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ARMIDALE REGIONAL LANDFILL

Environmental Assessment

Volume 1

ARMIDALE REGIONAL LANDFILL

Environmental Assessment - Volume 1 Main Report

Prepared for
Armidale Dumaresq Council
135 Rusden Street, Armidale NSW 2350

April 2010

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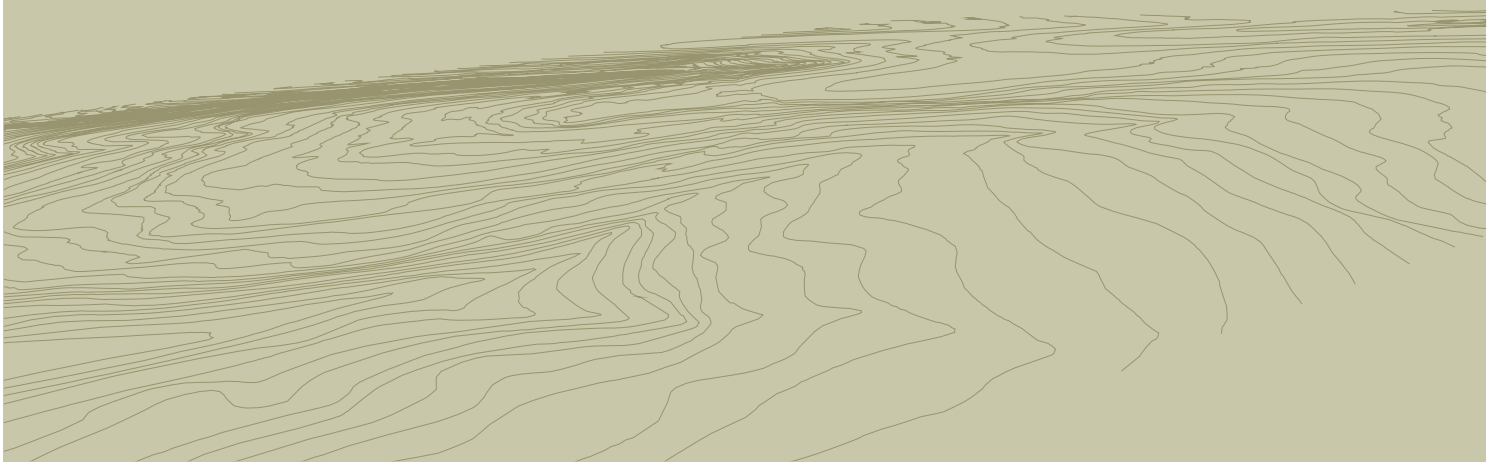
Environmental Assessment



FINAL

Environmental Assessment

Armidale Regional Landfill

Environmental Assessment

Armidale Regional Landfill

Prepared for

Armidale Dumaresq Council

Prepared by

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Revision 2	22/02/2010		Catherine Brady Associate Director	Original Signed
Revision 3	13/04/2010	For	Catherine Brady Associate Director	

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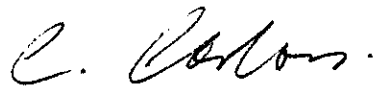
Armidale Regional Landfill
Environmental Assessment

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

Environmental assessment prepared by:	Chris Carloss
Name	Bachelor of Science, Master of Environmental Planning
Qualifications	AECOM
Address	PO Box Q410 QVB Post Office Sydney NSW 1230
In respect of:	
Project to which Part 3A applies	
Applicant name	Armidale Dumaresq Council
Address	PO Box 75A Armidale NSW 2350
Land to be developed	
Proposed development	Construction and operation of a Regional Waste Facility
Environmental assessment	An environmental assessment is attached
Certificate	I certify that I have prepared the contents of this document 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 to which it relates; and • The information contained in the document is neither false nor misleading.
Signature:	
Name	Chris Carloss
Date	13 April 2010

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Glossary of Terms

Term	Definition
Activity	An "activity" is defined in the same manner as under Part 5 of the *Environmental Planning and Assessment Act 1979* (*EP&A Act*) and includes the use of land, the subdivision of land, the erection of a building, the carrying out of a work and the demolition of a building, as well as other things referred to in either the *EP&A Act* or *Regulations* for the purposes of this definition.
Activity (Scheduled)	In regulatory terms an activity that is listed in Schedule 1 of the *Protection of the Environment Operations Act 1997* (*POEO Act*) is known as a Scheduled Activity and may be required to be licensed under the provisions of this Act by the Department of Environment, Climate Change and Water (DECCW).
Anaerobic	Living conditions in which there is an absence of oxygen. The term used to describe a biological process which occurs without the need for oxygen and is often used to describe types of bacteria and bacteriological processes. Anaerobic bacterial activity can be seen in the bottom muds of lakes, etc and is also the process by which entombed, putrescible waste is decomposed by organisms that do not require oxygen, i.e. anaerobic organisms.
Anniversary Date	The anniversary date is the anniversary each year of the date of issue of an Environment Protection Licence (EPL). In the case of an EPL continued in force by the *POEO Act*, the date of issue of the Licence is the first anniversary of the date of issue or last renewal of the Licence following the commencement of the Act.
Aerobic	Aerobic processes are processes that require oxygen. Aerobic bacteria, for example, are bacteria that require oxygen to live. "Anaerobic" (see above) is the opposite of Aerobic.
Assessment Background Level	The Assessment Background Level (ABL) is a measure of the background level for noise, representing discreet assessment periods (i.e. day, evening or night) for each day. It is determined by calculating the 10th percentile (lowest 10%) background noise level over a 90 minute period (LA_{90}).
Bioremediation	Remediation of contaminated land using biological methods.
CO_2e	Equivalent to carbon dioxide. Used as a standard measurement of the level of effect of various gases on the atmosphere, particularly greenhouse gases.
Commercial and Industrial Waste	Wastes generated by businesses and industries and institutions. These include shopping centres, restaurants, offices, schools, hospitals and government offices but exclude any building and demolition waste and municipal waste.
Carbon to Nitrogen (C:N) Ratio	The ratio, by mass, of carbon atoms to nitrogen atoms present within organic material.
EPA	See NSW EPA (Environment Protection Authority).
EPL	Environmental Protection Licence - EPLs, issued by DECCW, are a central means to control the localised, cumulative and acute impacts of pollution in NSW.
Debitage	A term used in archaeology that refers to all the waste material left over after the creation of a stone tool, via the production of chipped stone tools or the knapping of flints, for example. Debitage may include (but is not limited to) different kinds of flakes of lithic material and various other rejected material, as well as waste material that may still be used as tools, for example as scrapers. The term generally refers to pieces of stone that have not been utilised and are therefore discarded, however.
Facility	Premises at which a "scheduled activity", take place. Scheduled activities are those activities defined under Schedule 1 to the *POEO Act*.

Term	Definition
FIDOL factor	An acronym used in odour impact assessments when collectively considering the issues of Frequency, Intensity, Duration, Offensiveness and Location of odour events.
General solid waste (putrescible)	The NSW DECCW's July 2009 *Waste Classification Guidelines* defines general solid waste (putrescible) as including any of the following waste types: • Household waste that contains putrescible organics. • Waste from litter bins collected by or on behalf of local councils. • Manure and night soil. • Disposable nappies, incontinence pads or sanitary napkins. • Food waste. • Animal waste. • Grit or screenings from sewage treatment systems that have been dewatered so that the grit or screenings do not contain free liquids. • Any mixture of the wastes referred to above. It should be noted that, in assessing whether waste has been pre-classified by DECCW as general solid waste (putrescible), the following definitions should also be applied: • Animal waste: includes dead animals and animal parts and any mixture of dead animals and animal parts. • Food waste: means waste from the manufacture, preparation, sale or consumption of food but does not include grease-trap waste. • Manure: includes any mixture of manure and biodegradable animal bedding, such as straw. It should also be noted that wastes may be classified as general solid waste (putrescible) by the DECCW, from time to time, via a notice published in the NSW Government Gazette (all currently gazetted general solid wastes (putrescible) are listed on DECCW's website, at www.environment.nsw.gov.au/waste/wastetypes.htm).
Greenwaste	Organic waste resulting from the trimming, pruning, lopping, cutting or felling of any form of vegetation, for example grass, trees or shrubs.
Harm	Harm to the environment includes any direct or indirect alteration of the environment that has the effect of degrading the environment and, includes any act or omission that results in pollution.
Hazardous Waste	Has the same meaning as in Part 3 of Schedule 1 of the *Protection of the Environment Operations Act 1997*.
Industrial Waste	Has the same meaning as in Part 3 of Schedule 1 of the *Protection of the Environment Operations Act 1997*.
Inert Waste	Has the same meaning as in Part 3 of Schedule 1 of the *Protection of the Environment Operations Act 1997*.
Isopleths	Lines drawn on a map that join locations of equal value, e.g. air pressure, dust concentration, etc.
L_{A1}	The noise level that is exceeded for 1% of the sample period. During the sample period the noise level is below the L_{A1} level for 99% of the time.
L_{A10}	The noise level that is exceeded for 10% of the sample period. During the sample period the noise level is below the L_{A10} level for 90% of the time.
L_{Aeq}	The equivalent continuous sound level (L_{Aeq}) is the energy average of the varying noise over the sample period and is equivalent to the level of a constant noise, which contains the same energy as the varying noise environment.

