illawarra region, linking the Princes, Hume and Cumberland Highways. In the vicinity of New Illawarra Road, Heathcote Road has one traffic lane in each direction on an undivided carriageway, however overtaking lanes are provided along various sections. The section of Heathcote Road west of the New Illawarra Road has a posted speed limit of 100 km/h, and east of New Illawarra Road the speed limit is 70 km/h.

The intersection of Heathcote Road with New Illawarra Road is currently also an unsignalised T-junction. However, the RTA has advised that traffic control signals are proposed to be installed at the intersection of New Illawarra Road and Heathcote Road as part of its five year work program.

Access to the major Sydney arterial road network is as follows:

- Access to the South Western Motorway (M5) via two main routes:
  - For eastbound traffic - along New Illawarra Road, Old Illawarra Road, Alfords Point Road and Davies Road; and
  - For westbound traffic - along Heathcote Road;
- Access to the M7 Motorway (M7) is via the M5; and

- Access to the Princes Highway is via New Illawarra Road and Heathcote Road.

11.1.2 Existing conditions

Information on existing traffic volumes is provided in the assessment report (Appendix C). A review of the volume capacity ratio (measure of the observed traffic volumes along a section of road against the total capacity of the road) indicates that traffic flow is unimpeded by congestion for the AM (7:30 am – 8:30 am) and PM (3:45 pm – 4:45 pm) peak hours. Westbound traffic on Heathcote Road, east of New Illawarra Road is approaching capacity.

A review of the level of service of these roads indicated that all sections of road currently perform at a level of service A (free flow) or B (stable flow/slight delays).

An assessment of the current intersection operating performance was undertaken for the intersections of New Illawarra Road/Little Forest Road and Heathcote Road/New Illawarra Road using SIDRA intersection assessment software.

The right turn movement from Little Forest Road into New Illawarra Road during the AM peak period shows significant delays and operates at level of service F ('unsatisfactory') due to the heavy northbound through traffic on New Illawarra Road. However, only a small number of vehicles experience delays on the minor side road and hence the overall intersection is considered to perform well during both peak periods.

The number and type of crashes at this intersection (three in the period 2003-2007) do not show an obvious pattern or a safety concern at this intersection.

At the intersection of Heathcote Road and New Illawarra Road all turn movements for both peak hours have an acceptable level of service except for the right turn from New Illawarra Road into Heathcote Road, with level of service F. Additional intersection capacity would be required to address this issue.

At this location, 52 crashes were reported with 24 casualties in the period 2003-2007. The number of casualties as a proportion of crashes is high. It is understood that the RTA is reviewing the operation of this intersection and a future upgrade is likely.

11.2 Proposed internal road network arrangements

11.2.1 Access to the AWT facility

The proposed internal road would be constructed to provide access to the proposed AWT facility. Vehicles accessing the AWT facility would travel via the new internal road off Little Forest Road, turning left at the proposed AWT access, some 90 metres west of Little Forest Road. Light vehicles would turn left into the car park prior to the weighbridge. Heavy vehicles would proceed straight ahead through the weighbridge before arriving at the main facility site.

Outbound heavy vehicles would travel past the weighbridge, turn right into the new internal road and then right into Little Forest Road to the intersection with New Illawarra Road. Light vehicles would give-way to heavy vehicles before turning right onto the internal access road.

11.2.2 Access to the relocated PCYC mini-bike facility

With the relocation of the PCYC mini-bike facility, the access and egress arrangements to this facility would change. The PCYC operates mainly on Sundays when commercial waste truck volumes to LHWRC are lowest and no commercial waste vehicles would be operating at the AWT facility. When the mini-bike facility is not operating, the facility is closed and the gate locked. All vehicles accessing the mini-bike facility are passenger cars (often with trailers).

The new internal road would provide access to the relocated PCYC facility west of the entrance to the AWT facility. Inbound PCYC vehicles would turn left into the internal road from Little Forest Road and continue west towards the PCYC facility. Outbound PCYC vehicles would be require to give-way (via a stop sign and stop line painted on the access road) to vehicles exiting the AWT site before proceeding to Little Forest Road.

11.2.3 Access to the Energy Development (EDL) site

Access and egress to the existing EDL site would be re-directed off the proposed new internal access road. Currently access is gained to the site directly off Little Forest Road. The proposed entrance/exit to the EDL site would be relocated approximately 80 m west of Little Forest Road. Inbound EDL vehicles would turn left into the internal road from Little Forest Road and then turn right into the EDL facility. Outbound EDL vehicles would be required to give-way (via a stop sign and stop line painted on the access driveway) to vehicles exiting the AWT site before proceeding to Little Forest Road.

11.2.4 Access to the proposed truck parking area

Access and egress to the proposed truck parking area (separate development application) would also be provided at the western end of the proposed new internal road, similar to the PCYC facility.

11.3 Impact assessment

11.3.1 Construction

Traffic generation

Traffic generation as a result of construction would generally be limited to movements of construction workers and delivery of material and equipment. All vehicles would access the site via a new access way off Little Forest Road. Off-street parking would be provided on site for construction workers.

On average, 30 construction staff would access the site during the construction period. This would generate a daily traffic volume of 60 vehicle trips per day. The peak generation periods would occur outside the peak period for the surrounding road network. Traffic generated by construction workers during the AM and PM peak period has been estimated to be 80% of the daily movements.

From these assumptions, it is estimated that light vehicle traffic generated during the weekday peak periods would be 24 vehicle trips per hour, with 24 vehicles moving into the site during the AM peak period and 24 vehicles moving out of the site during the PM peak period.

Based on a worst case scenario, it is assumed that 100 heavy vehicles would need to access the site per day during construction. This would result in the generation of 200 heavy vehicle trips on a

typical weekday. It has been conservatively estimated that approximately 20% of the heavy vehicle trips would occur during the AM and PM peak periods (40 heavy vehicle trips per hour during the AM and PM peak periods) with 20 trips in and 20 trips out.

Total traffic generation during construction is summarised in Table 11-1. During construction, there would be a maximum traffic generation of 64 vehicle trips per hour during the AM and PM peak periods, consisting of 24 light vehicle trips and 40 heavy vehicle trips.

Table 11-1 Traffic generation and split during construction

Component	Daily total		AM peak		PM peak	
	In	Out	In	Out	In	Out
Construction worker (light vehicle) traffic	30	30	24	0	0	24
Heavy vehicle traffic	100	100	20	20	20	20
Total	*130*	*130*	*44*	*20*	*20*	*44*

Intersection performance

The critical intersections were analysed using SIDRA with the additional construction traffic, to determine operating performance.

The results of the analysis indicated that the delays for the right turn movement from Little Forest Road into New Illawarra Road during the peak periods would worsen with construction traffic. All other movements at this intersection would experience only minor changes. However, as noted above, only a small number of vehicles experience delays on this road, which is a minor public side road.

Similarly, at the intersection of Heathcote Road and New Illawarra Road, only the right turn from New Illawarra Road into Heathcote Road would experience some increases in delay.

The impact of the construction traffic on the road network surrounding the site would be temporary and would be limited to the 18 month construction period.

11.3.2 Operation

Site access

A new access to the external road network for general traffic access is proposed at Little Forest Road as described in section 11.2.

A gated emergency vehicle only access would also be provided to Little Forest Road, south of the site access.

Traffic generation

The project would generate additional traffic movements on the key surrounding road network, via New Illawarra Road, associated with:

- Vehicles entering and leaving the site associated with the estimated 69 employees (2012 to 2035);

- Heavy vehicles (10 tonne trucks) associated with the delivery of 100,000 tpa of waste for processing (2012 to 2035); and
- Heavy vehicles (22 tonne trucks) associated with the removal of up to 40,000 tpa of residuals (2025 to 2035).

10 tonne capacity compactor vehicles would comprise the majority of the heavy vehicle movements. It is estimated that 39 waste trucks per day would deliver waste to the site. This would result in 78 vehicle movements per day (39 in and 39 out), consisting of approximately four trucks per hour delivering to the site over a 10 hour period (6 am to 4 pm). This would result in a total of eight truck movements per hour.

In addition, during the period 2025 to 2035 an estimated seven trucks per day would remove residuals from the site, which would result in 14 vehicle movements per day (7 in and 7 out) or two vehicle movements per hour during the 10 hours of operation each day (6am to 4pm).

It is estimated that the project would employee 69 people over various shifts. It is assumed that all employees would drive to work and hence would generate 138 vehicle movements per day (69 movements in and 69 out). It is assumed that employees would arrive within 30 minutes leading up to their shift, and depart within 30 minutes of the end of their shift. The majority of staff would arrive and depart outside of the AM and PM commuter peak periods.

The peak traffic generation for employee vehicle traffic would occur between 12.30 and 1.30 pm when staff involved in waste receival and processing are changing shift. At this time, the vehicle traffic generation is estimated to be 55 vehicle trips (25 in and 30 out). These vehicle trips would occur outside the weekday commuter peak period.

Staff traffic generation during the commuter peak periods is estimated to be:

- 7.30 to 8.30 am – 10 vehicle trips per hour (10 in and 0 out); and
- 4.30 to 5.30 pm – 14 vehicle trips per hour (2 in and 12 out).

Total traffic generation during operation up to the end of 2024 is summarised in Table 11-2.

Table 11-2 Traffic generation and split during operation (pre 2025)

Component	Daily total		AM peak		PM peak	
	In	Out	In	Out	In	Out
Employee (light vehicle) traffic	69	69	10	0	2	12
Heavy vehicle traffic	39	39	4	4	4	4
Total	*108*	*108*	*14*	*4*	*6*	*16*

Table 11-3 Traffic generation and split during operation (post 2025)

Component	Daily total		AM peak		PM peak	
	In	Out	In	Out	In	Out
Employee (light vehicle) traffic	69	69	10	0	2	12
Heavy vehicle traffic:						
- AWT MSW delivery	39	39	4	4	4	4
- AWT off-site residual	7	7	1	1	1	1
Total	*115*	*115*	*15*	*5*	*7*	*17*

The traffic impact assessment estimated that there would only be a minor increase in traffic generated by the project,on the surrounding road network above the estimated 2018 background traffic, which was assumed to increase by 2% per annum until that time.

Traffic generation associated with proposed truck parking area

The proponent is also proposing to provide a truck parking area for the WSN waste collection business on part of the LHWRC site, adjacent to the project site (subject to a separate development application). However, the traffic implications of the truck parking area are included here for cumulative impacts to be considered.

The truck parking area would house up to 32 waste collection trucks (which would collect and dispose of waste that is currently being disposed at the LHWRC). Therefore, additional truck movements are not expected, though there may be a change in the vehicle movement times, with additional departure in the morning and arrival at the end of the day.

As a worst case, an additional 40 trucks would depart the LHWRC in the early morning (4.30 am – 5 am) and arrive back in the late morning / early afternoon (11 am – 1 pm). No truck parking area truck movements would occur during the commuter peak traffic periods.

It is estimated that 40 employees would be associated with the truck parking area and that it is assumed that all staff would drive to work. Hence, 80 vehicle movements per day (40 in and 40 out) would be generated from employees. The start and finish times would be associated with waste collection vehicle use times. No truck parking area employee traffic movements would occur during the commuter peak traffic periods.

Traffic generation associated with the PCYC

Currently the PCYC only operate on Sunday from approximately 8 am to 4 pm. Some 200 vehicles access the site on this day. One off events occur approximately four times per year (generally during school holidays). With the proposed relocation of the mini-bike facility there is not expected to be any change in potential traffic generation to the LHWRC.

Total additional cumulative traffic generation

Total additional traffic generation including traffic associated with the project, the proposed truck parking area and the PCYC relocation for pre-2025 and post 2025 are shown in Table 11-4 and Table 11-5 respectively.

Table 11-4 Additional cumulative traffic generation (pre-2025)

Component	Daily		AM Peak		PM Peak	
	In	Out	In	Out	In	Out
Employee vehicle traffic						
AWT site	69	69	10	0	2	12
WSN truck parking	40	40	0	0	0	0
PCYC	0	0	0	0	0	0
Sub-total Employee	*109*	*109*	*10*	*0*	*2*	*12*
Heavy vehicle traffic						
AWT site	39	39	4	4	4	4
WSN truck parking	40	40	0	0	0	0
Sub-total Trucks	*79*	*79*	*4*	*4*	*4*	*4*
Total	***188***	***188***	***14***	***4***	***6***	***16***

Table 11-5 Additional cumulative traffic generation (post-2025)

Component	Daily		AM Peak		PM Peak	
	In	Out	In	Out	In	Out
Employee vehicle traffic						
AWT site	69	69	10	0	2	12
WSN truck parking	40	40	0	0	0	0
PCYC	0	0	0	0	0	0
Sub-total Employee	*109*	*109*	*10*	*0*	*2*	*12*
Heavy vehicle traffic						
AWT site	46	46	5	5	5	5
WSN truck parking	40	40	0	0	0	0
Sub-total Trucks	*86*	*86*	*5*	*5*	*5*	*5*
Total	***195***	***195***	***15***	***5***	***7***	***17***

During the operation of all facilities (the project, proposed truck parking area and relocated PCYC) there would be a maximum additional traffic generation of 376 vehicle trips per day and 390 vehicle trips per day from 2025 to 2035. There would be a maximum hourly additional traffic generation during the AM and PM commuter peak periods of 18 vph and 22 vph respectively up to 2024 and 20 vph and 24 vph respectively from 2025 to 2035.

It should be noted that the vehicle movements generated from the proposed truck parking area are outside the commuter peak vehicle traffic periods. Hence only the vehicle movements generated from the project would impact on the commuter peak vehicle traffic periods.

Road network performance

An assessment of the future mid-block traffic volume capacity (v/c) ratio and level of service of New Illawarra Road, Little Forest Road and Heathcote Road in the vicinity of the site has been undertaken and the results presented in this section. The performance has been assessed under background traffic peak hour traffic volumes in 2018, 2025 and 2035 by superimposing the project traffic demand on the background peak hour traffic volumes. The project traffic is considered to be the cumulative impacts of:

- AWT facility operational traffic for delivery of MSW; and
- AWT facility traffic for removal of residuals off-site (scenarios 2025 and 2035 only).

It should be noted that (as discussed previously) the proposed truck parking area and PCYC relocation would not generate any additional vehicular traffic during peak periods. The assessment of mid-block capacity and performance is based on peak hour performance.

Table 11-6 and Table 11-7 show the volume to capacity ratios for the AM and PM peak hours respectively in the 2018 forecast year with background growth and the project operational traffic.

Table 11-6 Mid-block 2018 AM Peak Hour Volume to Capacity Ratio

Location	Travel direction	Capacity (vph)	Background traffic only		Background + AWT operational traffic		% Increase
			Volume (vph)	v/c Ratio	Volume (vph)	v/c Ratio	
Little Forest Road, west of New Illawarra Road	Eastbound	500	45	0.09	49	0.1	8.9%
	Westbound	500	39	0.08	53	0.11	35.9%
New Illawarra Road, north of Little Forest Road	Northbound	1300	1080	0.83	1083	0.83	0.3%
	Southbound	1300	720	0.55	728	0.56	1.1%
New Illawarra road, south of Little Forest Road	Northbound	1300	1063	0.82	1069	0.82	0.6%
	Southbound	1300	709	0.55	710	0.55	0.1%
Heathcote Road, west of New Illawarra Road	Eastbound	1300	632	0.49	634	0.49	0.3%
	Westbound	1300	1003	0.77	1003	0.77	0.0%
Heathcote Road, east of New Illawarra Road	Eastbound	1300	656	0.5	657	0.51	0.2%
	Westbound	1300	1380	1.06	1384	1.06	0.3%

Table 11-7 Mid-block 2018 PM Peak Hour Volume to Capacity Ratio

Location	Travel direction	Capacity (vph)	Background traffic only		Background + AWT operational traffic		% Increase
			Volume (vph)	v/c Ratio	Volume (vph)	v/c Ratio	
Little Forest Road, west of New Illawarra Road	Eastbound	500	21	0.04	37	0.078	76.2%
	Westbound	500	19	0.04	25	0.05	31.6%
New Illawarra Road, north of Little Forest Road	Northbound	1300	703	0.54	712	0.55	1.3%
	Southbound	1300	1047	0.81	1051	0.81	0.4%
New Illawarra road, south of Little Forest Road	Northbound	1300	694	0.53	696	0.54	0.3%
	Southbound	1300	1040	0.80	1047	0.81	0.7%
Heathcote Road, west of New Illawarra Road	Eastbound	1300	867	0.67	867	0.67	0.0%
	Westbound	1300	567	0.44	569	0.44	0.4%
Heathcote Road, east of New Illawarra Road	Eastbound	1300	1339	1.03	1344	1.03	0.4%
	Westbound	1300	694	0.53	696	0.54	0.3%

A review of the volume capacity ratio for the 2018 forecast year indicates that the additional traffic as a result of the project would cause only minimal incremental increases in traffic volumes and none to minor perceptible changes in the volume capacity ratio. Similar analysis for 2025 and 2035 show that the additional traffic associated with the project would cause minimal incremental increases in traffic volumes and zero to minor perceptible changes in v/c ratio (refer Appendix C for details).

Table 11-8 2018 Mid-block AM Peak hour Level of Service

Location	Travel direction	Background traffic only		Background + AWT operational traffic	
		Volume (vph)	LoS	Volume (vph)	LoS
Little Forest Road, west of New Illawarra Road	Eastbound	45	A	49	A
	Westbound	39	A	53	A
New Illawarra Road, north of Little Forest Road	Northbound	1080	B	1083	B
	Southbound	720	A	728	A
New Illawarra road, south of Little Forest Road	Northbound	1063	B	1069	B
	Southbound	709	A	710	A
Heathcote Road, west of New Illawarra Road	Eastbound	632	A	634	A
	Westbound	1003	A	1003	A
Heathcote Road, east of New Illawarra Road	Eastbound	656	A	657	A
	Westbound	1380	D	1384	D

Table 11-9 2018 Mid-block PM Peak hour Level of Service

Location	Travel direction	Background traffic only		Background + AWT operational traffic	
		Volume (vph)	LoS	**Volume (vph)**	**LoS**
Little Forest Road, west of New Illawarra Road	Eastbound	21	A	37	A
	Westbound	19	A	25	A
New Illawarra Road, north of Little Forest Road	Northbound	703	A	712	A
	Southbound	1047	B	1051	B
New Illawarra road, south of Little Forest Road	Northbound	694	A	696	A
	Southbound	1040	B	1047	B
Heathcote Road, west of New Illawarra Road	Eastbound	867	A	867	A
	Westbound	567	A	569	A
Heathcote Road, east of New Illawarra Road	Eastbound	1339	D	1344	D
	Westbound	694	A	696	A

In 2018, Heathcote Road east of New Illawarra Road shows level of service D for westbound traffic in the AM peak and for eastbound traffic in the PM peak period. As previously noted, the increase in traffic volumes as a result of the project represents 0.2% to 0.4% growth over the 2018 background traffic for this road, with no change in the level of service.

Similarly, in 2025, Heathcote Road east of New Illawarra Road shows level of service E for westbound traffic in the AM peak and for eastbound traffic in the PM peak. Traffic volumes as a result of the project would represent 0.3% to 0.4% growth over the 2025 background traffic, with no change in level of service.

For the 2035 modelling scenario, New Illawarra Road north of Little Forest Road shows level of service E for northbound traffic in the AM peak and level of service D for southbound traffic in the PM Peak period. New Illawarra Road south of Little Forest Road shows level of service D for northbound traffic in the AM peak and southbound traffic in the PM peak period. Heathcote Road east of New Illawarra Road shows level of service F for westbound traffic in the AM peak and for eastbound traffic in the PM peak period. The increase in traffic volumes as a result of the AWT operational traffic represents 0.1% to 0.5% growth over the 2035 background traffic.

Future intersection performance of Little Forest Road/New Illawarra Road

In all future scenarios assessed in the traffic report (2018, 2025 and 2035 with and without cumulative project traffic) at the intersection of Little Forest Road with New Illawarra Road the through traffic on New Illawarra Road would operate freely with minimal delays.

In the AM peak period the low volume right turn movements from Little Forest Road into New Illawarra Road and from New Illawarra Road into Little Forest Road would experience delays but

have short queue lengths. The delays are worse in future scenarios due to the increasing through traffic volumes on New Illawarra Road.

The traffic report concludes that there would be minimal delays experienced in the PM peak period in 2018, 2035 and 2025 for vehicles turning right into Little Forest Road from New Illawarra Road. However, vehicles turning right from Little Forest Road into New Illawarra Road would experience notable delays with small queue lengths due to the low volumes.

The additional AWT operational traffic entering these intersections would be very low in comparison to the background traffic and would not result in any notable changes in the intersection operating characteristics. It was also noted that when the AWT operational traffic is added, the level of service for the right turn movement from Little Forest Road would improve due to the decrease in the proportion of heavy vehicles. This is because the delays for light vehicles are less than heavy vehicles and hence the average delays are reduced.

Future intersection performance of Heathcote Road/New Illawarra Road

As noted above, the intersection of Heathcote Road with New Illawarra Road is likely to be upgraded in the future. The traffic impact assessment considered the potential impacts of the project based on an assumed design for the intersection.

In all future scenarios the intersection of Heathcote Road with New Illawarra Road would operate within capacity. In the AM peak period the overall intersection would operate at level of service C in 2018 and 2025 but operate at level of service D in 2035. In the PM peak period the overall intersection would operate at level of service B in 2018 and 2025 but operate at level of service C in 2035.

The eastbound through movements on Heathcote Road would experience significant delays in the AM peak period under all scenarios and in the PM peak period by 2035. Significant delays would also experienced by the right-turn movement from Heathcote Road eastern approach into New Illawarra Road during the AM peak period in 2025 and 2035 and during the PM peak period by 2035.

The additional AWT operational traffic entering these intersections would be very low in comparison to the background traffic and would not result in any notable changes in the intersection operating characteristics.

Site access / egress intersection performance

It is proposed to provide an unsignalised priority controlled T-junction at the intersection of Little Forest Road with the new internal access way. Peak traffic volumes on both Little Forest Road and the new proposed road are expected to be relatively low and the priority controlled intersection is expected to accommodate the through and turning traffic movements.

A single traffic lane on each approach to the intersection is considered adequate. Deceleration and acceleration lanes are not required at the intersection approaches. The width and alignment of the intersection arms would need to accommodate the swept paths of an articulated truck.

Road layout and parking demand during operation

Detailed plans of the proposed layout of the internal road network and parking on site are provided at Figure 6-4. The traffic impact assessment of the internal road network and parking concluded that the design meets the requirements of the relevant Australian Standards (AS 2890.1: 2004 and AS 2890.2: 2002).

As noted above, it is estimated that 69 staff would be employed during operation over various shifts. The design of the project includes provision of 72 on site parking spaces. The estimated employee parking demand is summarised in Table 11-10.

Table 11-10 Employee parking demand

Time of day	Employee parking demand			TOTAL	Number of parking spaces proposed	Potential number of available spaces
	Control Room	Waste receival and processing	Admin			
5.00 am - 8.00 am	2	30	0	32	72	40
8.00 pm - 12.30 pm	2	30	10	42	72	30
12.30 pm - 1.30 pm	2	55	10	67	72	5
1.30 pm - 4.00 pm	2	25	10	37	72	35
4.00 pm - 5.00 pm	2	25	0	27	72	45
5.00 pm - 9.00 pm	2	25	0	27	72	45
9.00 pm - 5.00 am	2	0	0	2	72	70

As noted in Table 11-10, the maximum number of parking spaces required on site is 67. This would occur for only short periods of time around 1 pm when the waste receival and processing staff are changing shift.

The number of spaces available for visitor parking is also shown in Table 11-10. A minimum of five visitor parking spaces would be available, for a short period. At other times, between 30 and 70 spaces would be available.

Sutherland Shire Council's Development Control Plan 2006 (DCP 2006) does not specify a minimum off-street parking requirement for this type of facility. The most similar land use/type of development specified by DCP 2006 is 'industrial'. The minimum parking requirement for 'industrial' land uses is as follows:

- 1 space per 100 m^2 of gross floor area, with a minimum of 2 spaces for each industrial unit;
- 1 space per 30 m^2 of grass floor area for ancillary office space; and
- 1 space per 30 m^2 of gross floor area for ancillary shop/retail space.

The total gross floor area of the receival hall and processing building is 6,195 m^2. According to DCP 2006, a minimum of 62 car parking spaces is therefore required to be provided on-site.

The proposed provision of 72 parking spaces is in excess of this requirement.

Car park design and access driveway

The car park is proposed to be provided at the northern end of the site near the site entrance off the proposed new internal access road. During detailed design, the car park would be designed in accordance with the RTA Guide to Traffic Generating Developments, AS 2890.1:2004 and AS 2890.2:2002.

The car park concept design shown on Figure 6-4 shows parking modules approximately 2600 mm x 5500 mm, which exceed the minimum requirements of AS 2890.1:2004. During detailed design, parking aisles would be provided with a minimum width of 6200 mm. The concept design shows that the access driveway width (4000 mm) complies with AS 2890.1:2004.

Sustainable transport opportunities

The additional number of staff at the LHWRC as a result of the AWT facility is relatively low (69 employees). The start and finish times and the limited non-car based transport opportunities due to the isolated nature of the site mean that there are limited opportunities for staff to access the site via sustainable transport modes.

11.4 Mitigation measures

The proponent would ensure that the layout of the proposed car parking areas, including driveways, aisle widths, grades, parking bay dimensions, sight distance requirements, splay at kerbslines and turn paths is designed in accordance with AS 2890.1-2004 and AS 2890.2-2002 during the detailed design phase.

Car parking areas and entry/exit points would be clearly delineated through line marking and signage to ensure smooth, safe traffic flow.

During the construction of the project, no mitigation measures are required on the external road network. A construction traffic management plan would form part of the construction environmental management plan to ensure safe movement of vehicles and pedestrian into and around the site. The plan would include details on construction vehicle routes, truck numbers, hours of operation, access arrangements and traffic control.

During operation, no mitigation measures are required on the external road network. The proponent would continue to liaise with the Roads and Traffic Authority regarding the design of Heathcote Road/New Illawarra Road intersection.

12. Greenhouse Gas

The information presented in this chapter is based on the findings of the greenhouse gas assessment undertaken by GHD. The greenhouse gas assessment report is included in Appendix D of this environmental assessment.

12.1 Methodology

The greenhouse gas assessment was conducted in accordance with the general principles of:

- The Greenhouse Gas Protocol, A Corporate Accounting and Reporting Standard developed by the World Business Council for Sustainable Development; and
- The Commonwealth Department of Climate Change (DCC) National Greenhouse Accounts (NGA) Factors, 2009).

The scope and methodology for conducting the assessment was based on the Director-General's Requirements for the project. These included a requirement for assessment of scope 1 and 2 emissions. Assessment of scope 3 emissions was not required. As a result, the emissions sources considered included:

- Emissions from fuel use associated with site preparation and construction;
- Diesel usage by mobile equipment during operation;
- Fuel used for residual waste transport, placement and compaction;
- Emissions from fixed equipment;
- Emissions from the biogas generators (from incomplete combustion, gas escapes); and
- Energy exported (greenhouse reduction).

12.2 Assumptions

Assumptions used in estimating the energy use and greenhouse gas emissions for the construction of the project are listed in Table 12-1.

Table 12-1 Construction energy use and greenhouse gas emissions assumptions

Parameter	Data Source and Assumptions
Diesel used in construction equipment	Construction equipment types and durations of use estimated were provided by the proponent. Diesel consumption was estimated based on equipment type and assumed specifications from manufacturers websites as 554 kL over the construction period. Diesel is assumed to have an energy density of 38.6 GJ/kL and emissions factor both from Table 4 of the DCC NGA Factors publication (2009) for fuel combustion emission factors – fuels used for transport energy purposes.
Electricity for site offices	Quantity estimated based on site office requirements as 93.5 MWh over the construction period. Emission Factor from Table 5 of the DCC NGA Factors publication (2009) for NSW (Scope 2).

Assumptions used in estimating the energy use and greenhouse gas emissions during operation are listed in Table 12-2.

Table 12-2 Operation energy use and greenhouse gas emissions assumptions

Parameter	Data Source and Assumptions
Net electricity exported to the grid	Quantity of electricity consumed by the AWT facility during operation estimated by WSN as 10,871 MWh/y. Quantity of electricity generated by the AWT facility during operation estimated to be 16,000 MWh/y by the proponent. Net electricity exported to the grid = 16,000 – 10,871 = 5,129 MWh/y Emission Factor from Table 5 of the DCC NGA Factors publication (2009) for NSW (Scope 2).
Biogas generators – combustion emissions	Biogas generators are assumed to have an efficiency of 40% based on the Arrow Ecology website. Biogas combusted = 16,000 MWh/y / 0.4 = 40,000 MWh/y Conversion factor 1 GJ = 0.278 MWh from Table 30 of the DCC NGA Factors publication (2008) for energy conversion factors Emission Factor from Table 2 of the DCC NGA Factors publication (2009) for NSW (Scope 1).
Diesel in mobile equipment at the AWT facility	Quantity of diesel consumption estimated by Arrow Ecology as 122.76 kL/y. Diesel is assumed to have an energy density of 38.6 GJ/kL from Table 4 of the DCC NGA Factors publication (2008) for fuel combustion emission factors – fuels used for transport energy purposes. Emissions factor from Table 4 of the DCC NGA Factors publication (2009) for fuel combustion emission factors – fuels used for transport energy purposes.
Diesel for residual waste transport, placement and compaction	Fuel use for residual waste placement and compaction (to end of 2024 only) is estimated based on data provided by the proponent to be 1.5 L/t of waste, or 49 kL/y. Fuel use for transport of residual waste to offsite class 2 landfill (7 year period 2025-2031) is estimated based on data provided by WSN Environmental Solutions to be 1.9 km/L. Assume average distance to offsite class 2 landfill = 40 km. Diesel is assumed to have an energy density of 38.6 GJ/kL from Table 4 of the DCC NGA Factors publication (2008) for fuel combustion emission factors – fuels used for transport energy purposes. Emissions factor from Table 4 of the DCC NGA Factors publication (2009) for fuel combustion emission factors – fuels used for transport energy purposes.

12.3 Scope 1 and scope 2 emissions

The scope 1 and scope 2 emissions associated with the construction of the project are listed in Table 12-3.

Table 12-3 Construction scope 1 & scope 2 emissions

Emissions Source	Quantity Consumed	Scope 1 Emissions (t CO_2-e)	Scope 2 Emissions (t CO_2-e)
Electricity for site offices	93,479 kWh	-	83
Diesel from construction equipment	554 kL	1,493	-
Subtotal*		**1,493**	**83**
Total		**1,577**	

*Note: Figures in table may not sum exactly to total value due to rounding.

The scope 1 and scope 2 emissions associated with the operation of the project are listed in Table 12-4.

Table 12-4 Operations scope 1 & scope 2 emissions

Emissions Source	Quantity Consumed Annually	Scope 1 Emissions (t CO2-e/y)	Scope 2 Emissions (t CO2-e/y)
Net electricity exported (electricity generated onsite minus electricity consumed for plant operation)	5,129 MWh		(4,565)
Residual waste management	104 kL	140	
Diesel from mobile equipment	123 kL	331	
Biogas generators	143,885 GJ	695	
Subtotal*		**1,166**	**(4,565)**
Total		**(3,399)**	

*Note: Figures in table may not sum exactly to total value due to rounding.

12.4 Greenhouse emissions results summary

The results from the greenhouse assessment are summarised Table 12-5.

The total emissions during construction amount to 1,577 t CO_2-e or 79 t CO_2-e per annum assuming a design life of 20 years. Total annual emissions reduction during operation amounts to 3,399 t CO_2-e. The estimated annual emissions reduction from the project is 3,320 t CO_2-e (assuming a design life of 20 years).

The total annual NSW emissions for 2007 was 151.6 Mt CO_2-e. Hence, the estimated annual emissions reduction from the project would equate to approximately 0.002% of the state's total emissions.

Table 12-5 Greenhouse assessment summary

Greenhouse indicator	Note	Value	Units
Net annual emissions	1		
◗ Scope 1		1,241	t CO_2-e/y
◗ Scope 2		(4,561)	t CO_2-e/y
Total		**(3,320)**	**t CO_2-e/y**
Greenhouse intensity of the project (Scopes 1, 2)	2	(0.033)	t CO_2-e/t MSW[9]
Total annual NSW emissions	3	151.6	Mt CO_2-e/y

Notes:

1. Refer to the greenhouse gas assessment report (Appendix D) for definitions of reporting scopes. A detailed emissions inventory can be found in the greenhouse gas assessment report (Appendix D)
2. Greenhouse intensity based on annual Scope 1 and 2 emissions (excluding annualised decommissioning emissions)
3. Total annual NSW emissions based on DCC (2009) 'State and Territory Greenhouse Gas Inventories 2007'

12.4.1 Greenhouse intensity

The emissions intensity for construction and operation of the project is a net abatement of 0.033 t CO_2-e/ t municipal solid waste processed, including scope 1 and scope 2 emissions considered in the assessment.

12.5 Impact assessment

Considering scope 1 and scope 2 emissions, the project is expected to result in a net annual greenhouse gas reduction of 3,320 tonnes CO_2-e, which is approximately 0.002% of the state's total emissions in 2007. Hence the project would have a positive environmental impact in terms of greenhouse gas and climate change.

12.6 Mitigation measures

During operation, the project would consume approximately 10 GWh of electricity annually. This operational electricity requirement is deducted from the 'green' energy that is generated from the biogas in the energy plant that would otherwise be exported to the grid. During the detailed design of the plant, it may be possible to integrate additional energy efficiency measures to reduce consumption of electricity. A discussion of potential measures to maximise energy efficiency are outlined in the following sections.

12.6.1 Lighting

Wide-panel skylights would be considered for installation on the roof of the large waste receival and waste processing buildings. The high-bay lamps serving these two areas would be coupled to appropriate photo-electric switching cells that automatically switches off selected high-bay lighting when suitable levels of natural lighting are available.

[9] MSW – municipal solid waste

A variety of efficient high-bay lighting alternatives, including fluorescent high-bay lamp options, would be considered.

Installation of dedicated task lighting in the AWT facility may be required to supplement the maintenance light levels provided by high-bay lighting. The use of dedicated task lighting would allow for a reduction in the number of high-bay lights installed for general illumination in this area, and so reduce unnecessary lighting energy consumption. The final lighting design would ensure that the lighting levels meet Australian Standards.

Where feasible and cost-effective energy efficient lamp and lighting control technologies would be considered in all other parts of the facility, and may include:

- Specification of 28W T5 fluorescent lighting (with high-frequency ballasts) in office and near-office areas in place of standard 36W T8 fluorescent lighting;
- Specification of appropriate compact fluorescent lighting in other areas such as bathrooms, hallways and entrance areas;
- The use of occupancy sensors to automatically switch lighting in low-traffic or low-occupancy areas, such as bathrooms, storerooms, communal rooms and individual office areas;
- Photoelectric switching cells would be considered in place of timer switches to control security lighting based on available natural light levels.

12.6.2 Compressed air

The use of compressed air would be minimised in the final process design, since up to 90% of the electrical energy input into a compressed air system is dissipated as waste heat. This makes compressed air one of the more inefficient sources of motive power available.

Where compressed air is required as part of the process design, the final design would consider the use of variable speed driven air compressors to supply optimised compressed air needs. Variable speed driven air compressor controls are capable of balancing the compressed air supply to meet the required air demand, thereby reducing unnecessary energy wastage in the system.

If multiple compressed air lines are required to supply various components of the process plant, solenoid valves would be considered on individual compressed air lines. This would isolate inactive components and so reduce systematic leakage. Compressed air leakage is a significant issue in industry, and solenoid valves are useful to mitigate against unnecessary air losses and associated energy wastage.