Term	Definition
L_{A90}	Generally referred to as the background noise level. It is the noise level that is exceeded for 90% of the sample period. During the sample period the noise level is below the L_{A90} level for 10% of the time.
Leachate	Liquid released by, or water that has percolated through organic waste material and contains other liquids, suspended solids and/or gases.
Licensee	The Licence holder described at the front of an EPL.
Material Harm	Has the same meaning as in Section 147 of the *POEO Act*, as follows: *147 Meaning of material harm to the environment* *1) For the purposes of this Part (of the POEO Act):* *a) harm to the environment is material if:* *(i) it involves actual or potential harm to the health or safety of human beings or to ecosystems that is not trivial, or* *(ii) it results in actual or potential loss or property damage of an amount, or amounts in aggregate, exceeding $10,000 (or such other amount as is prescribed by the regulations), and* *(b) loss includes the reasonable costs and expenses that would be incurred in taking all reasonable and practicable measures to prevent, mitigate or make good harm to the environment.* For the purposes of the Act, it does not matter that harm to the environment is caused only in the premises where the pollution incident occurs.
Mixed Solid Waste	For the purposes of this EA document, mixed solid waste includes Municipal Solid Waste (MSW), Commercial and Industrial waste and greenwaste.
Municipal Solid Waste (MSW)	Being waste consisting of: a) Household domestic waste that is set aside for kerbside collection or delivered by the householder directly to a waste facility. b) Other types of domestic waste, such as clean-up and residential garden waste. c) Local council generated waste, such as waste from street sweeping, public litter bins or parks.
NSW Department of Environment and Climate Change and Water	The former NSW Department of Environment and Conservation (DEC) was formed in 2003 via the amalgamation of four previously established environmental agencies, these being the Environment Protection Authority (EPA), the National Parks and Wildlife Service (NPWS), Resource NSW and the Botanic Gardens Trust. DEC also provided a co-ordination role for the Sydney Catchment Authority. The DEC was renamed the Department of Environment, Climate Change (DECC) before more recently being renamed the Department of Environment, Climate Change and Water (DECCW) in 2009.
NSW Department of Industry and Investment	The NSW Department of Industry and Investment (DII) is the former energy sector of the NSW Department of Water and Energy (DWE) (previously the former NSW Department of Infrastructure, Planning and Natural Resources - DIPNR). DII has responsibility for the delivery of the NSW Government's policy and reform agenda for the energy sector.
NSW Department of Planning	Department of Planning (DoP) is the NSW Government department primarily responsible for planning matters. Former operating names for DoP include Planning NSW and the Department of Urban Affairs and Planning (DUAP). DoP was also part of the former Department of Infrastructure, Planning and Natural Resources (DIPNR), operating at that time under the name Planning NSW.
NSW Environment Protection Authority	Now part of the NSW DECCW, however the Environment Protection Authority (EPA) also retains its own legal status with respect to certain statutory functions and powers as it exercises these within its overall responsibility to protect the environment of NSW.

Term	Definition
NSW Office of Water	The NSW Office of Water is the former water sector of the NSW DWE (previously the former NSW Department of Infrastructure, Planning and Natural Resources - DIPNR). The Office of Water carries out a regulatory and enforcement function for water matters and has responsibility for the delivery of the NSW Government's policy and reform agenda for the water sector.
Offensive Odour	The *POEO Act* defines an offensive odour as an odour: *(a) that, by reason of its strength, nature, duration, character or quality, or the time at which it is emitted, or any other circumstances:* *(i) is harmful to (or is likely to be harmful to) a person who is outside the premises from which it is emitted, or* *(ii) interferes unreasonably with (or is likely to interfere unreasonably with) the comfort or repose of a person who is outside the premises from which it is emitted, or* (b) *that is of a strength, nature, duration, character or quality prescribed by the regulations or that is emitted at a time, or in other circumstances, prescribed by the regulations.*
Organics	Means natural organic materials of either waste or non-waste origin, including any of the following: a) Putrescible organics such as meat, fish, poultry, fruit, vegetables, or their cooked or processed products, as well as biosolids and manure and other animal materials. b) Non putrescible organics such as timber, garden trimmings, agricultural, forestry or crop materials or natural fibrous organic or other vegetative materials. However the definition does not include any of the following: a) Human-made organic chemicals such as solvents or industrial, agricultural, mining, commercial or household chemicals, cleansing agents or personal care products. b) Naturally occurring organic chemicals which have been refined and/or concentrated by human activity such as oil, petrol, diesel or coal tar.
Pathogen	A living micro-organism that can cause harm to humans, animals, plants or other living organisms, usually by causing disease or other ailment in larger species.
Percentile	The percentage in relation to a number of samples taken that must meet a criterion. Within EPLs, percentile is usually the number of samples, expressed as a percentage that must meet the concentration limit specified in the EPA Licence for that pollutant over a specified period of time. In an EPA licence, the specified period of time is the Reporting Period, unless otherwise stated within the Licence.
Perched Water	Unconfined groundwater held above the water table by a layer of impermeable rock or sediment.
Phytocap	A phytocap, or "phytoremediation cap" is an alternate capping system sometimes used in the management of closed and completed landfill cells. A phytocap commonly incorporates the use of a range of native trees, shrubs and grasses that are tolerant to saline, ammonium-rich leachate and that therefore have the potential to treat leachate on-site. For the proposed landfill development at Armidale, phytocapping may prove to be a viable alternative capping system to the more commonly used, fully engineered capping systems.
Premises	The area occupied by the site referred to under a Licence issued under the NSW *POEO Act*. The Licence applies to the specified activity conducted on those premises. Premises may include buildings or structures, land or places, mobile plant, vehicles or vessels.

Term	Definition
Proposed Landfill Site	The entire section of land encompassing the proposed landfill to which this EA applies. The total land area of the proposed development site is approximately 86 hectares and incorporates provision for all the following: • Approximately 20 hectares of area that includes all land required for the actual landfill, including all site buildings, other operational requirements and leachate and stormwater management measures. • Site access from Waterfall Way (the relevant site access road). • A biodiversity offset area of approximately 61 hectares.
Putrescible Waste	Putrescible wastes are wastes that are subject to putrefaction (i.e. liable to decay, spoil or to become putrid) and includes the following: a) food waste (including meat, fish, poultry, fruit, vegetables and their cooked or otherwise processed by-products). b) waste consisting of animal matter (including dead animals and animal parts). c) grease trap waste. d) biosolids (as categorised as Stabilisation Grade C in accordance with the criteria set out in the EPA's *Biosolids Guidelines*), including manures and animal materials.
Ramsar Site	Wetlands of international importance declared under the terms of the Ramsar Convention on Wetlands (1971).
Rating Background Level	The Rating Background Level (RBL) for noise in each period is the medium value of the Assessment Background Level (ABL) noise values for the period over all of the days during which noise is measured. There is therefore a noise RBL value for each period, day, evening and night.
Recycling	The processing of waste materials into a similar non-waste product. Related organic processing includes the conversion of organics into soil conditioners, compost, humus or other products such as mulching, fermentation and digestion. Such processes are best carried out under controlled conditions.
Reporting Period	For the purpose of an EPL, the reporting period means the period of 12 months after the issue of the EPL and each subsequent 12 month period. In the case of an EPL continued in force by the *POEO Act*, the date of issue of the licence is the first anniversary of the date of issue or last renewal of the Licence following the commencement of the Act.
Resource NSW	A former government agency formed by the Waste Avoidance and Resource Recovery (WARR) Act 2001 and now part of the DECCW. DECCW's functions in relation to waste are to develop, coordinate and evaluate the strategies and programmes for the state-wide achievement of the NSW Government's policies for minimising waste and maximising resource recovery.
Residual Waste	The fraction of the total waste stream remaining after re-use, recycling or recovery of materials, within reasonable economic and technical bounds.
Resource Recovery	The extraction from waste of potential resources that can subsequently be used in the manufacture of new products. The value of resource recovery initiatives includes the potential production of energy via the use of various components of waste as fuel, the production of saleable compost made from the organic fractions of waste and potentially the reclamation of land.
Run-off	The portion of rainwater that drains away as surface flow.
Scheduled Activity	An activity listed in Schedule 1 of the *POEO Act*. See Activity (Scheduled).
State Pollution Control Commission (SPCC)	The former name of the environmental regulatory agency within NSW. The former SPCC now operates under the name EPA and is part of the DECCW.

Term	Definition
Solid Waste	Has the same meaning as defined in Part 3 of Schedule 1 of the *Protection of the Environment Operations Act 1997*.
Solid Waste Landfill	A site for the disposal of Solid Waste by landfilling, as defined in *Environmental Guidelines*: Solid Waste Landfills (EPA 1996). Solid Waste Landfills may be defined as either: • General solid waste (putrescible), formerly known as "Solid Waste Class 1". • General solid waste (non-putrescible), formerly known as "Solid Waste Class 2".
Sound Pressure Level	An air pressure in noise measurement, which is the root mean square air pressure expressed as decibels relative to 106 Pascals (Pa).
Sound Power Level	A power measurement that is an intrinsic (independent of distance) parameter for sources of noise.
Turbidity	Turbidity is a measure of suspended material in water that can cause it to look discoloured or muddy. Turbidity is commonly measured in Nephelometric Turbidity Units (NTU), using standard equipment.
Utilisation Area	Area shown as a utilisation area on a map submitted with the application for an EPL.
Waste	Waste is defined under the *POEO Act* in the following manner: a) Any substance (whether solid, liquid or gaseous) that is discharged, emitted or deposited in the environment in such volume, constituency or manner as to cause an alteration in the environment, or b) Any discarded, rejected, unwanted, surplus or abandoned substance, or c) Any otherwise discarded, rejected, unwanted, surplus or abandoned substance intended for sale or for recycling, processing, recovery or purification by a separate operation from that which produced the substance, or d) Any substance prescribed by the regulation to be waste for the purposes of (the) Act. A substance is not precluded from being waste for the purposes of the Act merely because it is able to be processed, re-used or recycled.
Waste Codes	Waste codes are as listed in Appendix 5 of the EPA document - A Guide to Licensing Part B.
Waste Guidelines	The *Waste Guidelines* is a document titled *Environmental Guidelines: Assessment, Classification and Management of Liquid and Non-Liquid Wastes*, issued by the EPA and in force from 1 July 1999 (EPA 1999a).
Waste Type	A categorisation of waste under the *POEO Act* and associated regulations into Group A, Group B, Group C, inert, solid, industrial or hazardous waste. Classification into Waste Type is determined under the procedures stated in the *Waste Guidelines 2008*.

Abbreviations and Acronyms

Abbreviations and Acronyms	Definition
AADT	Annual Average Daily Traffic
AAPH	Average Annual Public Holiday Traffic
AASS	Actual Acid Sulphate Soil
AAWE	Average Annual Weekend Traffic
AAWT	Average Annual Weekday Traffic
ABL	Assessment Background Level
ADLCCC	Armidale Dumaresq Landfill Community Consultative Committee
AECOM	AECOM Australia Pty Ltd
AEP	Annual Exceedance Probability
AGO	Australian Greenhouse Office
AHD	Australian Height Datum
AHIMS	Aboriginal Heritage Information Management System
ANZECC	Australia and New Zealand Environment and Conservation Council
ARI	Average Reoccurrence Interval
ASD	Approach Site Distance
ASR	Archaeological Surveys & Reports Pty Ltd
AUSPLUME	A computer-based air dispersion model
AWT	Alternative Waste Technology
CAMBA	China-Australia Migratory Bird Agreement
CDC	Complying Development Certificate
CEC	Cation Exchange Capacity
CEMP	Construction Environmental Management Plan
CNMP	Construction Noise Management Plan
Council	Armidale Dumaresq Council
CQA	Construction Quality Assurance
CQC	Construction Quality Control
DA	Development Application
DEC	(the former) NSW Department of Environment and Conservation (now DECCW)
DECC	(the former) NSW Department of Environment and Climate Change (now DECCW)
DECCW	NSW Department of Environment, Climate Change and Water (formerly DECC)
DEWHA	Department of Environment, Water, Heritage and the Arts.

Abbreviations and Acronyms	Definition
DEWR	Commonwealth Department of Environment and Water Resources (DEWR, now DEWHA)
DGRs	Director-General's Requirements
DII	NSW Department of Industry and Investment (formerly DPI)
DIPNR	(the former) NSW Department of Infrastructure Planning and Natural Resources (now DoP and DWE)
DLWC	(the former) NSW Department of Land and Water Conservation (now DWE)
DNR	Department of Natural Resources
DoP	NSW Department of Planning
DPI	(the former) NSW Department of Primary Industries (now DII)
DUAP	(the former) NSW Department of Urban Affairs and Planning (now DoP)
DWE	The former NSW Department of Water and Energy (now NSW Office of Water and DII
EA	Environmental Assessment
EAT	Emerson Aggregate Test
ECRTN	Environmental Criteria for Road Traffic Noise (EPA document)
EEC	Endangered Ecological Communities
EOI	Expressions of Interest
EPA	(the former) NSW Environment Protection Authority (now DECC)
EP&A Act	Environmental Planning and Assessment Act 1979
EP&A Regulation	Environmental Planning and Assessment Regulation 2000
EPBC Act	Commonwealth Environmental Protection and Biodiversity Conservation Act 1999
EPL	Environment Protection Licence
ERP	Emergency Response Plan
ESCP	Erosion and Sediment Control Plan
ESD	Ecologically Sustainable Development
ESP	Exchangeable Sodium Percentage
FSQ	Final Storage Quality
GCL	Geosynthetic Clay Liner
GHG	Greenhouse Gas
GIS	Geographical Information Systems
GRAWHA	Gondwana Rainforests of Australia World Heritage Area
GWP	Global Warming Potential
GVEPA	Gara Valley Environment Preservation Association
HDPE	High Density Polyethylene
IPCC	Intergovernmental Panel on Climate Change

Abbreviations and Acronyms	Definition
JAMBA	Japan-Australia Migratory Bird Agreement
LALC	Local Aboriginal Land Council
Landfill Facility	The proposed new Armidale Regional Solid Waste Landfill Facility, the subject of this EA.
LCS	Leachate Collection Systems
LEL	Lower Explosive Limit
LEMP	Landfill Environmental Management Plan
LEP	Local Environmental Plan
LGA	Local Government Area
MBT	Mechanical Biological Technologies
MRF	Materials Recycling Facility
MSDS	Material Safety Data Sheet
MSW	Municipal Solid Waste
NES	National Environmental Significance
NESAC	New England Strategic Alliance of Councils
NGACs	NSW Greenhouse Gas Abatement Certificates
NHNRC	National Health and Nutrition Research Council
NIRW	Northern Inland Regional Waste
NMOC	Non-methane organic compounds
NP&W Act	National Parks and Wildlife Act 1971
NRMMC	National Resource Management Ministerial Council
NTU	Nephelometric Turbidity Units
NV Act	Native Vegetation Act 2003
NW Act	Noxious Weeds Act 1993
^{o}C	degrees of temperature (as measured in the Celsius scale, also known as Centigrade)
OH&S	Occupational Health and Safety
PAS	Priority Action Statement
PASS	Potential Acid Sulphate Soils
PEA	Preliminary Environmental Assessment
PFM	Planning Focus Meeting
PHA	Preliminary Hazard Analysis
POEO Act	NSW Protection of the Environment Operations Act 1997
RBL	Rating Background Level
REC	Renewable Energy Certificate
RFS	NSW Rural Fire Service