12.6.3 Ventilation

The detailed ventilation design would consider the installation of variable speed drives on all supply air and exhaust air fan motors, which typically run continuously or for protracted periods. Depending on cost-effectiveness, variable speed drives may be installed on all supply and exhaust air fan motors rated over 1 kW. Ventilation fan motors serving the waste receival area may benefit from the use of variable speed drive control.

12.6.4 Odour prevention and removal

High-speed roller doors (similar to those at the MRRP) would be used for each of the waste drop-off bays.

In addition, the energy requirements of various odour control systems would be reviewed during the detailed design stage. The review would consider the cost, efficiency and maintenance trade-offs in order to determine the most suitable system for this situation.

12.6.5 Heating and cooling

The combined administration and control room area would require air-conditioning. The most energy efficient arrangement would be a centralised chilled water system. However this may not be feasible, as the area may be too small for the application. Energy efficient, inverter-type packaged air-conditioners are therefore likely to be used for heating and cooling in these areas, as well as energy efficient split-system air conditioning units for standalone rooms requiring heating and cooling.

All components of these air-conditioning systems installed outside the building would be located in shady areas, or provided with artificial shading, to improve the efficiency with which heat is rejected from the building. Appropriate room temperature set-points would also be applied when these air-conditioning units are commissioned.

Air-conditioning of the waste receival and waste processing areas would not be energy efficient or cost effective due to the large volume of these areas. Localised cooling, combined with suitable ventilation rates would be used for maintaining worker comfort in these areas.

Passive cooling arrangements to reduce the overall heat load on the buildings are more applicable to this situation. There may be substantial benefits from applying an infra-red reflective paint on part or all of these rooftops to reduce heat gain in these two areas. Similarly, external-shading devices may be considered for exposed walls that receive large amounts of sunlight, particularly on those walls that abut onto air-conditioned parts of the facility, such as the administration and control room areas.

12.6.6 Process efficiency

Energy efficiency would be considered when designing the process control system to ensure suitable control “interlocks” are applied to automatically switch-off unused process components when not required to operate. Such interlocked components might include linked conveyors, pumps, and other motor drives. Installation of variable speed drives on most process drive motors would also be considered to allow for both fine process control and energy efficient operation of the process plant.

In addition, high efficiency motors would be considered for all motor drive applications across the facility, particularly for motors rated between 22 kW and 45 kW, where efficiency differences between standard motors and high efficiency motors are typically at a maximum.

13. Biodiversity

The information presented in this chapter is based on the findings of the flora and fauna assessment undertaken by Eco Logical Australia Pty Ltd. The flora and fauna assessment report is included in Appendix E of this environmental assessment.

13.1 Methodology

The assessment methodology consisted of:

- A review of literature and existing data on flora and fauna in the region;
- Consultation with experts regarding threatened flora in the locality to identify the likelihood that threatened species would be present and to identify reference sites; and
- Field surveys.

Surveys were undertaken on 29 and 30 September and 7 October 2008. The survey methodology included:

- Systematic vegetation survey quadrats;
- Random meander;
- Targeted threatened flora searches;
- Preparation of flora species lists;
- Habitat assessment for threatened fauna (e.g. tree hollows, anthills, sandstone, sandy banks and other water features, rock outcrops or latrine sites and sandstone ledges);
- Opportunistic identification of fauna species including scat and track observations; and
- Visiting nearby reference sites to check if threatened species (particularly orchid species) listed on the proposed flora survey list were flowering.

An assessment of the potential impacts of the project on species, populations and ecological communities listed by the TSC Act was undertaken in accordance with the Draft *Guidelines for Threatened Species Assessment* (DEC 2005). An assessment of potential impacts in accordance with the EPBC Act was also undertaken.

13.2 Existing environment

13.2.1 Flora

The vegetation that would be impacted by the footprint of the project has been highly modified by the use of the site for mini-bike riding and associated infrastructure, weed invasion and rubbish dumping. Outside the footprint, more intact stands of native vegetation in moderate to good condition exist in narrow linear patches between mini-bike tracks and in patches on the site boundary.

Vegetation community

The vegetation community on site was identified as Sydney Sandstone Ridgetop Woodland. This community is not listed as threatened under the TSC and/or EPBC Acts.

Threatened flora

The results of the literature review and database searches indicate that a number of threatened flora species have been recorded within the study area (the 'study area' for the purpose of the flora and fauna assessment is a circular area of 10 kilometre radius surrounding the site) or have the potential to occur.

Threatened flora species considered to have the potential to occur based on the presence of habitat at the site are as follows:

- *Acacia baueri subsp. Aspera*;
- *Astrotricha crassifolia* (Thick-leaf Star-hair);
- *Epacris purpurascens var. purpurascens*;
- *Eucalyptus camfieldii* (Heart-leaved Stringybark);
- *Grevillea parviflora subsp. parviflora* (Small-flower Grevillea);
- *Leucopogon exolasius* (Woronora Beard-heath);
- *Melaleuca deanei* (Deane's Paperbark);
- *Persoonia hirsute* (Hairy Geebung);
- *Pterostylis saxicola* (Sydney Plains Greenhood); and
- *Pultenaea aristata* (Prickly Bush-pea).

No threatened flora were identified during surveys.

13.2.2 Fauna

Fauna habitat

Vegetation within the site generally consists of patches of open woodland to open scrub and heathland fragmented by mini-bike tracks. There are some small stands of less disturbed patches of vegetation mainly on the site's northern and southern boundaries. The site has good connectivity to surrounding larger areas of vegetation, such as those within the Holsworthy Military Area and the Heathcote and Royal National Parks. As a result, it may facilitate 'stepping stone' connectivity for mobile fauna species.

Habitat values within the site have been compromised to a large extent as a result of the high level of landscape modification and disturbance over a long period of time. Nevertheless, the site does provide potential habitat for a number of species that are typical of urban and bush interface environments and that are capable of using modified and fragmented vegetation. The woodland and heath on the site were not found to support hollow bearing trees. The heath understorey supported a moderate to high number of flowering shrubs that may provide foraging resources for species such as the threatened Eastern Pigmy Possum.

The motorcycle tracks and associated stockpiles of fill have resulted in the formation of depressions on the site that were inundated with water during surveys. Due to the silty nature of the fill however these 'wet' areas were significantly affected by sedimentation.

Habitat features within the site are considered to be:

- Open woodland and heath understorey (where present) that may provide foraging, roosting, perching and nesting habitat for some birds and bats;
- Open area that may provide foraging habitat for reptiles, raptors, some microchiropteran bats and ground-feeding birds; and
- Aquatic habitat associated with depressions that may provide foraging, refuge and breeding habitat, and a source of water for fauna species.

The site did not support termite mounds, which are a significant feed resource for the threatened heath monitor (*Varanus rosenbergi*).

There were no rock outcrops on the site, however there were some scattered sandstone rocks across the site that may provide habitat for small reptile species.

The site did contain some Eucalyptus and Melaleuca species that may provide summer and winter foraging for species such as the Grey-headed Flying Fox. However these species were not found on the site in significant numbers such that they would provide a significant foraging resource for these species.

The site does not support habitat for TSC/EPBC Act listed marine species. In addition, the site is not considered to contain critical or indeed suitable breeding or over-wintering habitat for any listed wetland or wading bird species.

Threatened fauna

The results of the literature review and database searches indicate that a number of threatened fauna species have been recorded within the study area or have the potential to occur.

Threatened fauna species considered to have the potential to occur based on the presence of habitat on site are as follows:

- Gang-gang Cockatoo
- Glossy Black-Cockatoo
- Powerful Owl
- Masked Owl
- Eastern Pygmy-possum
- Large-eared Pied Bat
- Eastern False Pipistrelle
- Eastern Bentwing-bat
- Eastern Freetail-bat
- Koala
- Grey-headed Flying-fox

- Yellow-bellied Sheathtail-bat
- Greater Broad-nosed Bat
- Giant Burrowing Frog
- Green and Golden Bell Frog
- Red-crowned Toadlet
- Rosenberg's Goanna

No threatened fauna were identified during surveys.

13.3 Impact assessment

13.3.1 Potential impacts on habitat

The project would result in the clearance of approximately 1.43 ha of vegetation, including vegetation that would be impacted by the project footprint and vegetation that would need to be removed to satisfy asset protection zone requirements (refer Chapter 14). Figure 13-1, on the following page, shows the vegetation impacted by the asset protection zone and proposed site infrastructure requirements.

The project footprint was selected to maximise use of existing cleared and disturbed areas, and permit much of the existing vegetation on the eastern and southern to remain undisturbed. This would also assist in screening the plant from surrounding areas.

Vegetation to be removed consists of weed infested areas, open grassed areas and disturbed patches of the Sydney Sandstone Ridgetop Woodland vegetation community. This community is not listed as threatened under the TSC and/or EPBC Acts.

Vegetation that would be removed consists of some mature Eucalypts including endemic species such as *Eucalyptus oblonga* (Stringybark), *Eucalyptus punctata* (Grey Gum), *Eucalyptus sclerophylla* (Hardleaved Scribbly Gum) and *Eucalyptus sparsifolia* (Narrow-leaved Stringybark), and some planted species including *Eucalyptus microcorys* (Tallowwood) and *Eucalyptus saligna* (Sydney Blue Gum).

Although the site does provide some connectivity value, the assessment identified more suitable and more substantial vegetated areas in the general vicinity of the site, which would provide a ‘stepping stone’ for mobile fauna species.

13.3.2 Potential impacts on threatened flora and endangered ecological communities

The potential for any adverse impacts on threatened fauna and flora species is considered to be low given the highly modified nature of the site, the fact that the project maximises use of disturbed areas, and the large area of quality habitat within the vicinity of the site.

An assessment of the likely impacts of the project on threatened species and endangered ecological communities with the potential to occur on site was undertaken (refer Appendix E for details). The assessment concluded that the project is unlikely to have a significant impact on threatened species, endangered ecological communities or their habitat, given that the footprint of the project is located

in an area that is already disturbed, and that no threatened species or communities have been recorded on site.

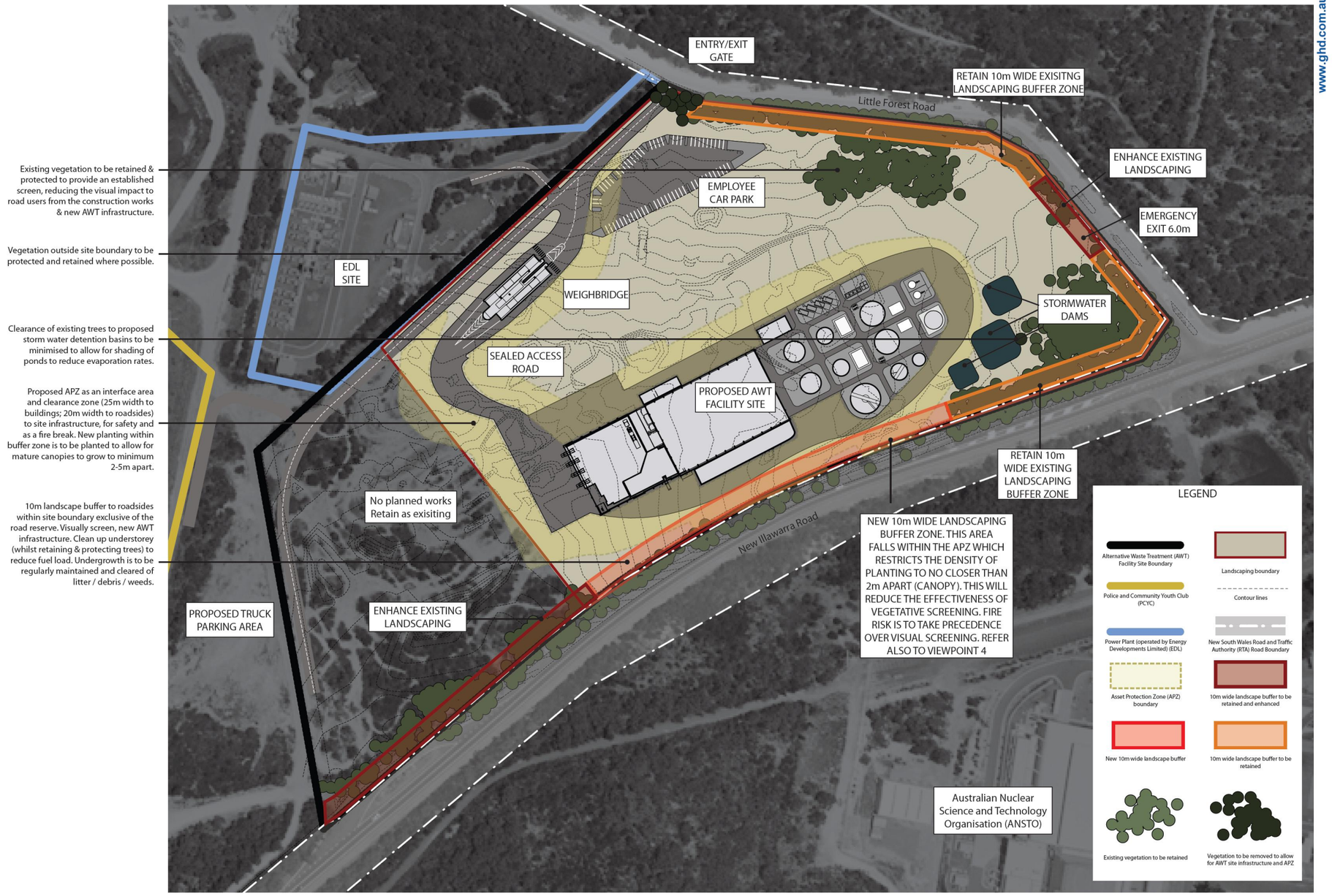


Figure 13-1 Vegetation impacted by asset protection zone requirements and proposed site infrastructure

13.4 Mitigation measures

13.4.1 Construction

Biodiversity management measures would be implemented during construction to minimise impacts on remaining vegetation. Management measures would be detailed in the construction environmental management plan and would include:

- Chipping/shredding cleared vegetation for use as mulch;
- Installation of standard erosion control measures prior to construction to limit erosion which could affect adjacent vegetation communities and watercourses;
- Erection of temporary exclusion fencing around areas of vegetation to be retained prior to construction. Locate materials, stockpiles, vehicle access and parking areas on existing cleared and disturbed land;
- Stabilisation of steep banks and bare earth areas as soon as possible after construction or removal of vegetation to limit gully and sheet erosion;
- Limit backfilling around the base of trees and shrubs to be retained;
- Implement a tree clearing protocol to ensure that any native fauna present are not injured during the clearing process; and
- Site inductions to include information on workers' obligations regarding the protection of vegetation and fauna habitats.

13.4.2 Operation

The design of the site layout has used large areas of cleared land to minimise the required vegetation loss at the site. This includes locating site stormwater and process water dams away from the vegetated area.

Weeds would be controlled throughout the site to minimise their spread to adjacent areas and would be removed and disposed of off-site. Noxious weeds would be managed in accordance with the *Noxious Weeds Act 1993*. The EMPs to be prepared for the project would detail this information.

Vegetation that would be removed consists of weed-infested areas, open grassed areas and disturbed patches of the Sydney Sandstone Ridgetop Woodland vegetation community. This community is not listed as threatened under the *Threatened Species Conservation Act 1995* (TSC Act) and/or *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

14. Hazards

The information presented in this chapter is based on the findings of the preliminary hazard analysis undertaken by GHD Pty Ltd and the bush fire assessment undertaken by Ecological Australia Pty Ltd. The preliminary hazard analysis report and the bush fire assessment report are included in Appendix F and G of this environmental assessment respectively.

14.1 Preliminary hazard analysis

14.1.1 Preliminary risk screening

In accordance with the requirements of SEPP 33, a preliminary risk screening of the project was undertaken. The methodology for risk screening is outlined in DoP's guidelines (1994). The guidelines provide a risk screening procedure based on the quantity of dangerous goods to be used by a project and the distance these materials are stored from a site's boundary. The dangerous goods screening for the project is provided in Table 14-1.

Table 14-1 Dangerous goods storage screening

Chemical	UN	Class	Packaging code	HazChem code	Quantity on site	Threshold
LPG (flare backup)	1075	2.1	-	2WE	<0.5 m^3	16 m^3 aboveground
Biogas - Methane 81%[1]	1971	2.1	-	2(S)E	1,000 m^3	>1,000 m^3 when stored 50m from site boundary
Diesel (boiler backup)	1202	3	PGIII	3(Z)	2.5 m^3	15 m^3 stored 10m from site boundary
Sodium Hydroxide Solution (50%)	1824	8	PGII	2R	1T	Class 8, PGII 25T
Hydrochloric Acid (33%)	1789	8	PGII	2R	1T	
Ferric Chloride (coagulant)	1773	8	PGIII	2X	25T	50T

Note 1 100% methane has been used as the closest material match for the biogas.

None of the materials listed in Table 14-1 exceed the screening threshold for on site storage of dangerous goods. This is provided that biogas and diesel would be stored greater than 50 m and 10 m from the site boundary respectively.

As a result of the small quantities of hazardous materials that would be delivered to the site, such delivery vehicles would make up only a very small portion of the total vehicle movements to and from the site.

The proposed movement of hazardous materials (both incoming and outgoing) is assessed in Table 14-2 against the transportation screening thresholds in the DoP guidelines (1994).

Table 14-2 Estimated vehicle movements of dangerous goods

Class	Substance	Peak weekly	Threshold	Qty per load	Threshold load
Packaging Grp		(Movements/Wk)	(Movements/wk)	(Tonnes)	(Tonnes)
Class 2.1	LPG (UN 1075)	<1	>30	<0.5	2 (bulk) 5 (packaged)
Class 3	Diesel UN 1202	<1	>60	<2.5	10 (bulk)
Class 8	Sodium Hydroxide (50%) UN 1824	1	>30	1	2 (bulk) 5 (packaged)
	Hydrochloric Acid (33%) UN 1789	1		1	
	Ferric Chloride UN 1773	1		25	

As the frequency of the dangerous goods deliveries is significantly below the thresholds, it is considered that the transport of dangerous goods to the project is not potentially dangerous and therefore does not require a route evaluation.

According to SEPP 33, if any of the screening thresholds are exceeded then a project should be considered to be potentially hazardous and a preliminary hazard analysis is required. In addition, if the quantities are close to the screening threshold values and the site is near a sensitive receiver, then the project is also considered to be potentially hazardous and a preliminary hazard analysis is required.

Based on the above assessment, the project would not require a preliminary hazard analysis as dangerous goods and vehicle movements do not exceed the respective thresholds, and are not considered potentially hazardous. However, as the quantity of biogas is close to the threshold, and to demonstrate that the project would not pose an additional risk offsite, a preliminary hazard analysis was undertaken for the project.

14.1.2 Impact assessment

The main potential hazards associated with the construction and operation of the project, identified by the preliminary hazard analysis (Appendix F) is outlined below.

Hazard identification represents a Level 1 or qualitative risk assessment and involves documenting all possible events that could lead to a hazardous incident. The aim of the hazard identification study process is to highlight any residual risks associated with the interaction of a project (as a whole) with the surrounding environment. A range of possible hazard scenarios were developed and ranked in terms of consequence and likelihood in consultation with relevant stakeholders.

Many of the scenarios identified in the hazard identification were not considered to pose a credible risk off site, or on site damage, fatality or injury. The scenario of fire or explosion of biogas was identified as a potential risk, and further investigated regarding the potential for off site impacts.

The worst case scenario considered was that of an ignited biogas release from the biogas buffer tank or associated pipe work. This was considered to have the highest potential risk. A quantitative risk assessment was undertaken, involving modelling of a potential jet fire. The quantitative risk assessment concluded that this potential hazard was not recognised to have the potential to result in off site impacts.

None of the other hazard scenarios identified had the potential to present an unacceptable risk to surrounding land users. Safeguards are required to ensure that the risk scenarios identified would be contained or at least controlled to an acceptable level.

14.1.3 Mitigation measures

To ensure the ongoing safe operation of the project, a comprehensive safety management system would be developed and implemented. The safety management system would take into account the results of the preliminary hazard analysis, and include measures such as the following:

- Installation of bollards or alternative protection around the biogas buffer tank to prevent vehicle collisions with the exposed piping and associated equipment;
- All potential ignition sources should be eliminated from areas containing biogas;
- Signage should be placed in suitable locations to indicate the presence of flammable substances;
- Local exhaust and general room ventilation to prevent accumulation of explosive mixtures;
- Handling equipment and tools grounded to prevent sparking;
- Depending on the odour properties of the biogas, an additive may be used to odorise the gas e.g. mercaptans in order to improve detection in case of a release;
- Permit to work systems for hot work;
- Specific materials of construction due to the flammable nature of the process output;
- Development of a maintenance regime; and
- Suitable emergency response procedures and equipment.

In addition, all materials would be stored in accordance with relevant legislation and Australian Standards.

14.2 Bushfire hazard assessment

14.2.1 Methodology

'Planning for Bushfire Protection' (NSW Rural Fire Service, 2006) (referred to below as PBP 2006) outlines the bush fire planning matters that need to be considered at various stages of the planning and development approval process. PBP 2006 applies to development on land that is classified as 'bush fire prone' on a bush fire prone land map. The bush fire assessment has been prepared in accordance with this document.

Site inspection

An inspection of the site and surrounding land was undertaken on 30 September 2008 to determine the slope and vegetation types, which are the basis of identifying bush fire hazard.

Vegetation

Vegetation was assessed on the site and over a distance of 140 m in all directions from the site boundary. Vegetation communities were determined according to Keith (2004).

Slope

Slope was assessed for a distance of 100 m under each surrounding vegetation community using a hand held inclinometer. Slope was often difficult to measure over a distance of 100 m underneath vegetation due to a dense understorey. As such, a combination of inclinometer measurements and digital elevation model data were used to identify slope across the site.

14.2.2 Existing fire risk

According to Sutherland Shire Council's Bushfire Prone Land map (2006), the site contains vegetation classified as:

- Vegetation Category 1; and
- Vegetation Buffer.

Remaining vegetation within the site boundary consists of highly disturbed pockets of heath/forest. The dominant vegetation community was identified by the flora and fauna assessment (Appendix E) as Sydney Sandstone Ridgetop Woodland.

According to PBP 2006, this vegetation is classified as 'Vegetation Group 1 – forest'. Although patches of heath exist, it was highly interspersed with forest and hard to differentiate. As a result, the community as a whole was considered to meet the forest classification.

The site is located on a gentle ridge with slopes not exceeding 5 degrees.

Although the site is subject to gentle slopes, overall, the bush fire hazard is considered to be moderate to high due to the dominance of the forest vegetation formation.

14.2.3 Fire management measures

Asset protection zones

An asset protection zone is an area of land, adjacent to a building, in which the bush fire fuel load is managed and maintained to minimise the impact of fire on that asset. The asset protection zone acts as a buffer between an asset and the bush fire hazard.

The recommended minimum asset protection zones are described below.

- To the west of the main facility building – 20 m;
- To the north, east and south of the main facility building - 25m;
- Surrounding the reception building – 25 m; and
- Both sides of the access road – 20 m.

The recommended asset protection zones are shown on Figure 14-1.

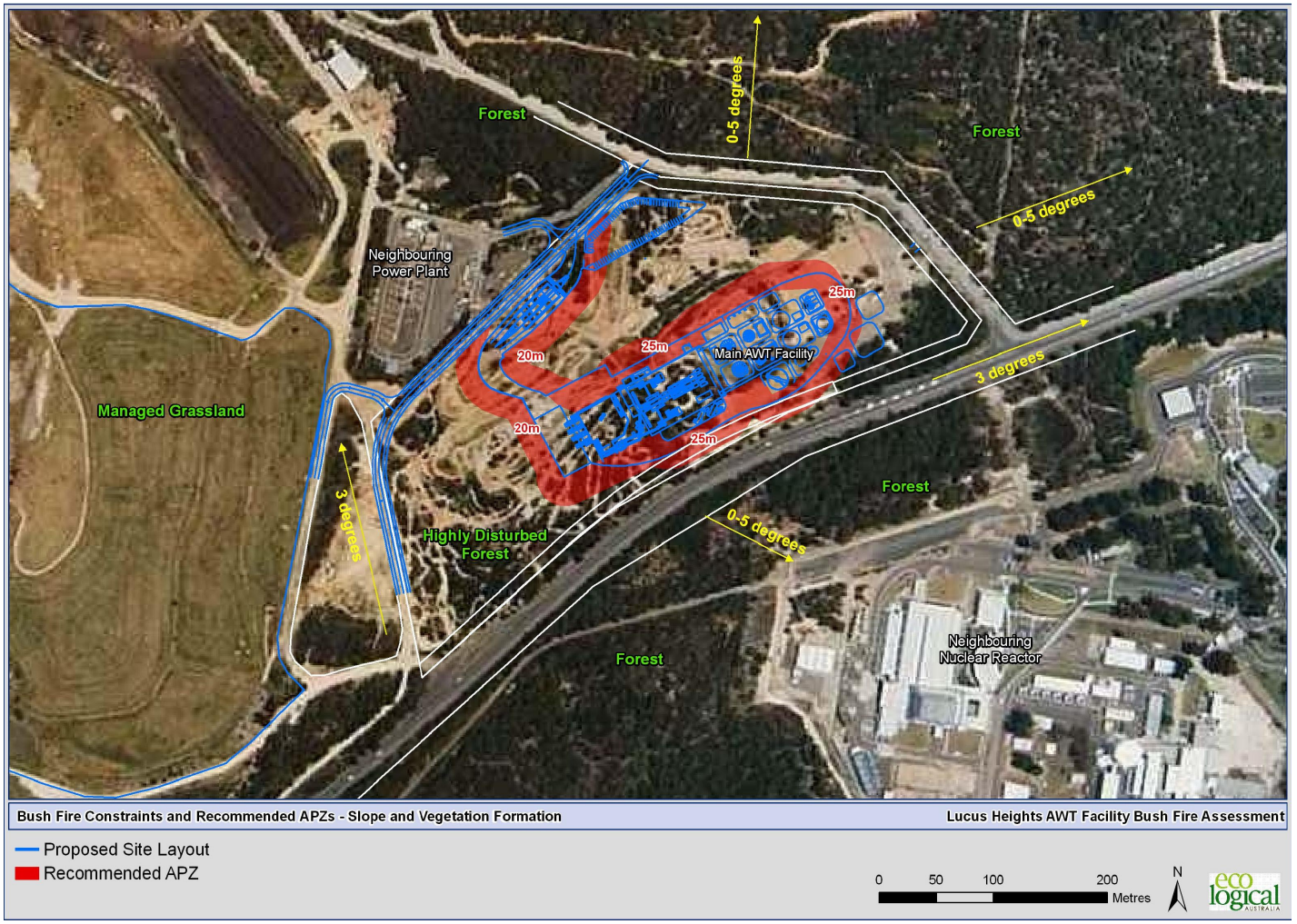


Figure 14-1 Recommended asset protection zones

Construction standards

Based on the vegetation type present at the site, the category of bush fire attack would be high and therefore level 2 construction standards would apply, as specified in Australian Standard 3959-1999 Construction of buildings in bush fire prone areas (AS 3959-1999). As the project does not involve construction of a dwelling, some of these provisions are not applicable. However, given the need to ensure a high level of protection for facilities on site, the detailed design of the project would take into account bush fire protection. Most importantly, combustible materials likely to be impacted by radiant heat would not be used in construction of the project.

The reception building to the north would be constructed to level 3 of AS 3959-1999.

Active mitigation/suppression

The project would include two 225,000 litre dedicated fire fighting water tanks on site. These are expected to provide fire-fighting capacity for the equivalent of four hours. Additional active mitigation/suppression systems (such as bush fire sprayer systems, radiant heat shields etc) are not considered relevant given the available setback and highly regulated nature of the project. However, as a minimum, fire fighting equipment such as extinguishers and hoses would be provided on site along with relevant staff training.

Site access roads

The road system would be built to appropriate standards and provide access to the rear of the site and turning areas for fire fighting vehicles. Specific requirements for the site access are detailed in Appendix G.

To maximise access/egress to and from the site, a second emergency access gate is proposed in addition to the main site access. The emergency access would be located off Little Forest Road, south of the actual site access. To limit general access from the emergency access, the gate would be locked and a key provided to the Rural Fire Service.

Summary of management measures

The following is a summary of bush fire protection measures for the site, including measures in addition to those discussed above.

1. Asset protection zone:

- Asset protection zones would be provided as detailed above.
- Rubbish and other material would not be stored in asset protection zones unless it is fully enclosed in non-combustible containers and removed on a regular basis (at least weekly).

2. Construction standards:

- All building materials would be non-combustible where possible and meet the objectives of construction level 2 of AS 3959-1999.

3. Access/egress:

- Safe access and egress would be provided, including an emergency access gate leading onto Little Forest Road, south of the actual site access.

- The Rural Fire Service would be consulted annually as part of the overall fire accreditation for the site with specific consideration of emergency response approaches (fire fighting strategies, evacuation planning).

4. Water supply:

- Water supply would meet the requirements of AS 2419.1-2005 Fire hydrant installations.
- Two 225,000 L dedicated fire-fighting water tanks would be provided on site.

5. Emergency management:

- A bush fire evacuation plan would be prepared and integrated with the LHWRC emergency management plan and any requirements by ANSTO.

6. Landscaping and site management:

- Landscaping would be maintained to meet the standards of an asset protection zone.
- Rubbish and other materials would not be stockpiled within the asset protection zone.

15. Noise

The information presented in this chapter is based on the findings of the noise assessment undertaken by Heggies Pty Ltd. The noise assessment report is included in Appendix H of this environmental assessment.

15.1 Methodology

The assessment methodology involved:

- Characterising the existing noise environment by conducting noise surveys at representative locations (see below);
- Calculating noise goals in accordance with relevant guidelines;
- Establishing potential noise levels associated with the project and the proposed truck parking area (separate DA) for consideration of potential cumulative noise emissions, including levels associated with construction, on site operation and traffic accessing the site; and
- Assessing the potential cumulative noise impacts of the project and the proposed truck parking area.

Noise monitoring

Unattended noise monitoring was carried out between 11 and 20 August 2008 at two locations (in Thomas Mitchell Drive, Barden Ridge and Mountain Street, North Engadine) considered to be representative of the nearest residences.

15.2 Existing environment

Noise monitoring results are summarised in Table 15-1.

Table 15-1 Noise monitoring results

Location	Noise Level (dBA re 20 µPa)					
	Day		Evening		Night	
	RBL[1]	L_{Aeq}[2]	RBL[1]	L_{Aeq}[2]	RBL[1]	L_{Aeq}[2]
Location 1 - Thomas Mitchell Drive, Barden Ridge	42	54	38	51	33	46
Location 2 - Mountain Street, North Engadine	40	54	36	47	32	49

Notes

1. The Rated Background Level (RBL) is representative of the typical minimum background sound level. By definition the RBL is the lowest 10 percent value of the 15 minute background noise level measurements taken over the assessment period.
2. The L_{Aeq} is the logarithmic average of the 15 minute sample in each assessment period.

15.3 Noise goals

15.3.1 Construction noise considerations

The 'Environmental Noise Control Manual' (DECC 1994) provides guidelines for assessing the noise impact from construction sites. The DECCW's general approach to the control of noise from construction sites involves the following.

Limiting hours of operation

General construction hours specified in the Environmental Noise Control Manual are:

- Monday to Friday – 7 am to 6 pm;
- Saturday – 7 am to 1 pm (if inaudible at residential premises) or 8 am to 1 pm (if audible at residential premises); and
- Sundays and public holidays – no work permitted.

Use of silenced equipment

All practical measures should be used to silence equipment, particularly in instances where extended hours of operation are required.

Noise emission objectives

The estimated duration of the proposed construction program is approximately 18 months. For a construction period greater than 26 weeks, the stated noise goal is that the $L_{A10(15minute)}$ noise level, when measured at a residential receiver, should not exceed the $L_{A90(15minute)}$ RBL by more than 5 dBA.

As the overall duration of the proposed construction program is greater than 26 weeks, the L_{A90} + 5 dBA noise goal is applicable to residential and other noise sensitive receivers (e.g., schools, hospitals, nursing homes, etc).

The Environmental Noise Control Manual makes no mention of criteria relevant to commercial or retail receivers. On previous similar projects, Heggies has recommended an increase of the noise goal for commercial/retail receivers of 5 dBA to 10 dBA.

The calculated construction noise objective for the project is 45 to 47 dBA at residential receivers, and based on the lower RBL recorded at North Engadine, 50 to 55 dBA at commercial receivers.

Work outside preferred construction hours

Where it is necessary for construction to be undertaken outside the DECCW's preferred daytime construction hours, the $L_{A10(15minute)}$ noise level emitted by the works should not exceed the L_{A90} level during the relevant evening or night-time period by a margin of more than 5 dBA.

15.3.2 Operation noise goals

Assessment of noise sources in accordance with the DECC (2000) *Industrial Noise Policy* involves consideration of two criteria - the 'intrusiveness' criterion and the 'amenity' criterion. The standard approach is to calculate both sets of criteria, and apply the lower of the two in each time period.

The noise assessment identified that the project specific goals are determined by the intrusiveness criterion, and are as follows:

- Location 1 (Barden Ridge) - 38 dBA (night), 43 dBA (evening) and 47 dBA (daytime).
- Location 2 (North Engadine) - 37 dBA (night), 41 dBA (evening) and 45 dBA (daytime).

Traffic noise

The DECC (1999) *Environmental Criteria for Road Traffic Noise* represents the NSW Government's noise design goals for the assessment of road traffic noise.

The ECRTN document presents recommended road traffic noise criteria for various types of road and land use developments. Old Illawarra Road is identified by the traffic assessment (refer Chapter 11) to be a sub-arterial road.

The relevant criteria is shown in Table 15-2:

Table 15-2 Traffic noise criteria

Type of development	Criteria	Where criteria are already exceeded
Land use developments with potential to create additional traffic on freeways/arterials.	Day ($L_{Aeq(15hour)}$) - 60 dBA Night ($L_{Aeq(9hour)}$) - 55 dBA	Where feasible and reasonable, existing noise levels should be mitigated to meet the noise criteria. Examples include appropriate location of private access roads; regulating times of use; using clustering; using 'quiet' vehicles; and using barriers and acoustic treatments. In all cases, traffic arising from the development should not lead to an increase in existing noise levels by more than 2 dB.

15.4 Impact assessment

15.4.1 Construction

Two scenarios were modelled for the project and proposed truck parking area, these were considered representative of the noisiest phase of the construction:

- Earthworks – the model involved two excavators, two compactors and two bulldozers/graders for the earthworks, and two water trucks. In addition, two truck movements in a 15 minute period were assumed.
- Building works – the model involved two cranes and two concrete trucks. In addition two truck movements in a 15 minute period were assumed.

The results are presented in Table 15-3.

Table 15-3 Calculated $L_{A10(15minute)}$ construction noise levels (no noise mitigation treatments)

Receiver location	Construction activity	Construction equipment	$L_{A10(15minute)}$ Daytime noise goal	Calculated $L_{A10(15minute)}$ construction noise level
Location 1, Barden Ridge	Earthworks	2 x excavators + 2 x compactors + 2 x dozer/grader + dump trucks	47 dBA	19 dBA
	Building works	2 x cranes + concrete truck + handtools		13 dBA
Location 2, North Engadine	Earthworks	2 x excavators + 2 x compactors + 2 x dozer/grader + dump trucks	45 dBA	22 dBA
	Building works	2 x cranes + concrete truck + handtools		15 dBA
ANSTO Buildings	Earthworks	2 x excavators + 2 x compactors + 2 x dozer/grader + dump trucks	50 dBA to 55 dBA	52 dBA
	Building works	2 x cranes + concrete truck + handtools		46 dBA

The data presented in Table 15-3 indicates that compliance with the noise goals is achieved at the nearest residences at Barden Ridge and North Engadine, and that no significant impacts from construction activities are expected at the ANSTO facilities.