Abbreviations and Acronyms	Definition
RL	Relative Level
RLPB	Rural Lands Protection Board
ROTAP	Rare or Threatened Australian Plant
RTA	NSW Roads and Traffic Authority
RUM	Return Unwanted Medicines programme
SEPP	State Environmental Planning Policy
SEPP 2005	State Environmental Planning Policy (Major Development) 2005
SISD	Safe Intersection Sight Distance
SoC	Statement of Commitments
SPL	Sound Pressure Level
STP	Sewage Treatment Plant
SWL	Sound Power Level
TSC Act	Threatened Species Conservation Act 1995
TSP	Total Suspended Particulates
TSR	Travelling Stock Route
Tss	Total Suspended Solids
VCP	Vegetation Clearing Protocol
VCU	Vertical Composting Unit
VMP	Vegetation Management Plan
vpd	Volume per day
vph	Volume per hour
WARR Act	NSW Waste Avoidance and Resource Recovery Act 2001
WLMP	Water and Leachate Management Plan
WMP	Weed Management Plan
WSP	Water Sharing Plans
WSUD	Water Sensitive Urban Drainage
WTS	Waste Transfer Station

Executive Summary

Introduction

Armidale Dumaresq Council (Council) has engaged AECOM Australia Pty Ltd (AECOM) to prepare this Environmental Assessment (EA) under Part 3A of the *Environmental Planning and Assessment Act 1979* (*EP&A Act)* for the development of the Armidale Regional Solid Waste (Putrescible) Landfill Facility off Waterfall Way in Armidale, NSW.

The proposed landfill facility would be designed to accept up to 15,000 tonnes per annum (tpa) of general solid waste, up to a total capacity of 750,000 tonnes over the proposed landfill's life span of 50 years. The proposed landfill facility is intended to service the future waste disposal needs of the Armidale Dumaresq, Guyra Shire, Uralla Shire and Walcha Local Government Areas (LGAs).

The existing landfill facility at the Armidale Waste Management Centre is fast approaching its final capacity. No further options are available to extend or otherwise prolong the life of the landfill, mainly due to the lack of further available land area at that site. As such, the need now exists to provide a long-term waste disposal solution for the region. It is therefore proposed to seek approval to construct and operate a new regional landfill facility.

This EA has been prepared in accordance with the provisions of Part 3A of the *EP&A Act*, together with the Director General's Requirements (DGRs) issued by the Director General of the Department of Planning (DoP) on the 20 November 2008.

Site Description

The Project Site for the proposed landfill facility is located on Waterfall Way (also known as Grafton Road) about 12 kilometres east of the central business district (CBD) of the City of Armidale. The Project Site has been selected to minimise potentially adverse land use, environmental, social and economic impacts.

The terrain that surrounds the Project Site is generally undulating. The north and south parts of the Project Site are at higher elevation and gradually slope towards a low lying area in the centre of the property. The lower area is associated with an intermittent unnamed creek that flows east towards the Gara River.

A large proportion of the Project Site has been cleared for agriculture. To the north of the site is a partially protected remnant of good quality native vegetation that forms part of the Gara Travelling Stock Route.

Background and Project Need

Armidale Dumaresq and several other surrounding LGAs are facing a waste management crisis. The existing Armidale Waste Management Centre landfill (currently used by both Armidale Dumaresq and Guyra Shire Councils) is predicted to reach capacity within the next year, with only very limited and currently unapproved possibilities for any further expansion. Others landfills within the broader region (those currently used by Uralla Shire and Walcha Councils) will progressively reach their final capacities over the next five to 15 years and would not have capacity within that time to realistically accommodate Armidale Dumaresq's and Guyra's ongoing landfill needs. Current predictions indicate that both population numbers and waste production rates within the region will remain relatively stable over the next 50 years, such that a total of approximately 15,000 tonnes of residual waste will need to be sent to landfill each year from the four participating councils of Armidale Dumaresq, Guyra, Uralla and Walcha LGAs.

Since the early 1990's, Council has investigated over 40 potential landfill sites throughout the region. These were progressively narrowed down to 11 sites via further investigation. Each of sites was then further considered via a more rigorous site investigation process. This process recommended the finally proposed landfill site, 12 kilometres east of Armidale on Waterfall Way, combining portions of two existing properties known as "Sherraloy" and "Edington". It is proposed that the land required for the landfill site would be formally subdivided from each of these two properties for purchase by Council as part of the development proposal. This combined 86 hectare site is the subject of this EA.

The existing Council owned and operated Waste Transfer Station (WTS), as part of the Armidale Waste Management Centre on Long Swamp Road, will continue to act in its current capacity as a waste processing and recycling centre, with only residual, non-recyclable waste needing to be sent to landfill at a separate site.

Project Justification

The environmental impact assessment of the proposal undertaken in this EA has addressed the relevant biophysical, economic, social and sustainability considerations. The proposed landfill facility is considered to be fully justified due to:

- A genuine need for a landfill site in the region.
- Long-term biophysical benefits arising from the project.
- Relatively minor social and economic impacts.
- Compliance with the criteria for sustainability.

Review of Alternatives and Site Selection Process

Review of Alternatives to Landfilling

Council has considered a number of alternative options for landfilling, including:

- A mechanical (rolling drum) composting process.
- A cellular composting process.
- Re-excavation of existing landfills to recover compostable material.
- A Vertical Composting Unit (VCU).
- It was determined that notwithstanding new technologies and a commitment to recycling and reuse, there would always be residual waste that would require final disposal as landfill.

Alternative Site Assessment

Eleven alternative sites were assessed taking strategic planning guidelines, statutory planning issues, ground and surface water environment, level of service, adequacy of service, local amenity and environmental considerations, site features required, set-up costs, operational costs, social issues and geotechnical investigations into account. Community consultation was also undertaken during the site selection process. Following this selection process Council resolved to pursue the establishment of a new landfill on the proposed Project Site.

Project Description

It is proposed that the new landfill facility on Waterfall Way would be constructed and licensed to operate as a General solid waste (putrescible) facility (formerly known as “Solid Waste Class 1” facility) although it is also intended, as soon as possible in the future after initial commencement, to continue its routine operation only as a General solid waste (non-putrescible) facility (formerly known as “Solid Waste Class 2” facility). In order to achieve this, it is Council’s intention to introduce additional waste processing facilities at its Armidale Waste Management Centre. These would operate in association with the proposed landfill facility and would seek to remove, for re-processing, as much possible of the “putrescible” fraction of Council’s waste from the current, otherwise non-recyclable waste stream.

The proposed landfill facility on Waterfall Way is being designed as a conventional landfill that would be constructed above natural ground level. It would require some initial excavation of the landfill’s footprint area for site establishment reasons, mainly for construction / installation of the landfill liner and leachate collection system. The final landform would be above natural ground levels but would be progressively covered, rehabilitated and appropriately landscaped over the life of the landfill in order to complement the existing surrounding topography of the local area.

The landfill would be progressively developed as five individual, operational cells that would each contain approximately 211,000 m^3 of landfill material (comprising both waste and cover materials). At currently proposed filling rates (i.e. without any further re-processing of the putrescible fraction of the existing, non-recyclable waste stream) each cell would have an operational life of approximately 10 years. The total landfill development would therefore have an operational life of approximately 50 years.

Each cell would consist of the following main components, detailed in **Section 5.0** of this EA.

- Leachate Barrier System.
- Leachate Collection and Conveyance System.
- Leachate Pond.
- Sedimentation Basin.

- Dry Basin.
- Internal Access Road.
- Biodiversity Offset Area.
- Diesel Storage Tank and Bunded Area.

A site amenities building, including staff toilets, staff lunch room, office, first aid / Occupational Health and Safety (OH&S) facilities (eye wash facilities and fire extinguishers, etc) and car parking spaces for both staff and visitors would also be constructed as part of the proposal.

Typical dimensions of each cell would be approximately 80 metres wide, 275 metres long and 14 metres high. A leachate barrier and leachate collection and conveyance system that would drain to an appropriately sized leachate pond would be installed to contain leachate on site. Intermediate cover would be applied to all landfilled areas that would otherwise be exposed for more than 90 days. Final clay capping of each cell would occur progressively and final capping would commence within 30 days of the final landfill height being reached at each location. Finally capped areas would be progressively revegetated with shallow rooted native grasses and shrubs to return the landfill footprint to its pre-existing land use condition, suitable for agricultural purposes.