15.4.2 Operation

Cumulative $L_{Aeq(15minute)}$ noise levels for the existing operations (landfill and recycling operations), the project, and the proposed truck parking area operations were calculated for the year 2012 under acoustically neutral, prevailing wind and temperature inversion conditions (including wind) for nominated receiver locations. The results are summarised in Table 15-4 and Table 15-5 and shown by the noise level contours included in Appendix H for daytime neutral and night-time temperature inversion (no wind).

Table 15-4 Noise emissions – day and night time during acoustically neutral conditions

Location	Criteria (dBA)		Predicted $L_{Aeq(15\ minute)}$ noise levels (dBA)	
	Day	Night	Day	Night
Location 1, Barden Ridge	47	38	21	19
Location 2, North Engadine	45	37	22	20
ANSTO gatehouse	65	65	43	41

	Criteria (dBA)		Predicted $L_{Aeq(15\ minute)}$ noise levels (dBA)	
ANSTO nearest building	65	65	27	26

Table 15-5 Noise emissions – night time during prevailing winds and temperature inversion conditions

Location	Criteria	Predicted $L_{Aeq(15\ minute)}$ Noise Levels (dBA)	
		Night-time temperature inversion	Night-time temperature inversion + SW wind
Location 1, Barden Ridge	38	25	25
Location 2, North Engadine	37	26	25
ANSTO gatehouse	65	43	43
ANSTO nearest building	65	27	26

The data presented in Table 15-4 and Table 15-5 indicates that the calculated noise levels will not exceed the noise goals at any of the locations considered.

15.4.3 Operation traffic

To assess the potential cumulative impact of traffic noise at existing residences on the access roads to the site noise level calculations were carried out using the UK Department of Transport, 'Calculation of Road Traffic Noise' (CORTN 1988) algorithms. The modelling allows for traffic volume and mix, type of road surface, vehicle speed and ground absorption. The algorithm output of CORTN was modified to calculate the relevant L_{Aeq} road traffic noise emission descriptors, as required.

The calculated noise levels for the year 2012 were determined by taking into account overall traffic volumes (including existing traffic associated with the LHWRC operation, traffic expected to be generated from the project and the change in truck access times associated with the proposed truck parking area[10]), vehicle speed, percentage of heavy vehicles and distance between roadway and the receiver, and include 2.5 dBA facade reflection. The year 2012 is considered to also be representative of the 'worst case year' when all elements are operational, and other non-project traffic movements on Old Illawarra Road at their lowest volumes. Furthermore, whilst after year 2024 when the LHWRC landfilling finishes, residual waste from the project would be transported off site, the associated AWT facility movements are significantly lower than the landfill associated movement

[10] The proposed truck parking area (separate (under a development application) is not expected to generate additional truck movements, but rather a change in the time that trucks access the LHWRC. Currently these trucks leave the LHWRC after their last disposal of the day which would be during the lunch time hours of 11.00 am to 1.00 pm. With the proposed truck parking area it is expected that associated trucks would leave the LHWRC between 1.00 pm and 3.00 pm on weekdays and between 12.30 pm and 1.00 pm on weekends.

pre year 2024. Hence the impact of the AWT facility movements off site after year 2024 would therefore be lower than the impact of the combined movements of year 2012.

Two scenarios were modelled at the nearest receiver to the site access road:

- $L_{Aeq(15hour)}$ daytime noise levels; and
- $L_{Aeq(9hour)}$ night-time noise levels.

Noise modelling results are summarised in Table 15-6.

Table 15-6 Existing and future traffic noise levels

Receiver	Noise Level (dBA)					
	Daytime $L_{Aeq(15hr)}$			Night-time $L_{Aeq(9hr)}$		
	Existing	Future with project	Increase	Existing	Future with project	Increase
Location 1, Barden Ridge	68	68	0.8	64	65	0.8

Notes

1. Existing and future noise levels have been rounded to the nearest decibel, with the change in noise level shown to one decimal place.
2. The predicted levels include a 2.5 dBA facade correction,

The predicted existing and future noise levels have been rounded to the nearest decibel, with the change in noise level shown to one decimal place. Existing and future traffic noise levels both exceed the baseline ECRTN criteria of 60 dBA and 55 dBA for day and night time respectively. However, the traffic noise increase of 0.8 dBA complies with the 2 dBA allowance goal.

15.5 Mitigation measures

The project would be designed, constructed and operated to ensure that noise criteria are not exceeded. Project designers and operators would be required to meet noise criteria.

A construction noise management plan would be prepared as part of the construction environmental management plan to detail how construction impacts would be minimised and managed.

The operational environmental management plan would include noise control measures, monitoring and procedures to handle any noise complaints.

15.6 Summary of resulting impacts

Potential noise impacts of the project during construction and operation are expected to be minimal and would comply with design goals at nearby sensitive receivers. The site is quite distant from residential areas.

16. Social and Economic

This chapter describes the existing socio-economic environment of Sutherland Shire including existing demographic, socio-economic and employment profiles. It also describes the potential socio-economic impacts from the project and relevant mitigation measures.

16.1 Existing environment

The estimated resident population of the Sutherland Shire is approximately 214,000 people (Sutherland Shire Council, 2007). Growth has been relatively stagnant since 2001, as a result of the lack of residential development impetus and changing household patterns.

The results of the 2006 Census (ABS) indicated that approximately 18% of the population of the Sutherland Shire is aged 60 years and over, compared with approximately 16% in the Sydney Statistical Division. Almost a quarter of the population is aged 0 to 17 years (23.9%) but there are fewer 25 to 34 year olds compared to the Sydney Statistical Division (13.2% compared to 15.3%).

Over a quarter of the population (26.6%) earns an income of $1,000 per week or more, and 34.4% earns less than $400 per week, compared with 21.7% and 38.1% respectively for the Sydney Statistical Division.

Overall, 47.7% of the population held educational qualifications, and 41% had no qualifications, compared with 43.0% and 42.8% respectively for the Sydney Statistical Division

Approximately 38% of residents work within the Sutherland Shire.

Of the labour force of Sutherland Shire, 97.1% were employed in full and part time roles (65.2% of the population aged 15+), and 2.9% were unemployed (2.0% of the population aged 15+), compared with 94.7% and 5.3% respectively for the Sydney Statistical Division.

The three most popular industry sectors in the Sutherland Shire are retail trade (employing 10.8% of the population), health care and social assistance (9.4%) and manufacturing (9.3%) sectors.

16.2 Impact assessment

16.2.1 Potential social impacts

The site was previously used by the PCYC for the mini-bike club. Development of the project means that this use of the site by the PCYC would no longer be possible. However, the proponent offered to relocate this activity to an area within the LHWRC site and this is expected to occur mid 2009.

Other potential impacts include employment, amenity and health impacts.

Employment

The project would generate employment during both construction and operation. The estimated construction workforce would be 30-50 people during the construction phase.

The project would employ approximately 69 staff during operation over three shifts.

Potential amenity impacts

The construction and operation of the project has the potential to create amenity and health related impacts, with the main potential issues being:

- Noise during construction and operation has the potential to impact on residential amenity;
- Visual impacts - Changes to the visual quality of the landscape, both during construction (landscape disturbance and the presence of the construction worksite) and operation (presence of new structures);
- Air quality impacts – the main potential for negative impacts would be as a result of dust generation during construction, and odour during operation; and
- Increase in traffic associated with the project.

The potential for negative amenity impacts would be significantly reduced by the implementation of appropriate design features and stringent environmental management controls guided by the construction and operation environmental management plans.

The design and commissioning of the Ecolibrium^{TM} Mixed Waste Facility at the MRRP has enabled the proponent to test the success of environmental measures used to mitigate the impact of such a facility on the environment. The experience gained at that facility provides a level of confidence that the measures implemented as part of this project would be appropriate and deliver the desired environmental outcomes.

Residential areas are generally more than 2 km from the site. Noise during construction and operation is predicted to comply with noise design goals and the DECC (1994) *Environmental Noise Control Manual*.

Potential visual impacts are discussed in chapter 18. The main visual impact of the project would be the change in the views for passing motorists. Although the project would introduce a new feature in the local landscape, potential impacts would be minimised by the implementation of the recommended landscape plan.

Chapter 10 describes the potential air quality and odour impacts of the proposal. Project design features would ensure that air quality is maintained and as a result, the project is not predicted to impact on local or regional air quality. Dispersion modelling indicates that off-site odour levels could be maintained at acceptable levels.

Potential traffic impacts are discussed in chapter 11. The project would result in a slight increase in traffic along the main access route. The traffic impact assessment concluded that the project would not result in any notable changes in intersection operating characteristics.

16.2.2 Potential economic impacts

Potential positive impacts of the project include:

- Cost – co-locating the project with the existing LHWRC is cost-competitive compared to locating the facility on a greenfield site, and as a result, there would not be additional travel costs to contractors associated with the transport of waste to the site.
- Employment – as described above, construction and operation of the project would generate employment.

- Generation of income – the project would result in the generation of income within the local and wider community by providing wages and salary bills for direct and indirect employment, together with the multiplier effect of income expenditure. Generation of income would enhance the economy of the local area.
- Supply of goods and services – local businesses would benefit from the project through the supply of general goods and services. For example construction material and construction services.
- Diversion of waste from landfill – the project forms part of a range of alternative technologies required to manage regional waste. The project provides a cost effective solution to waste management.

Economic costs associated with undertaking the proposal include:

- Capital cost – the estimated project value is $60 million.
- Infrastructure costs – the project may place additional demands on service infrastructure such as electricity, however infrastructure costs are expected to be minor. The facility will produce sufficient electricity to meet the operational needs with excess electricity to be exported to the grid.
- Environmental monitoring – on-going environmental management and monitoring would be required for the duration of operation.

16.3 Mitigation measures

The following mitigation measures are recommended:

- Consultation with the local community and other key stakeholders as outlined in chapter 4.
- Implementation of measures to minimise the potential for construction and operation impacts on amenity. This would include measures recommended in other sections of the environmental assessment and the development and implementation of construction and operation environmental management plans; and
- Maximising the use of arterial roads for construction access, and placing controls over the use of local roads for construction vehicles.

17. Heritage

The information presented in this chapter is based on the findings of a heritage assessment conducted by Australian Museum Business Services (AMBS). The heritage assessment report is included in Appendix I of this environmental assessment.

17.1 Assessment methodology

The heritage assessment was prepared in accordance with the requirements of the relevant statutory authorities and included:

- Consultation with the local Aboriginal community, in accordance with the draft *Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation* (DEC 2005);
- Search of the DECCW Aboriginal Heritage Information Management System database, to determine the location and nature of any Aboriginal heritage sites recorded within, or in the vicinity of the site;
- Review of relevant previous archaeological reports specific to the site, to determine the extent of past archaeological research in the region;
- Review of relevant contextual environmental information and previous land use history;
- Site survey (undertaken on 17 September 2008 by AMBS project officers), to allow identification and assessment of any Aboriginal and historic heritage values present in the site; and
- Preparation of the heritage assessment report (refer Appendix I).

17.2 Existing environment

17.2.1 Aboriginal heritage

The heritage assessment (refer Appendix I) identified 122 registered Aboriginal sites listed on the DECCW Aboriginal Heritage Information Management System (AHIMS) within 3 km of the site.

The assessment did not identify any Aboriginal sites, places or objects within the site. During the survey, some sandstone was noted along some of the tracks, exposed as a result of erosion caused by vehicles. However, no Aboriginal art/engravings or axe grinding grooves were identified.

17.2.2 Historic cultural heritage

No heritage sites listed on national, state or local heritage registers and inventories are located within the vicinity of the project.

The assessment did not identify any items or places of historic heritage value within the site.

17.3 Impact assessment

As no items or places of heritage significance were identified, the assessment concluded that the project would not impact on Aboriginal or historic cultural heritage. The Aboriginal cultural heritage

assessment report concludes that no further aboriginal or historic archaeological investigations or survey of the site is required prior to construction.

17.4 Mitigation measures

Although there is low potential for significant Aboriginal objects to be present at the site, GLALC would be contacted if any items of Aboriginal heritage significance are identified during the project construction or operation.

18. Visual Amenity

The information presented in this chapter is based on the findings of the landscape and visual assessment undertaken by Musecape. The assessment report is included in Appendix J of this environmental assessment.

18.1 Existing environment

18.1.1 Existing visual environment

There is a mix of land uses in the vicinity of the site, including waste (LHWRC), scientific/industrial (ANSTO), bushland (Holsworthy Military Reserve) and sporting (Ridge Sports Complex).

The site slopes gently to the north east, with elevations ranging from 150 to 160 mAHD.

The landscape character of the site is one of scattered stands of remnant indigenous woodland and heath, with large areas cleared for the PCYC mini bike activities. There are considerable areas of bare earth, some low structures associated with the mini bike activities and a large quantity of used rubber tyres used as safety barriers around the tracks.

The terrain of the site has been disturbed by the mini bike activity, with natural soil profiles altered where development has taken place, including the deposition of various amounts of fill over the natural landform to create bike tracks and jumps.

18.1.2 Visibility of the site and potential visual receptors

The site is visible (in part) from Little Forest Road and New Illawarra Road (both public roads). It is not visible from any other public viewpoints or residential areas. As a result, the main views to the project from the public domain would be from New Illawarra Road.

The existing perimeter vegetation along New Illawarra Road and Little Forest Road is approximately six metres high and varies in density. In places there are relatively clear views from New Illawarra Road into the site. Views into the site from New Illawarra Road are partly screened by a low earth bund inside the boundary fence, existing stands of casuarinas and remnant stands of native vegetation. Views into the site from Little Forest Road are similarly screened, except around the entrance to the LHWRC site, where there are uninterrupted views into the site.

There is limited visibility of the site from Heathcote Road due to the topography, distance and dense roadside vegetation. Passing motorists may have glimpses of the site where there are gaps in the roadside vegetation, but generally the visual exposure of the site from Heathcote Road is low.

18.1.3 Visual absorption capacity

Visual absorption capacity is an assessment of the ability of a particular area of landscape to absorb development without creating a significant change in visual character or scenic quality.

While the existing site has extensive cleared areas, it contains few buildings and is generally well screened by vegetation along the New Illawarra Road and Little Forest Road boundaries. It is

considered that the site would therefore have limited capacity to absorb additional development of the scale of the project without changes to the way it is perceived from public viewing points.

Given the relatively gentle topography, the low height of existing vegetation cover and the short distance from public viewing points on New Illawarra Road, the visual absorption capacity is considered to be low. This is partly offset by the ANSTO facilities on the opposite side of New Illawarra Road, which present as a major development, although their visual impact is mitigated by large setbacks and retention of considerable bushland between the road and the buildings on site.

18.2 Key features of the project

An artist's impression of the project is provided at Figure 18-1 (and is reproduced at a larger size in Figure 6-2). This shows the project as it would appear when viewed from above, to the south west, looking north east.

Figure 18-1 Artist's impression of the project

The processing hall would be approximately 15.4 m high and the receival hall approximately 18.4 m high, with an internal step down of 3 m between the external drop-off bays and the floor of the receival hall. There would be a common roof height over each hall, so the height for visual assessment purposes is 15.4 m.

Overall, the main building would be approximately47.8 m wide by 129.6 m long. The methanogenic tanks would be 15.5 m high. The acidogenic tanks would be 12.7 m high. All dimensions are indicative, as the detailed design of the facility has not yet been undertaken. However any changes in height or width would not be significant.

The project includes a 'landscape zone' along the New Illawarra Road site boundary to allow for screening (including landscaping). The width of the landscape zone is a minimum of 10 m.

Landscaping of the site would be undertaken in accordance with a landscape management plan. The landscape plan is provided in Figure 6-5. A planting plan is shown in Figure 18-2.

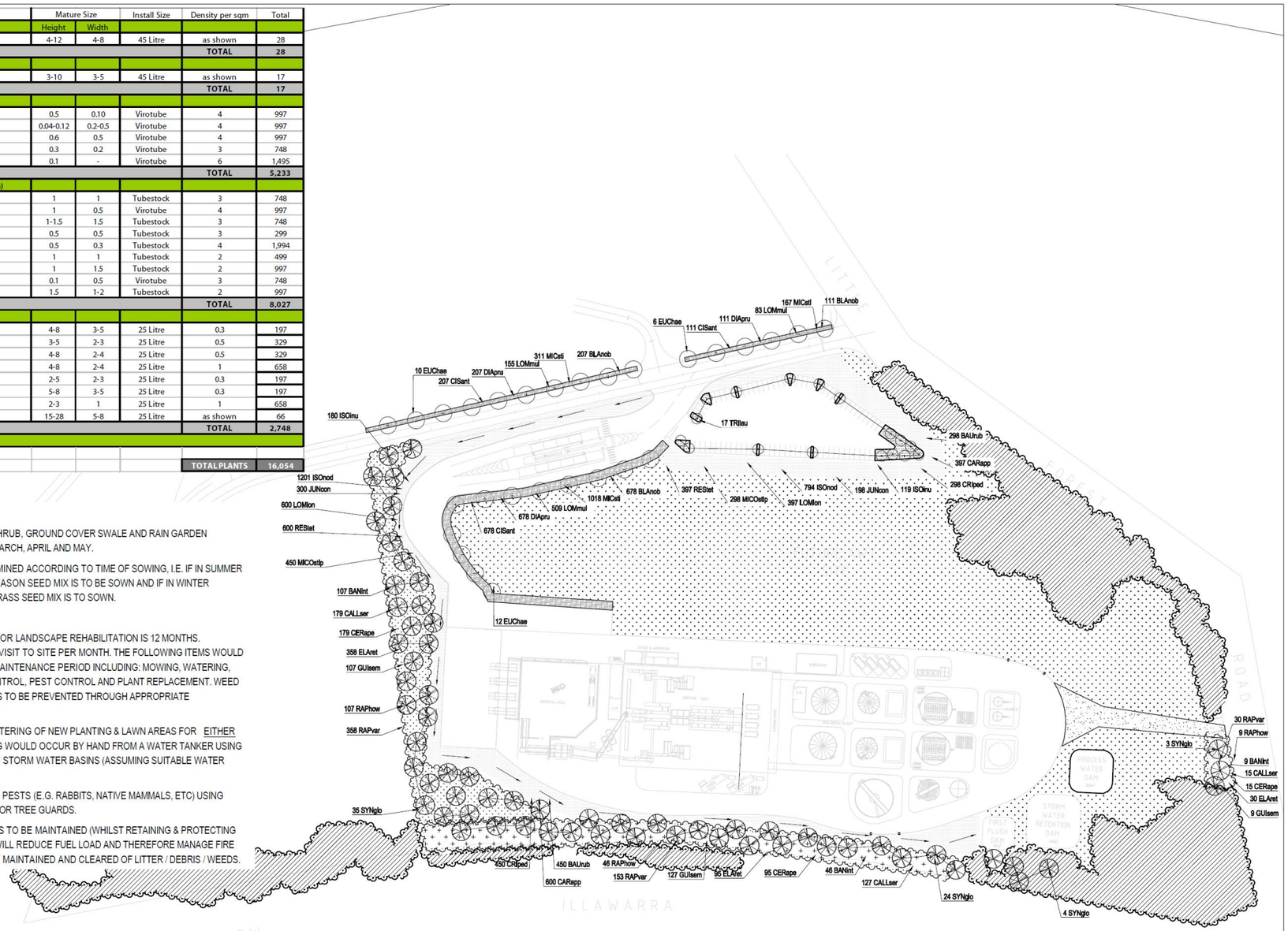
		Mature Size		Install Size	Density per sqm	Total
	AVENUE TREES	Height	Width			
EUChae	*Eucalyptus haemastoma,* Broad-leaf Scribbly Gum	4-12	4-8	45 Litre	as shown	28
					TOTAL	**28**
	CAR PARK TREES					
TRIlau	*Tristaniopsis laurina,* Water GUm	3-10	3-5	45 Litre	as shown	17
					TOTAL	**17**
	GROUND COVERS (total area = 1,256 sqm)					
BLAnob	*Blandfordia nobilis,* Christmas Bells	0.5	0.10	Virotube	4	997
CISant	*Cissus antarctica,* Kangaroo Grape	0.04-0.12	0.2-0.5	Virotube	4	997
DIApru	*Dianella prunina,* Flax Lily	0.6	0.5	Virotube	4	997
LOMmul	*Lomandra multiflora,* Lomandra	0.3	0.2	Virotube	3	748
MICsti	*Microlaena stipoides,* Weeping Meadow Grass	0.1	-	Virotube	6	1,495
					TOTAL	**5,233**
	SWALE\RAIN GARDEN AREA (total area = 4,986sqm)					
BAUrub	*Baumea rubiginosa,* Soft Twig Rush	1	1	Tubestock	3	748
CARapp	*Carex appressa,* Tall Sedge	1	0.5	Virotube	4	997
CRIped	*Crinum pedunculatum,* Crinum Lily	1-1.5	1.5	Tubestock	3	748
ISOInu	*Isolepis inundata,* Swamp Club Rush	0.5	0.5	Tubestock	3	299
ISOnod	*Isolepis nodosus,* Knobby Club Rush	0.5	0.3	Tubestock	4	1,994
JUNcon	*Juncus continuus,* Rush	1	1	Tubestock	2	499
LOMlon	*Lomandra longifolia,* Spiny Mat Rush	1	1.5	Tubestock	2	997
MICOstip	*Microlaena stipoides ,* Weeping Meadow Grass	0.1	0.5	Virotube	3	748
RESTet	*Restio tetraphyllus,* Tassel Rush	1.5	1-2	Tubestock	2	997
					TOTAL	**8,027**
	SCREENING VEGETATION (total area = 5,264 sqm)					
BANInt	*Banksia integrifolia,* Coast Banksia	4-8	3-5	25 Litre	0.3	197
CALLser	*Callicoma serratifolia,* Black Wattle	3-5	2-3	25 Litre	0.5	329
CERape	*Ceratopetalum apetalum,* Coachwood	4-8	2-4	25 Litre	0.5	329
ELAret	*Elaeocarpus reticulatus,* Blueberry Ash	4-8	2-4	25 Litre	1	658
GUIsem	*Guioa semiglauca,* Guioa	2-5	2-3	25 Litre	0.3	197
RAPhow	*Rapanea howittiana,* Brush Muttonwood	5-8	3-5	25 Litre	0.3	197
RAPvar	*Rapanea variabilis,* Muttonwood	2-3	1	25 Litre	1	658
SYNglo	*Syncarpia glomulifera,* Turpentine	15-28	5-8	25 Litre	as shown	66
					TOTAL	**2,748**
	HYDROSEEDING (total area = 24,043sqm)					
					TOTAL PLANTS	**16,054**

GENERAL NOTES

1. THE IDEAL TIME FOR PLANTING OF TREE, SHRUB, GROUND COVER SWALE AND RAIN GARDEN PLANTING IS IN THE AUTUMN MONTHS OF MARCH, APRIL AND MAY.
2. HYDROSEEDING SEED MIX IS TO BE DETERMINED ACCORDING TO TIME OF SOWING, I.E. IF IN SUMMER MONTHS (OCTOBER TO MARCH) A WARM SEASON SEED MIX IS TO BE SOWN AND IF IN WINTER MONTHS (APRIL TO SEPTEMBER) A COOL GRASS SEED MIX IS TO SOWN.

LANDSCAPE MAINTENANCE

1. NORMAL MAINTENANCE DEFECTS PERIOD FOR LANDSCAPE REHABILITATION IS 12 MONTHS. GENERALLY THIS WOULD REQUIRE ONE (1) VISIT TO SITE PER MONTH. THE FOLLOWING ITEMS WOULD GENERALLY BE ADDRESSED DURING THE MAINTENANCE PERIOD INCLUDING: MOWING, WATERING, FERTILIZING, WEED MANAGEMENT AND CONTROL, PEST CONTROL AND PLANT REPLACEMENT. WEED SPREAD TO ADJACENT FORESTED AREAS IS TO BE PREVENTED THROUGH APPROPRIATE MANAGEMENT AND CONTROL STRATEGIES.
2. IRRIGATION STRATEGY WILL COMPRISE WATERING OF NEW PLANTING & LAWN AREAS FOR EITHER TWO YEARS, OR TWO SUMMERS. WATERING WOULD OCCUR BY HAND FROM A WATER TANKER USING WATER CAPTURED AND STORED ON SITE IN STORM WATER BASINS (ASSUMING SUITABLE WATER QUALITY).
3. NEW PLANTING IS TO BE PROTECTED FROM PESTS (E.G. RABBITS, NATIVE MAMMALS, ETC) USING APPROPRIATE TEMPORARY FENCING AND / OR TREE GUARDS.
4. UNDERSTOREY TO EXISTING VEGETATION IS TO BE MAINTAINED (WHILST RETAINING & PROTECTING TREES) TO AN APPROPRIATE LEVEL THAT WILL REDUCE FUEL LOAD AND THEREFORE MANAGE FIRE RISK. UNDERGROWTH IS TO BE REGULARLY MAINTAINED AND CLEARED OF LITTER / DEBRIS / WEEDS.



EXISTING VEGETATION TO BE RETAINED AS SCREENING

PROPOSED SCREENING VEGETATION

INFILL VEGETATION TO INCREASE SCREENING

SWALE

GRASSED AREA

GRANITIC GRAVEL AREA

MULCHED AREAS AND GROUND COVER UNDERSTORY PLANTING

PROPOSED AVENUE TREES

PROPOSED SCREENING TREES

PROPOSED WSUD AND TREES WITHIN CAR PARK

Figure 18-2 Proposed planting plan

18.3 Impact assessment

18.3.1 Construction

The construction of the project would generate visual impacts during the 18 month construction period. These impacts would be limited to motorists traveling along New Illawarra Road. During construction works, exposed soils would be visible, along with machinery and equipment required for construction, and the buildings under construction. These impacts would be temporary and limited to the construction period.

18.3.2 Operation

The project involves development of the site, involving construction of a range of buildings and associated structures, hardstand areas and landscaping. As the site was used for mini bike training and contains no significant built form, the project would result in a change in the character and appearance of the site, with the potential for this change to be visible from surrounding areas.

As noted above, the main views of the project from the public domain would be from New Illawarra Road. There are sequential views into the site from this road, interrupted to varying degrees by roadside vegetation and vegetation within the site. There is a band of disturbed native vegetation around the boundary with New Illawarra Road that currently restricts views into the south eastern corner of the site. The project would involve buildings and tanks in excess of 15 m high located in the vicinity of New Illawarra Road. Without the implementation of the proposed mitigation measures (setbacks and screening), the upper parts of the new structures would be potentially visible to motorists approaching the site from both the north east and the south west.

The potential visual impacts of the project would depend on a number of factors including the final location, design and exterior finishes of the buildings and other structures; the landscaping and screening provided; and the extent of clearing required.

Screen planting, in association with bunding (at appropriate locations), would help to reduce the potential visual impact of the project in the mid to long term (5 years plus). The buildings would be setback approximately 35 m from the site boundary, with an additional 10-15 m of land before the verge of New Illawarra Road. This setback consists of the 25 m wide asset protection zone as recommended in Chapter 14 and a 10 m wide landscape zone consisting of an area of new landscaping (including remodelling of existing earth bund and additional shrub and tree planting), an area of vegetation enhancement (infill tree and shrub planting to increase screening of existing vegetation), and areas where existing vegetation is to be retained (sufficient existing visual screening). The setback, and the retention of existing vegetation where possible would significantly reduce the visibility of the new structures from New Illawarra Road. Indicative views of the project as seen from various viewpoints are provided in Figure 18-3 to Figure 18-7. These figures also show existing views for comparison and provide comments and assessment of the visual impacts of each viewpoint.

VIEWPOINT 1 - BEFORE CONSTRUCTION AND LANDSCAPE MITIGATION

VIEWPOINT 1 - AFTER CONSTRUCTION AND LANDSCAPE MITIGATION

Viewpoint 1

Indicative view of the facility as seen from the future relocated PCYC minibike track. This viewpoint is located approximately 450m west of the proposed main AWT building.

The proposed PCYC minibike track is represented in the foreground, while a band of proposed screening vegetation at maturity, extending towards New Illawarra Road, is shown in front of the facility.

This screening vegetation falls within the Asset Protection Zone (APZ) which restricts the density of planting to no closer than 2m apart (mature canopy). This will reduce the effectiveness of vegetative screening. Fire risk is to take precedence over visual screening.

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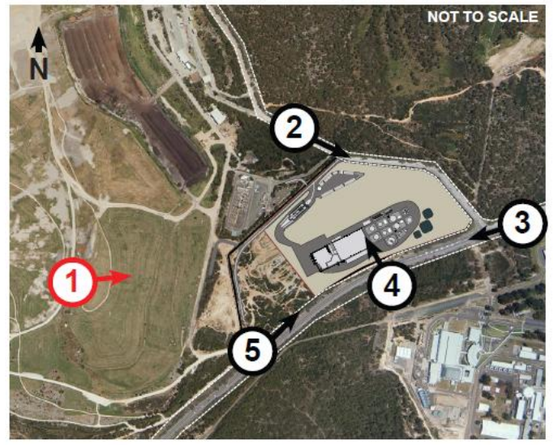


VIEWPOINT LOCATIONS AND DIRECTIONS OF VIEW

LUCAS HEIGHTS AWT FACILITY

ENVIRONMENTAL SOLUTIONS

date 03/08/09
job no. 31-24359
drawing Viewpoint 1 Rev D

Figure 18-3 Visualisation viewpoint 1

VIEWPOINT 2 - BEFORE CONSTRUCTION AND LANDSCAPE MITIGATION

VIEWPOINT 2 - AFTER CONSTRUCTION AND LANDSCAPE MITIGATION

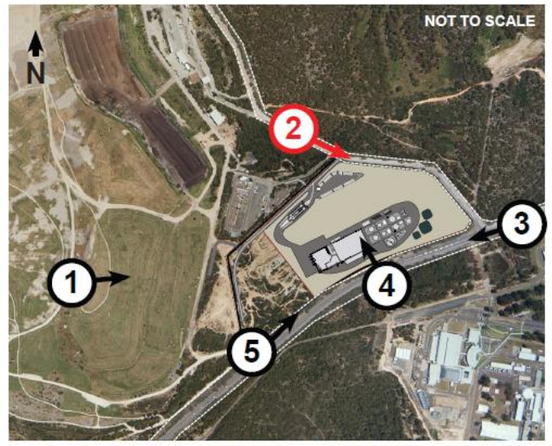
Viewpoint 2

Indicative view of the AWT facility as seen from Little Forest Road. This viewpoint is located approximately 220m north-east of the proposed main building.

Vegetation clearance on the site is noticeable in this view, as is the four lane sealed entrance road and carpark. Filtered views through retained vegetation of the administration building, main AWT building and tanks may be visible to travellers on Little Forest Road.

Landscaped areas around the buildings are also shown and are proposed to increase screening of site infrastructure. Views may also be afforded through to the screening vegetation planted on the other side of the site, along New Illawarra Road.

This view shows the proposed screening vegetation at maturity.



VIEWPOINT LOCATIONS AND DIRECTIONS OF VIEW

LUCAS HEIGHTS AWT FACILITY

ENVIRONMENTAL SOLUTIONS

date 03/08/09
job no. 31-24359
drawing Viewpoint 2 Rev D

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Figure 18-4 Visualisation viewpoint 2

VIEWPOINT 3 - BEFORE CONSTRUCTION AND LANDSCAPE MITIGATION

VIEWPOINT 3 - AFTER CONSTRUCTION AND LANDSCAPE MITIGATION

Viewpoint 3

Indicative view of the AWT facility as seen from New Illawarra Road. This viewpoint is located approximately 300m east of the proposed main building.

Some vegetation clearance on the site may be noticeable in this view, although roadside vegetation is represented as being retained, with the addition of screening vegetation in the 10m landscape zone.

Views to tanks and the main AWT building will be filtered through proposed and retained vegetation and views will change as the receptor moves along the road.

This view shows the proposed screening vegetation at maturity.

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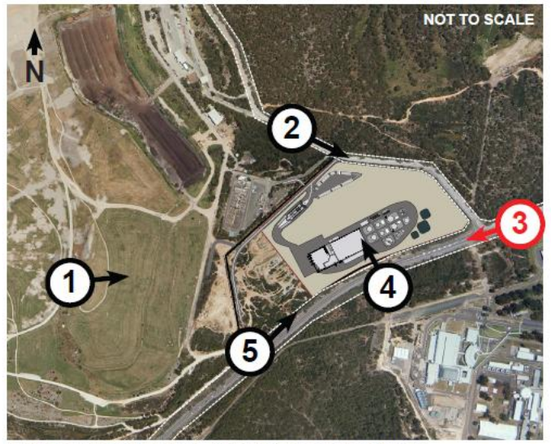


VIEWPOINT LOCATIONS AND DIRECTIONS OF VIEW

LUCAS HEIGHTS AWT FACILITY

ENVIRONMENTAL SOLUTIONS

date 03/08/09
job no. 31-24359
drawing Viewpoint 3 Rev D

Figure 18-5 Visualisation viewpoint 3

VIEWPOINT 4 - BEFORE CONSTRUCTION AND LANDSCAPE MITIGATION

VIEWPOINT 4 - AFTER CONSTRUCTION AND LANDSCAPE MITIGATION

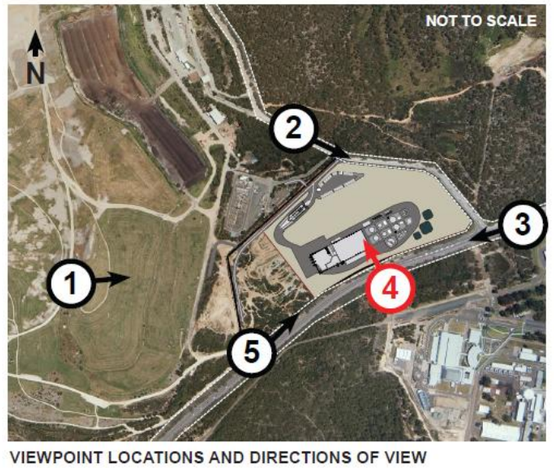
Viewpoint 4

Indicative view of the AWT facility as seen from New Illawarra Road. This viewpoint is located approximately 60m south of the proposed main building.

The existing roadside vegetation at this location is much thinner than at other parts of the boundary and proposed landscape works, as shown, will help to screen views of the facility along this section of road, however filtered views of the main building and tanks are expected to be available to receptors.

These landscape works will include remodelling the existing earth bund (so as not to impact upon healthy existing trees) and planting it with grasses, shrubs and trees. This screening vegetation falls within the Asset Protection Zone (APZ) which restricts the density of planting to no closer than 2m apart (mature canopy). This will reduce the effectiveness of vegetative screening. Fire risk is to take precedence over visual screening.

This view shows the proposed screening vegetation at maturity.



VIEWPOINT LOCATIONS AND DIRECTIONS OF VIEW

LUCAS HEIGHTS AWT FACILITY

ENVIRONMENTAL SOLUTIONS

date 03/08/09
job no. 31-24359
drawing Viewpoint 4 Rev D

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Figure 18-6 Visualisation viewpoint 4

VIEWPOINT 5 - BEFORE CONSTRUCTION AND LANDSCAPE MITIGATION

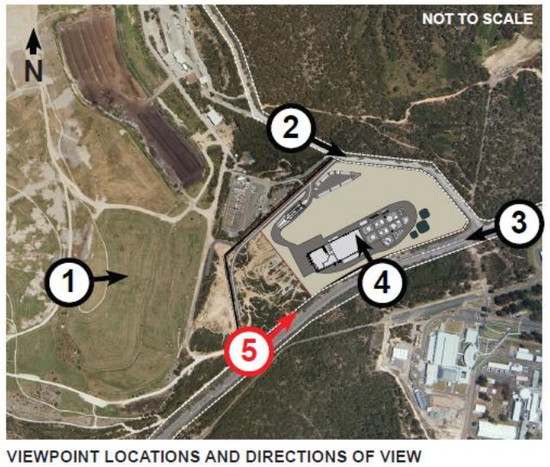
VIEWPOINT 5 - AFTER CONSTRUCTION AND LANDSCAPE MITIGATION

Viewpoint 5

Indicative view of the facility as seen from the truck bay on New Illawarra Road. This viewpoint is located approximately 250m south-west of the proposed main building.