The landfill facilities include a single lane access road between the proposed landfill facility and Waterfall Way. The access road would be bitumen sealed from the intersection with Waterfall Way to a wheel wash located near the landfill footprint.

Planning Framework

Commonwealth Legislation

The *Environmental Protection and Biodiversity Conservation Act 1999* (*EPBC Act*) governs the Commonwealth environmental assessment process and provides protection for matters of National Environmental Significance (NES), including Australia's World Heritage properties. The *EPBC Act* defines proposals that are likely to have an impact on matters of NES as a "controlled action" and also requires a referral to be made to the Commonwealth Minister for the Department of Environment, Water, Heritage and the Arts (DEWHA) for a determination as to whether the proposed action is considered to be a controlled action. The Minister declared in October 2007 that the project is a controlled action under the *EPBC Act*.

The proposed development therefore requires approval under the *EPBC Act*. Assessment requirements of the Commonwealth have been incorporated into the formal requirements of the NSW State Government. While the State process is the primary mechanism for assessment, the project will ultimately be reviewed for approval at both State and Commonwealth levels on this basis.

NSW State Legislation

This proposal has been assessed in accordance with the requirements of *State Environmental Planning Policy (Major Projects) 2005* (*SEPP 2005*) under Part 3A (Major Infrastructure and Other Projects) of the *EP&A Act*. The proposed landfill is defined as a 'waste facility' under *SEPP 2005* as it would have the capacity to receive more than 650,000 tonnes of putrescible waste over the site's 50 year lifespan. Accordingly, project approval is sought by Council from the Minister for Planning, who is the approval authority under Part 3A. This EA provides information required by the Minister to assess the proposal and follows consultation with government and community stakeholders, pre-planning studies to assess the need and feasibility of the proposal and subsequent impact assessment studies. Planning approvals, land valuation and acquisition, detailed design, licensing and construction would follow approval of this EA. A draft Landfill Environmental Management Plan (LEMP) has been prepared as part of the assessment. The LEMP would be finalised when detailed design of the facility is completed.

A range of Environmental Planning Instruments (EPIs), created under the *EP&A Act*, provide further guidance and regulation for development at a state, regional and local level. The EPIs considered in relation to the Project include:

- State Environmental Planning Policy (Infrastructure) 2007.
- State Environmental Planning Policy No. 33 (Hazardous and Offensive Industry).
- State Environmental Planning Policy No. 44 (Koala Habitat Protection).
- State Environmental Planning Policy No. 55 (Remediation of Land).
- The New England Draft Development Strategy.
- Armidale Dumaresq Local Environmental Plan 2008.

Other NSW State Legislation relevant to the Project include:

- Crown Lands Act 1989.
- Heritage Act 1977.
- Native Vegetation Act 2003.
- Noxious Weeds Act 1993.
- Protection of the Environment Operations Act 1997.
- Roads Act 1993.
- Rural Fires Act 1997.
- Threatened Species Conservation Act 1995.
- National Parks and Wildlife Act 1974.
- Water Management Act 2000.

Consultation

This EA has been prepared in accordance with Part 3A of the *EP&A Act* and its regulation. Part 3A of the *EP&A Act* ensures that the potential environmental effects of a proposal are properly assessed and considered in the decision making process.

In preparing this EA, the Director-General's Requirements (DGRs) have been addressed as required by Clause 75F of the *EP&A Act*.

Government Consultation

Consultation with NSW and Commonwealth government departments has been carried out to obtain the assessment requirements for the EA and to identify potential issues that should be addressed. Issues raised through government consultation have been addressed throughout this EA.

Community Consultation

Community consultation was strategically planned and aimed to target Primary Stakeholders, the wider community and Special Interest Groups. Consultation was undertaken during key stages of the project to ensure continued stakeholder involvement. Various communication mediums were used to address stakeholder and community information needs, including community meetings, newsletters, a website, media releases, direct contact, a Community Liaison Manager, a free phone number and email, forms, letters and public information displays. Key issues raised through community consultation have been addressed in this EA.

Environmental Impact Assessment

Landform and Soils

An investigation of soils and their management was undertaken as part of the EA. The assessment included:

- Identification of site history.
- Potential contamination and salinity related impacts.
- Identification of the soil landscapes.

Suitable erosion and sediment control measures would be installed during the initial construction period of the access road and for each cell footprint to mitigate potential erosion impacts. Appropriate ongoing control measures would also be implemented and fully maintained during the progressive development of each subsequent landfill cell and control measures would be applied during the operation of the proposed facility. These sediment and erosion control measures would be documented in the final LEMP as part of an Erosion and Sediment Control Plan (ESCP).

Geology

The Project Site is in an undulating landscape on the New England Plateau. The dominant underlying substrata include greywacke, siltstone, mudstone-argillite and chert associated with the deep marine sedimentary Sandon Beds.

A geological mapping programme was undertaken to investigate the apparent geological fault identified to be present within the proposed landfill site. Detailed field observations, structural measurements and examination of available data do not support the existence of a significant geological fault within the vicinity of the Project Site.

No mitigation measures would be required, however further geotechnical and hydrogeological investigation would be undertaken should evidence of a geological fault be encountered during earthworks.

Surface Water

An assessment was undertaken of the existing surface water environment of the proposed site and the potential construction and operational impacts on the environmental integrity of these local waters was assessed.

The stormwater management system proposed for the Project Site would ensure that clean stormwater is diverted away from the site and would not come into contact with dirty water and leachate. Dirty water and leachate would be directed to an appropriately sized sedimentation basin and leachate pond, respectively. Monitoring of surface water and leachate would to be carried out at the Project Site as detailed in the Water Quality Monitoring Programme and Management Plan and the Water and Leachate Management Plan.

Groundwater

Hydro-geological investigations were conducted to establish the current hydro-geological conditions across the site and to determine the potential impacts arising from the project. The area of elevated topography at the southern part of the Project Site is expected to act as a local groundwater recharge location, with infiltrating waters forming spatially and temporally transient perched groundwater at shallower depths. Deeper percolation of groundwater is expected to occur to deeper aquifers via the site's fractured mudstone.

An assessment of the potential risk and subsequent impacts of leachate infiltration through the landfill liner concluded that the estimated timeframe for leachate to reach the Gara River would be approximately 700-800 years. It was concluded that even under worse case conditions, leachate leaks from the landfill liner would have negligible impacts on the Gara River.

A number of design features and management measures would be implemented to mitigate the potential for leachate generated by the waste in the proposed landfill to impact upon groundwater. Appropriate mitigation measures are detailed in this EA. The management of groundwater impacts in the post-closure phase would continue in the same manner for the leachate management system as used during the operational period. Monitoring of groundwater would be carried out at the Project Site as detailed in the Water Quality Monitoring Programme and Management Plan and the Water and Leachate Management Plan

Air Quality

The Project Site occurs within a rural, agricultural area where background pollution levels are typically low. The wind environment at the site indicates that emissions would quickly disperse for a significant proportion of the time. Dust and odour may potentially impact upon nearby receivers, however, detailed air quality modelling shows that the impacts arising from the proposed landfill facility would not be significant. Appropriate dust and odour control measures would nevertheless be employed in order to minimise all off-site dust and odour impacts.

Greenhouse Gas Emissions

Greenhouse gases (GHG) would be generated during both the construction and operation of the proposed landfill facility with the largest proportion of these gases generated as putrescible waste within the proposed landfill decomposes. A *Greenhouse Gas Inventory* prepared for the proposal predicts net emission quantities for all significant GHGs and proposes methodologies for emissions avoidance (including energy efficiency measures), reduction, abatement and offsetting measures.

Noise

The background noise levels at the Project Site are extremely low. The noise environment is typical of rural areas, with ambient noise levels during the day dominated by routine rural human activities, animal and bird noises and intermittent traffic. Equipment used during the construction and operation of the landfill has the potential to impact upon these ambient noise levels. An assessment based on the 'worst-case scenario' concluded that with the implementation of proposed mitigation measures, noise levels generated by the proposed landfill facility would generally comply with environmental criteria. Traffic generated by the development would increase traffic noise levels by less than 2dB(A) and would comply with road traffic noise criteria.