Vegetation clearance on the site may be noticeable in this view. The majority of vegetation on the site, in close proximity to this view, will be retained as this area is not needed for construction of the facility

Filtered views of the facility may be visible from this location and visibility will increase as the receptor moves down New Illawarra Road towards the site due to decreased vegetation screening and closer proximity to the AWT facility.



VIEWPOINT LOCATIONS AND DIRECTIONS OF VIEW

www.ghd.com.au

LUCAS HEIGHTS AWT FACILITY

ENVIRONMENTAL SOLUTIONS

date 03/08/09
job no. 31-24359
drawing Viewpoint 5 Rev D

Figure 18-7 Visualisation viewpoint 5

18.4 Mitigation measures

The visibility of the project along New Illawarra Road would be minimised by the implementation of the measures below.

Setbacks and screening

A landscape zone would be provided along the New Illawarra site boundary to allow for landscaping and screening of the project, as shown in the visualisations provided in Figure 18-3 to Figure 18-7 and the landscape plan for the site (Figure 6-5). Landscaping of the site (including the landscape zone) would be undertaken in accordance with this plan and the planting plan (Figure 18-2) which includes detailed specifications for species selection, planting and maintenance to achieve desired mature dimensions and requirements for weed control.

The plan specifies measures to reduce the potential visual impacts of the project. It includes measures such as:

- Provision of a minimum 10 m wide landscape zone (comprising areas where existing vegetation is to be retained, an area of vegetation / screening enhancement and a new landscape zone);
- Ensuring landscaping is consistent with the bushfire assessment report and recommendations (Appendix G);
- Selection of plants with reference to Sutherland Shire Council's 'Landscaping and Planting Guidelines for Fire-prone Areas in Sutherland Shire';
- Achieving a visual softening of the built form using landscaping within the site, where practicable;
- Maintaining a proportion of native tree cover where practicable; and
- Provision of an earth bund within the new landscape buffer zone to ensure that vegetation of sufficient height could be planted.

In order to minimise the visual impact of the project, the proponent would commence planting prior to construction to allow trees to begin growing as early as possible.

The section of the landscape zone requiring construction of a mound (the new landscape buffer zone) along the front boundary would be undertaken up to the boundary of land contained within the lease held with ANSTO. The land between the New Illawarra Road carriageway and the site boundary is not part of the leasing arrangement. The proponent would seek consent from the landowner to modify this land at an appropriate time, if required.

Building design features

The detailed design of the project would involve consideration of building materials and treatments to minimise the potential visibility of the project, as described below:

- External building finishes would be chosen to minimise visual impact. Recessive, low-reflectivity finishes that blend with the adjoining bushland would be used. Roof colours and finishes would complement the colour of the building facades and the hues would aim to blend with the colours prevailing in the surrounding landscape.

- Highly reflective surfaces/colours, brightly coloured or strongly contrasting materials, and unpainted metal would be avoided.
- Articulation of building surfaces with bays, wall offsets etc would be considered.
- Any boundary fences, particularly those visible from the public domain, would be simple, non reflective and have a high degree of transparency.
- Car parking areas would be appropriately landscaped incorporating shade trees, and should not be visible from public roads.
- Signage would comply with relevant standards and follow a consistent style.
- Electricity supply would be underground if possible. Above-ground supply infrastructure would be designed and located to minimise visual impact.
- Exterior lighting would be designed to minimise light spill, and be provided generally in accordance with Australian Standard 4282-1997 Control of the Obtrusive Effects of Outdoor Lighting.

18.5 Summary of resulting impacts

The project would not be visible from residential areas or other significant viewpoints. The nearest residential areas are located over 2 km from the site. Given the relatively non-sensitive nature of the potential views of the project (passing motorists) and the fact there are other industrial/scientific and waste facilities in the surrounding area, the visual impact of the project is not considered to be significant and the impacts could be minimised by the mitigation measures recommended in section 18.4).

PART D
Conclusion

19. Environmental Management

This chapter outlines the requirements for environmental management plans that would be part of the construction and operational phases of the project.

A summary of the environmental monitoring requirements and lists of the approvals and licences required are also provided.

19.1 Current Environmental Management

Management of activities at the LHWRC is undertaken in accordance with the site Environmental Management Plan (EMP). This includes environmental monitoring as outlined in the Environment Protection Licence EPL 5065. The current monitoring regime is outlined in Table 3-1 in chapter 3 of this environmental assessment.

19.2 Background and Structure

EMPs would be produced for the project, once approval from the NSW Department of Planning has been obtained. Two separate EMPs would be produced, one for the construction phase and one for the operational phase of the project. The general structure of the EMPs is listed below.

19.2.1 Introduction and Purpose

Establishes and details environmental goals and objectives.

19.2.2 Statutory Requirements

Commonwealth and State statutory requirements including licences and approvals would be detailed in the EMP.

19.2.3 Environmental Management Procedures

Describes operational procedures for preventing environmental impacts including:

- Safeguards to be implemented;
- List of actions, timing and responsibilities;
- Reporting requirements;
- Specifications incorporating environmental safeguards;
- Training of personnel (proponent and contractors) in environmental awareness, due diligence and Best Practice Management Systems;
- Environmental accident and incident reporting requirements;
- Process surveillance and auditing procedures;
- Environmental complaint handling procedures;
- Site management and control procedures.

19.2.4 Monitoring Requirements

Environmental monitoring would be required for noise, flora and fauna, air and dust, waste, soils and water and traffic. A monitoring plan would be included in the EMPs which details location, duration and frequency of monitoring and procedures and conditions to be followed for each of these requirements.

19.2.5 Emergency Response

The EMP would include an Emergency Response Plan consistent with the plan for the LHWRC site, incorporating procedures for fires, pollution incidents and accidents. The Plan would detail procedures to be followed, responsibilities, equipment and contact details for responsible site staff and emergency authorities. The Plan would be developed in consultation with local organisations and authorities such as ANSTO, Sutherland Shire Council, Fire Brigade, State Emergency Service, Volunteer Bush Fire Brigade and PCYC.

19.2.6 Review and auditing procedures

This details procedures to:

- Audit the project against the environmental assessment, EMP and any conditions, approvals and licences; and
- Review and amend the EMP if shortcomings are found during the audit.

19.3 Construction EMP

An EMP for the proposed construction works would be developed once a construction contractor has been selected. Each contractor working on the project would prepare a safe work method plan and risk assessment to cover their specific activities, and these plans would be reviewed and approved by the proponent. The Contractor would require an accredited Environmental Management System ISO 14001.

In accordance with the DECCW noise control manual (DECC 1994), construction activities would be restricted to between 7:00 am and 6:00 pm Monday to Friday and 7:00 am to 1:00 pm on Saturdays. No construction work would be undertaken on Sundays or public holidays. Construction work undertaken outside of these hours would be subject to consultation with the DECCW and Sutherland Shire Council.

Control of erosion and sedimentation would be required during the construction period, including temporary works. This includes erosion and sediment control works to prevent sediments from being carried into the stormwater system and natural creek system. The control measures would include cut-off drains, silt fences and other erosion controls.

A site sediment and erosion control plan would be prepared in accordance with the requirement of the Blue Book: Managing Stormwater: Urban Soils and Construction, Department of Housing. These controls would be implanted before any construction commences. A 90th percentile 5 day rainfall duration would be used to determine the volume of temporary sediment dams. As stated in the licence conditions, an upper limit of 50 mg/L of total suspended solids exists for any pumped discharge of stormwater.

The construction EMP would be similar in structure to the *Jacks Gully Waste and Recycling Centre- Alternative Waste Technology Centre Construction Environmental Management Plan* (GHD, 2007).

Specific plans would include:

- **Noise Management Plan** - The plan would address how noise would be mitigated and managed during construction activities. Noise assessments would be carried out in accordance with the NSW Industrial Noise Policy;
- **Flora and Fauna Management Plan** - Site preparation and construction must be carried out in a manner that would minimise impacts on flora and fauna. The Flora and Fauna Management Plan would address how potential construction impacts on Flora and Fauna would be mitigated and managed during the construction phase;
- **Air and Dust Management Plan** – Site construction activities must be carried out in a manner that would minimise dust impacts. The Dust Management Plan would include mitigation measures to control dust from exposed areas, stockpiles, plant & equipment and unsealed roads within LHWRC;
- **Waste Management Plan** – This plan would outline the waste management procedures associated with the construction including disposal requirements, measures to prevent the generation and measures to reduce, re-use or recycle wastes where possible;
- **Soil and Water Management Plan** – The plan will be prepared to address how potential construction impacts in soil and water quality will be mitigated and managed during construction works. These would include drainage controls, erosion controls, sediment controls and dust controls;
- **Traffic and Roadworks Management Plan** – The plan will include truck movements to and from the site, interactions with general public, parking and access requirements for construction personnel and safety signage and training of personnel in traffic management.

The construction EMP would provide a working tool during the detailed design of the proposed development and would form the basis for environmental specifications in any contractual arrangements between the proponents and the contractor. The EMP would also include specific environmental strategies and plans for construction activities associated with the development.

19.4 Operational EMP

The operational EMP would include a number of procedures which would be made more specific following the environmental assessment approval conditions and POEO Licence Application. The plan would be similar in structure to the *Jacks Gully Waste and Recycling Centre – Alternative Waste Technology Operational Environmental Plan* (GHD, 2007).

Specific Plans would include:

- **Stormwater Management Plan** – The plan would include the measures to retain and re-use water on-site and ensure the surface run-off water is maintained at acceptable levels. The plan would also include erosion and sediment mitigation measures;
- **Process Water Management Plan** – The plan would include measures to optimise reuse and ensure that wastewater generation and need for disposal is minimised;

- **Air Quality Management Plan** – The plan would include mitigation measures for control of odours, dust and particles and monitoring undertaken. The plan will also outline procedures to handle customer complaints.
- **Noise and Vibration** – The noise and vibration management plan will include noise and vibration control measures, monitoring and procedures to handle noise complaints.
- **Waste management plan** – The plan would include disposal requirements, measures to prevent the generation and measures to reduce, re-use or recycle wastes where possible.
- **Soil and water management plan** – The plan would address how potential construction impacts on soil and water quality will be mitigated and managed during operation and the required water quality monitoring.
- **Pest, Vermin and Weed Control** – The plan will outline mitigation measures that will control pest and vermin that may be attracted to the waste facility and minimise the degradation of the local amenity caused by pest, vermin and noxious weeds.

19.5 Environmental Monitoring

Environmental monitoring procedures that are currently carried out on-site are in accordance with the monitoring requirements as stipulated in EPL 5065. These procedures are summarised in Table 3-1. Note: the AWT facility will get its own EPL, in addition to the LHWRC EPL.

The monitoring procedures to be implemented during construction and operation are outlined in Table 19-1 and Table 19-2 respectively.

Table 19-1 Monitoring Requirements during Construction

Issue	Monitoring
Noise	Measure noise levels at the boundary prior to construction, at commencement of construction and monthly during construction.
Flora and Fauna	Monitor the extent of clearing to ensure it is confined to areas in the environmental assessment.
	Conduct targeted survey on-site for any threatened flora and fauna species for relocation prior to construction, if feasible.
Air and Dust Quality	Continually monitor dust generation from site (visually) to ensure excessive dust is not being produced and that dust suppression activities are effective.
	Monitor dust generation from site by checking readings from existing dust gauges on site and additional gauges - on a monthly basis.
	Continue to monitor dust generation from continuous dust sampler.
Waste Disposal/Litter	Inspect waste receptacles to ensure they are not overfilled and are being collected regularly.
	Monitor waste recycling and disposal procedures to ensure they are being complied with the current recycling procedures at the main LHWRC site.
Water	Allow for sufficient water retention and capacity in sediment dam for the area, including a first flush tank. Undertake regular surface water monitoring at receiving waterways.

Issue	Monitoring
	Review results from surface water sampling undertaken internally by WSN as part of overall site management – prior to discharging and during discharge to Mill Creek.
Groundwater	Review groundwater levels and sampling results from external monitoring undertaken for WSN as part of overall site management.
Erosion & Sediment Control	Prior to commencement of each stage of construction, inspect site to ensure that sediment and control devices are in place.
	Inspect sediment control devices to ensure they are installed and operating correctly. Inspect devices particularly during wet weather events to monitor water flows and drainage lines and install new devices as required.
Traffic	Inspect trucks to ensure they are not overloaded, adhere to speed limits, cover their loads, correctly licensed and undertake regular inspections and safety checks.
	Inspect signs and hazards markers to ensure they are used appropriately, are in place and clearly visible.

Table 19-2 Monitoring Requirements during Operation

Issue	Monitoring
Water	Monitor water in sedimentation dams and receiving waterways on a monthly basis. Monitor surface water during wet weather events.
	Review results from surface water sampling undertaken by WSN as part of overall site management plan prior to discharging and during discharge to Mill Creek.
Air Quality	Monitor dust generation from site by checking readings from existing dust gauges and additional gauges – on a monthly basis.
	Monitor odour levels once plant is operating and undertake regular odour patrols in the area.
Groundwater	Review groundwater levels and quality sampling results from monitoring undertaken by WSN as part of overall site management.
Noise	Conduct noise monitoring at plant during plant commissioning stage and normal operation.
Pest, Vermin and Weed Control	Arrange for inspection on a annual basis by a licensed pest control and ensure adequate control is implemented. Control weeds using an appropriate biodegradable herbicide.
Traffic	Ensure vehicles are adhering to speed limits, and weights limits and using defined access roads.
Gas Monitoring	Undertake regular gas monitoring at methanogenic tank to ensure nil fugitive gas emissions and escape.

19.6 Environmental Auditing

Independent environmental audits would be carried out annually. The audit report would be made available to WSNs Chief Executive Officer, The WSN Board, Sutherland Shire Council, DECCW and relevant stakeholders.

19.7 Environmental Reporting

19.7.1 Record Keeping

Full record of all environmental procedures observed would be recorded including:

- Monitoring dates, analysis and results;
- Details of quantities of construction and demolition removed from the site and details of materials recovered;
- Details of quantities and types of waste removed from the site;
- Environmental complaints received, including corrective action taken; and
- Details of environmental licences and approvals.

19.7.2 Reporting

An Annual Return would be prepared for submission to DECCW. The return would include:

- A statement of Compliance with licence conditions;
- Monitoring and complaints summary;
- Any shortcomings in site activities or environmental controls identified in the Return would be identified and EMP amended accordingly;
- In addition, incidents causing or threatening material harm to the environment would be reported to the DECCW, in accordance with POEO licence conditions.

The reporting requirements are outlined in Table 19-3.

Table 19-3 Reporting Requirements

Item	Frequency
Annual Return	Annual
Statement of compliance signed by designated representative of operating licensee	Annual
Record of Complaints	Within 48 hours of receipt of complaint.
Notification of Incident of Environmental Harm	Immediate notification through EPA pollution line; Written report required within reasonable time frame of the event occurring.
Gas Incident	Within 7 days of occurring.
Fire or Explosion Incident	Immediate notification through EPA pollution line; Written report as soon as practicable.
Fire Report	Immediate notification through EPA pollution line; Written report within 7 days of occurrence.

20. Draft Statement of Commitments

Section 75F(6) of the EP&A Act states that the Director-General may require the proponent to include in an environmental assessment a statement of the commitments the proponent is prepared to make for environmental management and mitigation measures. In accordance with this requirement, this section provides the commitments for environmental mitigation, management and monitoring for the project.

The proponent commits to implement the measures outlined in Table 20-1.