A Construction Noise Management Plan (CNMP) would be implemented and would include a noise monitoring program, reasonable and feasible noise mitigation measures and a complaint management strategy.

Biodiversity

The Project Site is partially cleared and has been grazed over time. Surveys undertaken during spring and autumn identified one threatened plant species (narrow-leaved black peppermint) and one Rare Or Threatened Australian Plant (ROTAP) species (Bendemere white gum) occurring on the site. A relatively small area of box-gum woodland Endangered Ecological Community was identified in the Gara Travelling Stock Route. Up to 17 other threatened plant species are considered to potentially occur at the site.

Four species of threatened fauna were detected during the study, including speckled warblers, diamond firetails, koalas and eastern bent-wing bats. A further 13 threatened fauna species are considered to potentially occur at the site. The proposed landfill facility will require the clearance of approximately 20 hectares of woodland and grassland that supports native flora and fauna, however a Biodiversity Offset Area is proposed as an integral part of the proposal. This offset area would comprise a compensatory habitat of approximately 61 hectares and would connect to the Travelling Stock Route and provide connectivity between remnant woodlands in the Project Site. Together with feral species eradication programmes and appropriate fencing, these measures would contribute to the maintenance of biodiversity value in the local area.

Socio-Economic

The construction phase of the proposed landfill facility would employ up to 15 people. During operation of the proposed landfill, it is estimated that 2 people would be permanently employed on site, however there may also be other indirect employment opportunities including carrying out environmental monitoring of the proposed landfill and suppliers of goods and services.

The proposed landfill facility would have a positive economic impact on the Armidale Dumaresq LGA, particularly through the increase in efficiencies associated with waste transport. There would be a direct impact on agricultural production at the Project Site, however the proposal includes progressive rehabilitation of the landfill footprint to its pre-exiting land use condition.

Appropriate landfill management practices would ensure that introduced animal pests do not increase in abundance or affect local stock or crops. Appropriate compensation would be negotiated for affected landholders with respect to the required subdivision and purchase of the required portions of their properties that would be needed for the proposed landfill facility.

Indigenous and European Heritage

An archaeological assessment undertaken for the site identified two items of indigenous heritage (i.e. Aboriginal artefacts), these being a silcrete flake scraper and a silcrete flake. The Project Site is considerably disturbed and there are few undisturbed contexts in which archaeological material may still occur, therefore it was concluded that there is little potential for the Project Site to contain any significant archaeological material.

An appropriate management strategy has been developed to mitigate the potential for either of the identified sites to be damaged by construction or operational activities associated with the proposed landfill facility. An Indigenous Heritage Management Plan would also be prepared to outline the appropriate mitigation measures to protect the known sites. Further consultation with Aboriginal stakeholders would be undertaken prior to construction commencing.

The TSR is a significant item of European heritage found in the vicinity of the site. Impacts on biodiversity within the TSR resulting from the project would be mitigated by providing compensatory habitat and the implementation of a Biodiversity Offset Management Plan.

National Environmental Heritage

There is potential for the proposed landfill facility to impact on the water quality of the Gara River and therefore potentially have downstream impacts on the Oxley Wild Rivers National Park and Gondwana Rainforests of Australia World Heritage Area. Impact to the World Heritage Property would be negligible due to stringent mitigation measures that would be implemented, including the development of a WLMP that:

- Ensures both surface water and leachate are properly and effectively controlled and managed during the operational life of the landfill.
- Considers all aspects of the surface water and leachate storage at the Project Site, including design of a permanent leachate pond, sedimentation basin and dry basin.

Land Use

The current land use at the site is predominantly agricultural. Land use within the footprint of the proposed landfill facility would be altered from its existing agricultural use for approximately 50 years. The Project Site would, however, be progressively rehabilitated to its pre-existing landuse condition and the long term impact on agricultural land use would be negligible. The rehabilitation and planting of approximately 61 hectares of compensatory habitat (as part of a Biodiversity Offset Area) surrounding the proposed landfill facility would change the current land use, however this would provide important habitat corridors for the long term maintenance of local biodiversity.

Traffic and Transport

The potential impacts associated with the landfill development are expected to be related to changes in:

- Traffic flows.
- Traffic generation.
- Traffic distribution.

The Traffic Assessment has considered these potential traffic impacts of the proposed landfill facility. Traffic impacts as a result of the proposal are expected to be negligible.

Hazards

Potential hazards such as bushfires, hazardous materials, vandalism, explosions, land subsidence and flooding have been considered, with respect to their potential to affect the site or to create other significant impacts in relation to the proposed landfill facility. The development is not potentially hazardous or offensive according to the requirements of *SEPP 33 - Hazardous and Offensive Development* . With the adoption of sound design principles and the implementation of the proposed management and mitigation measures, the proposed landfill facility would not pose a significant risk to human health or the biophysical environment during construction or operation.

Visual

The proposal would alter the existing appearance of the site throughout the construction phase and during the operational life of the landfill, however the progressive landscaping and revegetation of each completed landfill cell would mitigate the visual impacts on nearby receivers resulting from the proposal.

Existing vegetation within the property boundary but outside the proposed landfill and associated infrastructure footprint would be maintained throughout the life of the landfill project. The Biodiversity Offset Area would comprise predominantly stringybark woodland, which when mature would provide considerable screening of the proposed landfill facility. The final location and nature of all planting would be subject to NSW Rural Fire Service bushfire regulations.

Climate Change

An assessment of the projected climate change in the region of the Project Site was undertaken and the potential climate change risks and adaptation responses for incorporation into the design phase of the landfill project have also been outlined.

Cumulative Impacts

There are no major developments planned in the vicinity of the landfill site. Consequently, there are not considered to be any significant cumulative impacts associated with the proposal, if the proposed mitigation measures for biodiversity and other suggested mitigation measures are implemented.

Statement of Commitments

In accordance with the DGRs issued under Part 3A of the *EP&A Act*, a Statement of Commitments (SoC) for the Project is included in this EA. The SoC sets out the environmental management and monitoring measures that would be put in place during the construction and operation of the proposed landfill facility to minimise adverse impacts on the environment.

The Proponent is committed to ensuring the preparation and implementation of the environmental management and monitoring plans, further investigations and studies and environmental mitigation measures detailed in the SoC for the proposed Project Approval.

This reiterates the commitment of Council and any of its contractors to the mitigation of environmental impacts that have been indentified in this EA.

Environmental Risk Assessment

The Environmental Risk Analysis for the proposed landfill facility is based on a process adapted from Australian Standard AS 4360:2004 Risk Management, as well as environmental risk tools developed by other organisations. The process is qualitative and is based on a Residual Risk Matrix.

Residual Environmental Risk is assessed on the basis of the significance of environmental effects of the proposal and the ability to confidently manage those effects to minimise harm to the environment.

The Environmental Risk Analysis indicates that the proposal presents an overall low to medium risk in relation to each of the identified environmental issues, provided that the recommended mitigation, management and monitoring measures are implemented.

Sustainability

The design of the proposed landfill facility has been conducted in accordance with the four principles of Ecologically Sustainable Development (ESD), namely:

- The "*precautionary principle*" i.e. if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.
- "*Inter-generational equity*" i.e. the present generation should ensure that the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations.
- "*Conservation of biological diversity and ecological integrity*" i.e. biological diversity and ecological integrity should be preserved as much as possible by investigating appropriate design and site options that minimise the impact on biological resources including threatened species and their habitats and ecologically sensitive communities.
- "*Improved valuation, pricing and incentive mechanisms*" i.e. environmental factors should be included in the valuation of assets and services.

These principles have been considered during all aspects of the project development. The relevant requirements of the Commonwealth *EPBC Act* have also been taken into account.

Conclusions

This EA addresses the requirements set out by the DoP in their letter to AECOM dated 11 November 2008 and in response to Adequacy Review comments received in July and August 2009. In the context of these requirements the following overall conclusions are made:

- There is an urgent need to find an alternative waste disposal solution for the Armidale region.
- Council has investigated alternative options to landfilling, including do-nothing, composting, mechanical biological treatment and thermal treatment, but concluded that land filling of residual waste in conjunction with a number of current waste avoidance/recycling initiatives would be the best option for this region.
- Based upon a stringent rating and weighting process along with an intensive community consultation program, the Project Site assessed in this EA is considered to be the best site available. No environmental issues were identified that would preclude this site from use as a landfill.

- The potential impacts of the proposed landfill facility on water (surface and groundwater), air (greenhouse, dust, methane, odours), noise, litter, feral animal/weeds and heritage have been fully assessed and it is considered that with the adoption of the proposed mitigation measures outlined in this EA, there would be a negligible impact on the surrounding environment.
- Through the adoption of the mitigation measures proposed in this EA the potential impacts would be successfully addressed to ensure that there is an overall negligible impact on the environment.
- In particular, stringent controls for leachate management, groundwater and surface water monitoring, landfill lining and surface water management would be put in place to ensure that there is no discharge of contaminated ground and/or surface waters to the receiving water bodies in this catchment.
- The assessment has indicated that there would be some habitat loss or disturbance on the site resulting from the proposed works. However, this habitat loss would be offset by providing approximately 61 hectares of revegetated, compensatory habitat.
- Further, with this offset in place, it has been concluded that there would be no significant impact on biodiversity, the environment or heritage arising from this proposal.

It is concluded that identified potential impacts from the proposed landfill facility can be appropriately managed through the implementation of proposed specific mitigation measures and commitments outlined in this assessment and contained in the SoC. Council would implement these commitments via the initiation of its LEMP for the proposed landfill facility. This LEMP would also be used by government agencies to both administer and regulate the proposed landfill facility.

The findings of the environmental assessment presented in this EA and accompanying technical studies confirm that the proposed landfill facility has a strong justification for proceeding and is considered to be suitable for approval under Part 3A of the *EP&A Act*.

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1.0 Introduction

1.1 Overview

Armidale Dumaresq Council (Council) has recognised the need to provide a long term solution to the region's waste disposal problem and proposes to develop the Armidale Regional Solid Waste (Putrescible) Landfill Facility (Landfill Facility) off Waterfall Way in Armidale, NSW. Council is the proponent for the project, on behalf of itself and three other participating councils: Guyra Shire, Uralla Shire and Walcha Councils. Council intends to be the owner and operator of the proposed landfill facility and would also be responsible for its management throughout the operational life and the subsequent rehabilitation phases. This EA supports and forms part of an Application for Project Approval for the proposed new landfill facility.

Armidale is a city of about 25,000 people, located in the Northern Tablelands (New England) region of northern NSW, about 500 kilometres north of Sydney on the New England Highway. The Project Site for the new landfill facility is located on Waterfall Way (also known as Grafton Road) about 12 kilometres east of the central business district (CBD) of the City of Armidale (refer **Figure 1** and **Figure 2**). The proposed landfill facility would be designed to accept up to 15,000 tonnes per annum (tpa) of general solid waste, up to a total capacity of 750,000 tonnes over the proposed life span of 50 years. The proposed landfill facility is intended to service the future waste disposal needs of the Armidale Dumaresq, Guyra Shire, Uralla Shire and Walcha LGAs.

Council's existing domestic waste landfill is located on a separate site, at the Armidale Waste Management Centre (on Long Swamp Road), close to Armidale City and about 10 kilometres from the Project Site (refer **Figure 1**). This facility currently serves both the Armidale Dumaresq and Guyra Shire LGAs. The proposed landfill facility on Waterfall Way is required as Council's existing landfill is rapidly reaching its final capacity. In 2003, Council commissioned a WTS at the Waste Management Centre that enables all wastes to be sorted for maximum recovery of recyclable materials. One of the primary objectives of the implementation of the WTS was to enable the adoption of sustainable waste management practices whilst maximising the operational life of the existing landfill. The operation of the WTS currently achieves a resource recovery (i.e. recycling) rate of 48.1% (refer **Section 2.4.2**). The WTS also enables strict controls to be imposed on the type of refuse ultimately being directed to landfill.

In 2004, Council received approval from the NSW Environment Protection Authority (EPA, the legal entity for licensing issues within the NSW Department of Climate Change and Water [DECCW]) to extend the operating area of its existing landfill at the Waste Management Centre. Even with this extension and Council's impressive resource recovery rate, the existing landfill is still fast approaching its final capacity. No further options are available to extend or otherwise prolong the life of the landfill, mainly due to the lack of further available land area at that site. An urgent need now exists to provide a long-term waste disposal solution for the region, before Council's existing landfill reaches its final capacity.

Council is committed to the reduction of waste being directed to landfill. It should be noted that the proposed landfill facility is not being considered in isolation of other waste management efforts being considered by Council including the future application of Alternative Waste Technologies (AWT), to further increase resource recovery rates and thus to reduce waste to landfill volumes in the future (refer **Section 2.2.2**).

AECOM Australia Pty Ltd (AECOM) has been commissioned by Council to manage the project's planning approvals, initial land acquisition, community and other consultation requirements, design, construction and commissioning. AECOM is also preparing a LEMP for the facility, as well as an application for an Environmental Protection Licence (EPL).

1.2 Environmental Assessment

1.2.1 Environmental Planning and Assessment Act

The *Environmental Planning and Assessment Act 1979* (*EP&A Act*) and the *Environmental Planning and Assessment Regulation 2000* (*EP&A Regulation*) provide a framework for environmental planning in NSW and include provisions to ensure that proposals which have the potential to impact the environment are subject to detailed assessment. The proposed landfill facility has the "*capacity to receive more than 650, 000 tonnes of putrescible waste over the life of the site*" (Group 9, 2005: 27) and is defined as a "*resource recovery or waste facility*" within Schedule 1 of *State Environmental Planning Policy (Major Development) 2005* (*SEPP 2005*). As such, the proposed landfill facility has been declared by the Minister for Planning as a 'Major Project' (02/09/2009) and is subject to the provisions of Part 3A of the *EP&A Act*.

This EA has been prepared by AECOM on behalf of Council, and supports and forms part of Council's Application for Major Project Approval of the proposed landfill facility in accordance with Part 3A of the *EP&A Act*.

The purpose of this EA is to provide sufficiently detailed information about the project and analysis of its environmental impacts, in order to appropriately inform the formal decision making process with respect to Major Project Approval. The EA identifies relevant approvals and permits that may need to be secured and discusses appropriate methodologies required to mitigate or minimise environmental impacts that have been identified.

1.2.2 Preliminary Environmental Assessment

A Preliminary Environmental Assessment (PEA) was prepared by AECOM in October 2008 to provide preliminary information to the Department of Planning (DoP) and other relevant agencies and stakeholders about the key elements of the proposed development, so that project-specific DGRs could be formulated. The PEA identified the key issues for further assessment and included a risk assessment of each potential environmental impact, as part of an overall process to identify whether an issue was potentially of high, medium or low environmental significance. The PEA also supported AECOM's request for updated DGRs to be issued by the DoP (October, 2008), as previously issued DGRs had since lapsed.

1.2.3 Director-General's Requirements

DGRs for the proposed development were originally issued in 2005, however due to delays in design development, an EA was not completed within the mandated two year period and updated DGRs were issued on 20 November 2008 (refer **Appendix A** for the full copy of the DGRs). These included the requirements of all other relevant NSW State government agencies, as well as the requirements of the Commonwealth Department of Environment, Water, Heritage and the Arts (DEWHA).

Pursuant to the requirements of Part 3A of the *EP&A Act*, this EA report has been prepared to:

- Conform with the requirements of the *EP&A Act*, including satisfying specific assessment requirements issued by the Director-General of DoP.
- Provide sufficient information so that the Minister for Planning can make a determination on the project.
- Identify other approvals that may be needed for the project to proceed.
- Inform the community and stakeholders about the project and describe the consultation activities undertaken.

The requirements of all other previously issued DGRs have also been considered during the preparation of this EA document. Copies of previously issued DGRs are presented in **Appendix A** of this report.

In preparing this EA report on behalf of Council, AECOM has examined and taken into account, as far as practicable, all matters affecting, or likely to affect the environment by reason of the development and operation of the proposed Armidale landfill facility.

An overview of the methodology for the approvals process, based on the provisions of Part 3A of the *EP&A Act* is presented in **Figure 3**.