Table 20-1 Draft statement of commitments

Issue	Commitment
Environmental management plans	As described in chapter 19, a construction environmental management plan (CEMP) would be prepared and implemented to guide environmental management and monitoring activities during construction. The CEMP would include the following sub-plans: ◗ Noise management plan – The plan would address how noise will be mitigated and managed during construction activities, in accordance with DECC (1994) Environmental Noise Control Manual; ◗ Flora and fauna management plan (including tree clearing protocol) – The plan would address how impacts on flora and fauna would be mitigated and managed during the construction phase, including the measures listed in chapter 13; ◗ Air and dust management plan – The plan would outline mitigation measures to control dust from exposed areas, stockpiles, plant equipment and unsealed roads, including the measures listed in chapter 10; ◗ Waste management plan – The plan would include disposal requirements, measures to prevent the generation and measures to reduce, re-use or recycle wastes where possible; ◗ Soil and water management plan – The plan would address how potential construction impacts on soil and water quality will be mitigated and managed during construction works, including the measures listed in chapter 9; ◗ Traffic management plan – The plan will include truck movements to and from the site, interactions with general public, parking and access requirements for construction personnel and safety signage and training of personnel in traffic management. Similarly, an operational environmental management plan (OEMP) would be prepared and implemented to guide environmental management and monitoring activities during operation. The OEMP would include the following sub-plans: ◗ Stormwater management plan – The plan would include the measures to retain and re-use the maximum amount of water on-site and ensure the surface run-off water is maintained at acceptable levels. The plan would also include erosion and sediment mitigation measures; ◗ Process water management plan – The plan would include measures to optimise reuse and ensure that wastewater generation and need for disposal is minimised; ◗ Air quality management plan – The plan would include mitigation measures

Issue	Commitment
	for control of odours, dust and particulates and monitoring undertaken. The plan will also outline procedures to handle any complaints. ◗ Noise management plan – The noise management plan will include noise control measures, monitoring and procedures to handle any noise complaints. ◗ Waste management plan – The plan would include disposal requirements, measures to prevent the generation and measures to reduce, re-use or recycle wastes where possible; ◗ Soil and water management plan – The plan would address how potential construction impacts on soil and water quality will be mitigated and managed during operation and the required water quality monitoring; ◗ Pest, vermin and weed control – The plan will outline mitigation measures that will control pest and vermin that may be attracted to the waste facility and minimise the degradation of the local amenity caused by pest, vermin and noxious weeds. ◗ Traffic management plan – The plan will include parking and access requirements, safety signage and training of personnel in traffic management. Monitoring would be undertaken according to the EPL for the AWT facility issued by DECCW, which would include monitoring set out in section 19.5 of this environmental assessement.
Soil and water	The proponent would implement all practicable measures to minimise soil erosion and discharge of sediments from the site. The erosion and sediment control plan prepared as part of the construction environmental management plan would ensure: ◗ Sediment and erosion control measures, such as sediment fences, are installed and maintained, with particular attention where the drainage is towards a surface water body; ◗ Stockpiles are stabilised and remain covered and appropriate sediment and erosion control measures are installed down slope of all stockpiles; and ◗ Spill kits are made available to construction vehicles. The construction environmental management plan would also set out procedures for the management of accidental spills to minimise potential contamination during construction. Areas containing storage tanks would be fully bunded to contain accidental spills. Opportunities for beneficial reuse of excess process water would be investigated. An asbestos identification protocol would be developed for the identification and removal (by a suitability qualified contractor) of asbestos should it be discovered during the earthworks and construction activities.
Air quality and odour	A dust management plan would be prepared as part of the construction environmental management plan detailing measures for the control of dust generation, including: ◗ Site management measures to limit dust emissions from work sites, including: o Managing stockpiles to suppress dust emissions; o Watering of unsealed haul roads and disturbed surfaces

Issue	Commitment
	(including construction areas); o Restricting the size of disturbed surfaces as much as practicable; o Prevention of truck over-loading and covering dusty loads; and o Vehicle movement controls, particularly entrance to and exit from construction work sites (and washing down trucks before they leave the site – if necessary). ◗ When conditions are excessively dusty and the dust emissions criteria from operations cannot be maintained, then all dust generating activities must cease until dust suppression can be adequately carried out; and ◗ Dust monitoring would be undertaken during construction. Monitoring would comply with DECCW guidelines for the Sampling and Analysis for Air Pollutants in NSW (DECC 2005). The proponent would ensure the design and operation of the project minimises the potential release of odour emissions. The specifications provided to prospective equipment suppliers would dictate the technical and environmental performance the equipment would be expected to meet, based on the proponent's operational requirements and the conditions of consent for the project.
Traffic and transport	The proponent would ensure that the layout of the proposed car parking areas, including driveways, aisle widths, grades, parking bay dimensions, sight distance requirements and turn paths is designed in accordance with AS 2890.1-2004 and AS 2890.2-2002 during the detailed design phase. Car parking areas and entry/exit points would be clearly delineated through line marking and signage to ensure smooth, safe traffic flow. During the construction of the project, no mitigation measures are required on the external road network. A construction traffic management plan would form part of the construction environmental management plan to ensure safe movement of vehicles and pedestrian into and around the site. The plan would include details on construction vehicle routes, truck numbers, hours of operation, access arrangements and traffic control. The proponent would continue to liaise with the Roads and Traffic Authority regarding the design of Heathcote Road/New Illawarra Road intersection.
Greenhouse gas and energy efficiency	Potential energy efficiency measures including in the areas of lighting, compressed air, ventilation, odour prevention and removal, heating and cooling and process efficiency (as detailed in section 12.6) would be considered in the detailed design phase of the project.
Biodiversity	Biodiversity management measures would be implemented during construction to minimise impacts on remaining vegetation. Management measures would be detailed in the construction environmental management plan and would include: ◗ Chipping/shredding cleared vegetation for use as mulch; ◗ Installation of standard erosion control measures prior to construction to limit erosion which could affect adjacent vegetation communities and watercourses; ◗ Erection of temporary exclusion fencing around areas of vegetation to be retained prior to construction. Locate materials, stockpiles, vehicle access and parking areas on existing cleared and disturbed land;

Issue	Commitment
	◗ Stabilisation of steep banks and bare earth areas as soon as possible after construction or removal of vegetation to limit gully and sheet erosion; ◗ Limit backfilling around the base of trees and shrubs to be retained; ◗ Implement a tree clearing protocol to ensure that any native fauna present are not injured during the clearing process; and ◗ Site inductions to include information on workers' obligations regarding the protection of vegetation and fauna habitats. The design of the site layout has used large areas of cleared land to minimise the required vegetation loss at the site. This includes locating site stormwater and process water dams away from the vegetated area. Planting and landscaping would be carried out in accordance with the landscape management plan that has been prepared to guide the improvement and maintenance of vegetation at the site.
Hazards - risk	To ensure the ongoing safe operation of the project, a comprehensive safety management system would be developed and implemented. The safety management system would take into account the results of the PHA, and include: ◗ Installation of bollards or alternative protection around the biogas buffer tank to prevent vehicle collisions with the exposed piping and associated equipment; ◗ All potential ignition sources should be eliminated from areas containing biogas; ◗ Signage should be placed in suitable locations to indicate the presence of flammable substances; ◗ Local exhaust and general room ventilation to prevent accumulation of explosive mixtures; ◗ Handling equipment and tools grounded to prevent sparking; ◗ Depending on the odour properties of the biogas, an additive may be used to odorise the gas e.g. mercaptans in order to improve detection in case of a release; ◗ Permit to work systems for hot work; ◗ Specific materials of construction due to the flammable nature of the process output; ◗ Development of a maintenance regime; and ◗ Suitable emergency response procedures and equipment. In addition, all materials would be stored in accordance with relevant legislation and Australian Standards.
Hazards - bushfires	To minimise potential bushfire risk, asset protection zones would be provided and maintained, appropriate construction materials and methods would be used, safe access and egress and an adequate supply of water would be provided: 1. Asset protection zone: ◗ Asset protection zones would be provided as detailed above. ◗ Rubbish and other material would not be stored in asset protection zones unless it is fully enclosed in non-combustible containers and removed on a regular basis (at least weekly).

Issue	Commitment
	2. Construction standards: ◗ All building materials would be non-combustible where possible and meet the objectives of construction level 2 of AS 3959-1999. ◗ The administration building would be constructed to level 3 of AS 3959-1999. 3. Access/egress: ◗ Safe access and egress would be provided, including an emergency access gate leading onto Little Forest Road, south of the actual site access. ◗ The Rural Fire Service would be consulted annually as part of the overall fire accreditation for the site with specific consideration of emergency response approaches (fire fighting strategies, evacuation planning). 4. Water supply: ◗ Water supply would meet the requirements of AS 2419.1-2005 Fire hydrant installations. ◗ Two 225,000 L dedicated fire-fighting water tanks would be provided on site. 5. Emergency management: ◗ A bush fire evacuation plan would be prepared and integrated with the LHWRC emergency management plan and ANSTO requirements. 6. Landscaping and site management: ◗ Landscaping would be maintained to meet the standards of an asset protection zone. ◗ Rubbish and other materials would not be stockpiled within the asset protection zone.
Heritage	GLALC would be contacted if any items of Aboriginal heritage significance are identified during the project construction or operation.
Noise	The project would be designed and operated to ensure that noise criteria are not exceeded. A construction noise management plan would be prepared as part of the construction environmental management plan to detail how construction impacts would be minimised and managed. The operational environmental management plan would include noise control measures, monitoring and procedures to handle any noise complaints. Noise monitoring during construction and operation would be undertaken in accordance with DECCW requirements.
Social and economic	The proponent would undertake consultation with relevant stakeholders including during the construction period. Once operational, tours of the project could also be organised. The proponent would maximise the use of arterial roads for construction access, and place controls over the use of local roads for construction vehicles.

Issue	Commitment
Visual amenity	A landscape zone would be provided along the New Illawarra site boundary to allow for landscaping and screening of the project. Landscaping of the site would be undertaken in accordance with the landscape management plan. The landscape plan includes landscaping and screening of the project along both New Illawarra Road and Little Forest Road boundaries. The design of the project would involve consideration of building materials and treatments to minimise the potential visibility of the project. Design recommendations provided in section 18.4 would be incorporated into the detailed design of the project where practicable.

21. Project Justification and Conclusions

21.1 Justification for undertaking the project

The justification for the project is based on a number of factors:

- The project is consistent with the strategic direction for waste management in NSW and the proponent's corporate objectives and strategic drivers;
- The project meets a need for alternative waste technologies needed to increase resource recovery from municipal waste and divert valuable materials from landfill;
- The project would assist in satisfying regional demand for more sustainable waste management facilities;
- The project would enable councils to reduce their long term waste management costs and reduce greenhouse gas emissions associated with landfilling their wastes;
- The site is suitable for the proposed use; and
- The project uses innovative technology already operating locally at a similar scale.

These factors are summarised below.

21.1.1 The strategic direction for waste management in NSW

The project would deliver outcomes consistent with state legislation and strategies for sustainable waste management. These include the *Waste Avoidance and Resource Recovery Act 2001*, the Waste Avoidance and Resource Recovery Strategy 2007, and the Sydney Metropolitan Strategy.

The project aligns with the philosophy of viewing waste as a resource – and recovering resources in their highest net resource value state. The recovery of resources in this manner creates value from the waste stream.

It is estimated that up to 70% of the 100,000 tonnes of waste that the project would process each year, would be diverted from landfill.

21.1.2 The proponent's corporate objectives and strategic drivers

The proponent is committed to the principles of waste avoidance and resource recovery. The proponent is committed to providing environmentally sound and sustainable waste management solutions that improve resource recovery, and reduce the quantities of waste being disposed to landfill.

Landfilling is currently the main method used to dispose of putrescible waste in Sydney. It is widely recognised that this method of waste disposal can result in significant environmental impacts that need to be managed in the medium to long term.

The proponent is transforming its business from one that is based mainly on the disposal of putrescible waste to landfill, to an environmentally sound and sustainable business, using appropriate engineering solutions for waste management such as materials recovery facilities and AWT facilities.

The project would meet the objectives and business strategy of the proponent.

21.1.3 Need for alternative waste technologies

The NSW Government has set targets for waste diversion by 2014. Recycling of municipal waste is to be increased from a baseline of 26% of waste to be diverted from landfill, to 66% to be diverted by 2014. However, the total amount of diversion by recovering paper and recyclable containers alone has leveled out. The only way councils will achieve the 66% diversion target is to recover organic components of the waste stream (e.g. food) through an alternative waste management system.

21.1.4 Suitable site

The site has access to several major roads, including New Illawarra Road, Heathcote Road and the M5 further to the north, which provide efficient access. It is located adjacent to the existing LHWRC facility, and is zoned for the proposed use.

21.1.5 Proven technology

The technology proposed for the project is already operating. A fully functioning plant that was the basis for the project design has been operating in Tel Aviv, Israel for many years, and the proponent recently opened a similar facility (Ecolibrium™ Mixed Waste Facility) at the MRRP in Narellan to service the Macarthur Region of councils.

21.2 Conclusions

This environmental assessment has considered the potential impacts of the proposal to construct and operate an AWT facility at the site and potential cumulative impacts of other proposed projects within the LHWRC at Lucas Heights.

This environmental assessment has been prepared in accordance with the provisions of Part 3A of the *Environmental Planning and Assessment Act 1979* and the requirements of the Director-General of the NSW Department of Planning. The environmental assessment has documented the potential environmental impacts associated with the project, considering both potential positive and negative impacts of the project, and recommending management and mitigation measures to protect the environment where required.

Environmental investigations were undertaken during the preparation of the environmental assessment to assess the potential environmental impacts. These included specialist assessment on issues involving air quality and odour, traffic, noise, greenhouse gas emissions, biodiversity, hazards, bushfire, heritage and visual amenity.

Overall the project would:

- Divert valuable resources from landfill and permit recovery and recycling of resources from the waste stream;
- Significantly reduce greenhouse gas emissions through:
  - Capture of biogas produced through treatment of the organic component of the waste stream;
  - Recovering (for recycling) homogenous streams of plastic, metal and glass;
  - Avoiding emissions from material that would otherwise be landfilled; and
  - Substitution of fossil fuels by generation of green electricity and export to the grid.

- Reduce disposal to landfill of potential resources and assist Sydney councils in achieving their targets for diversion of waste from landfill; and
- Minimise odour, noise and traffic impacts on the local community.

The project would also provide benefits through development of a new industry and new employment opportunities in the region.

The environmental assessment has examined a number of key issues surrounding the project, including identification of potential negative impacts. There are no major environmental issues with this project. The main potential impacts that need to be managed are:

- Potential air quality issues such as dust generation associated with construction of the project;
- Noise-related impacts associated with construction and operation of the project;
- Hazards and bushfire risks;
- Visibility of the project to passing traffic and neighbouring sites; and
- Construction impacts (traffic generation, soil and water management etc).

The environmental assessment concludes that many of the potential issues identified (including air and noise issues) would be effectively managed through project design features. To manage other issues, and in some cases eliminate them completely, a number of mitigation and management measures (commitments) would be implemented. These are outlined in chapter 20.

Commitments made by the proponent include the preparation of a construction environmental management and operational environmental management plan to ensure that the mitigation and management measures are developed, implemented and monitored. These plans would also ensure compliance with relevant legislation and any conditions of approval.

22. References

Australian Museum Business Services. 2009. *'Alternative Waste Treatment Facility, Lucas Heights Waste and Recycling Centre: Heritage Assessment'.* Sydney.

Australian Standards, *AS 2419.1: Fire Hydrant Installations*

Australian Standards, *AS 2941: Fixed Fire Protection installations – Pumpset Systems*

Australian Standards, AS *4282-1997: Control of the Obtrusive Effects of Outdoor Lighting*

Australian Standards, *AS 4454-2003: Composts, soil conditioners and mulches*

Beaver. D, Betteridge. C. 2009. *'Lucas heights Waste and Recycling Centre- Landscape and Visual Assessment'*. MUSEcape Pty Ltd, Randwick.

Cardno Eppell Olsen. 2009. *'Proposed Alternative Waste Technology Facility at Lucas Heights Waste and Recycling Centre: Traffic Impact Assessment'*. Sydney.

Department of Climate Change June 2008. *State and Territory Greenhouse Gas Inventories 2006'*

Department of Climate Change 2009. *National Greenhouse Accounts (NGA) Factors*

Department of Environment and Conservation 2005. Draft *Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation*

Department of Environment and Climate Change 1994. *Environmental Noise Control Manual*

Department of Environment and Climate Change 1999. *Environmental Criteria for Road Traffic Noise*

Department of Environment and Climate Change 2000. *NSW Industrial Noise Policy*

Department of Environment and Climate Change 2005. *Approved Methods for Modelling and Assessment of Air Pollutants in New South Wastes*, Department of Environment and Climate Change

Department of Environment and Climate Change 2006. *Technical Notes: Assessment and Management of Odour from Stationary Sources in New South Wales*

Department of Environment and Climate Change, 2007. *Approved Methods for the Sampling and Analysis of Air Pollutants in NSW*

Department of Environment and Climate Change 2008. *Waste Classification Guidelines*

Department of Planning. 1994. *'Applying SEPP 33 – Hazardous and Offensive Development Guidelines'*

Department of Planning. 2005. *Sydney Metropolitan Strategy, City of Cities: A Plan for Sydney's Future*

Department of Planning. 2008. *'Director-General's Requirements. Lucas Height AWT Project. Application Number 08_0163'.* Sydney.

Department of Housing. 2006. '*Managing Stormwater Urban Soils and Construction'*

Eco Logical Australia. 2009. *'Bush Fire Assessment. Proposed Alternative Waste Technology (AWT) Facility at the Lucas Heights Waste and Recycling Centre (LHWRC) Project Number 0279-0001'.* Sydney.

Eco Logical Australia. 2009. *'Flora and Fauna Assessment- Proposed Alternative Waste Technology (AWT) Facility at the Lucas Heights Waste and Recycling Centre (LHWRC) Project Number 0279-0001'.* Sydney.

GHD. 2006. *'Environmental Assessment Proposed Alternative Waste Technology Facility at Jacks Gully Waste and Recycling Centre. Volume 1- Main Report'.* GHD Pty Ltd, Sydney.

GHD. 2009a. *'Report for Proposed Lucas Heights AWT- Preliminary Hazard Analysis'.* Sydney.

GHD. 2009b. '*Alternative Waste Technology Facility, Lucas Heights: Greenhouse Gas Emissions Assessment*', Sydney

Heggies. 2009. *'Lucas Heights Alternative Waste Technology Facility Noise Assessment'*. Heggies Pty Ltd, Lane Cove.

Holmes Air Sciences. 2005. *'Air Quality Assessment: Waste Service Proposed Landfill Gas Power Generation Plant for Eastern Creek 2'*

Holmes Air Sciences. 2006. '*Air Quality Modelling Report: Jacks Gully Alternative Waste Technology Facility*' prepared for GHD

Holmes Air Sciences, 2008 '*Air Quality Assessment: Lucas Heights Landfill – Modifications to Existing Approval Conditions'*, prepared for WSN, December 2008

Keith, D. A. 2004. '*Ocean shores to desert dunes: the native vegetation of New South Wales and the ACT'*. Department of Environment and Conservation, Sydney.

NEC. 1999. *Lucas Heights 1, Lucas Heights Waste Management Recycling Centre, Lucas Heights Conservation Area Environmental Impact Statement*

NSW EPA. October 1997, Amendment July 2001. *Environmental Guidelines: Use and Disposal of Biosolids Products*

NSW EPA, *Environmental Guidelines: Assessment, Classification & Management of Liquid & Non-Liquid Wastes*

NSW Rural Fire Service. 2006. *'Planning for Bushfire Protection'*

PAEHolmes. 2009. *'Air Quality Assessment. Lucas Heights Alternative Waste Technology Facility'*. Sydney.

Sutherland Shire Council. 2006. *Development Control Plan*

World Business Council for Sustainable Development. no date. *The Greenhouse Gas Protocol, A Corporate Accounting and Reporting Standard*

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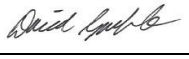
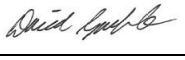
6	A Montgomery	D Gamble		FINAL		31/08/09