1.3 The proposal

1.3.1 Objectives

The overall objectives of the proposed landfill facility proposal are to:

- *Provide a long-term, fully licensed waste disposal facility capable of servicing the population of Armidale Dumaresq LGA and other participating, surrounding LGAs.*
- *Protect the surrounding environment (including connectivity to the Oxley Wild Rivers National Park), through implementation and management of environmental controls and contingency measures.*
- *Continue efforts to ensure wastes are managed throughout the Armidale Dumaresq LGA in accordance with the waste management hierarchy and the principles of the Waste Avoidance and Resource Recovery Act 2001 (WARR Act), where disposal of waste to landfill is considered to be the final waste management option.*
- *Ensure that new technologies are progressively implemented in relation to resource recovery and environmental management of the proposed landfill facility throughout its life (including both operational and rehabilitation phases).*
- *Encourage and facilitate community participation in matters relating to regional waste disposal.*
- *Operate a waste disposal facility that is sympathetic to the amenity of the area in which it is located.*
- *Ensure that the proposed landfill facility is operated so that any emissions are in accordance with environmental health regulations and guidelines stipulated within relevant local, State and Federal Government policies and legislation.*
- *Provide a rehabilitated landfill that is complimentary to the surrounding rural land use and that will not produce an adverse environmental legacy for future generations.*

These project objectives will be used to guide Council's decisions about the provision of environmental controls and management measures, throughout the life of the proposed landfill facility and are reflected within the SoC (refer **Section 9.0**).

1.3.2 Major features of the proposal

The major features of the proposal include:

- Gross air space available (i.e. the total volume available for landfilling) has been calculated to be approximately 1,056,000 m^3.
- Access to the site would be via Waterfall Way, from a point approximately 12 kilometres east of Armidale.
- An access road to the site is proposed to be constructed from Waterfall Way through the Gara Travelling Stock Route (TSR).
- Five landfill cells, each proposed to contain approximately 211,000 m^3 of waste.
- An approximate cell life of 10 years is proposed for each cell, based on an estimated filling rate of up to 15,000 tpa.
- A separate leachate barrier and leachate collection and conveyance system is proposed within each cell.
- Tertiary surface water controls including clean stormwater (perimeter) diversion drains, leachate pond, a stormwater detention pond and a dry dam of sufficient capacity to contain all surface water on site, in the event that the capacity of all other surface water controls were to be exceeded.
- Final landform designed to complement the existing topography of the area.
- Substantial revegetation of the final surface would be conducted after final capping of the landfill in order to return the site to no less than the equivalent of the current level of vegetation.
- Areas of vegetation "offset" or compensatory habitat are also proposed to be developed at a 3:1 ratio (i.e. three times more revegetated area than the area quarantined for landfilling purposes). These offset areas are proposed to protect and regenerate approximately 60 hectares of land within the overall development site. Offsets would be established across the site, generally within those areas of the site that are not proposed for the actual landfilling operations.

1.3.3 Design and Operation

The proposed landfill facility would be designed in accordance with the DECCW (formerly DECC) *Environmental Guidelines: Solid Waste Landfills, 1996* (the *Guidelines*). Council would also seek an appropriate licence from DECCW under the *POEO Act* to operate the proposed landfill facility as a landfill for "General solid waste (putrescible)" materials (formerly labelled "Solid Waste Class 1" materials).

Materials collected via Council's kerb side waste collections would continue to be sorted at the existing WTS at the Council Waste Management Centre on Long Swamp Road. The WTS sorts all materials that may feasibly be recycled and/or that should be disposed via another, more appropriate facility (including clinical waste, chemicals, batteries and discarded computer equipment, printers, and the like).

1.3.4 Land area requirements

An area of approximately 20 hectares would be required for the proposed landfill facility, including land required for the engineered sections of the landfill (landfill footprint), site buildings, leachate and surface water (stormwater) management measures and the access road from Waterfall Way. An area of approximately 61 hectares would be required for the biodiversity offset area (refer **Section 8.8.17**).

The total land area to be acquired by Council is approximately 86 hectares and is referred to as the Project Site (refer **Figure 2**). The proposed landfill facility and associated biodiversity offset area would be contained within the 86 hectare Project Site.

The proposed access road into the landfill would be approximately 1.8 kilometres long. The access road is proposed to intersect with Waterfall Way, traverse through the TSR and run parallel to the boundary fence between properties known as 'Edington' and 'Strathaven' (refer **Figure 4**). The section of access road located within the TSR is Crown Land and a licence would be sought to maintain an access easement over the TSR (refer **Section 6.2.2**).

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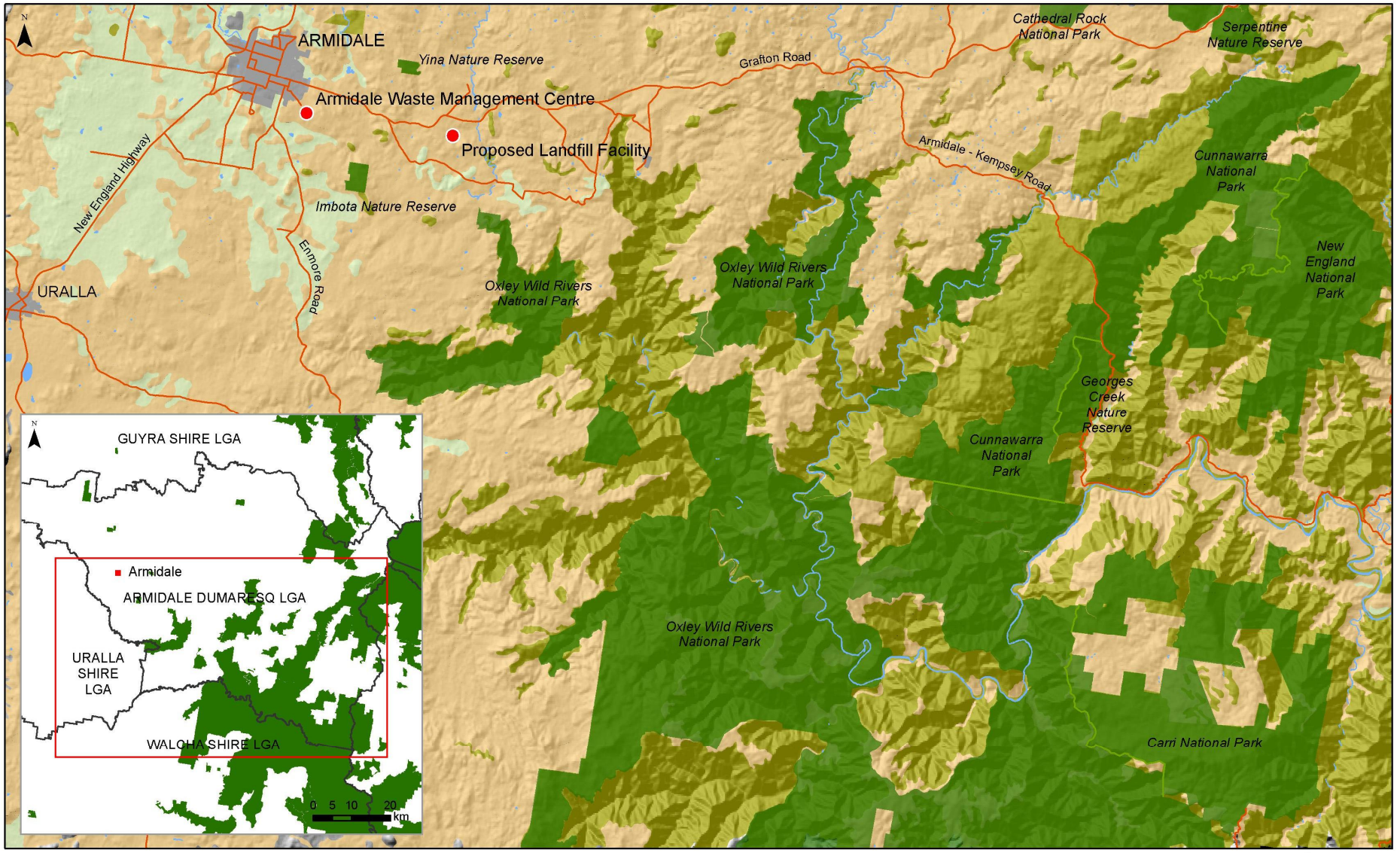

ARMIDALE DUMARESQ COUNCIL - ARMIDALE REGIONAL LANDFILL FACILITY

PROJECT SITE - REGIONAL CONTEXT

Source: Map Data (2008), Dept. of Natural Resources (2004)

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Fig. **1**

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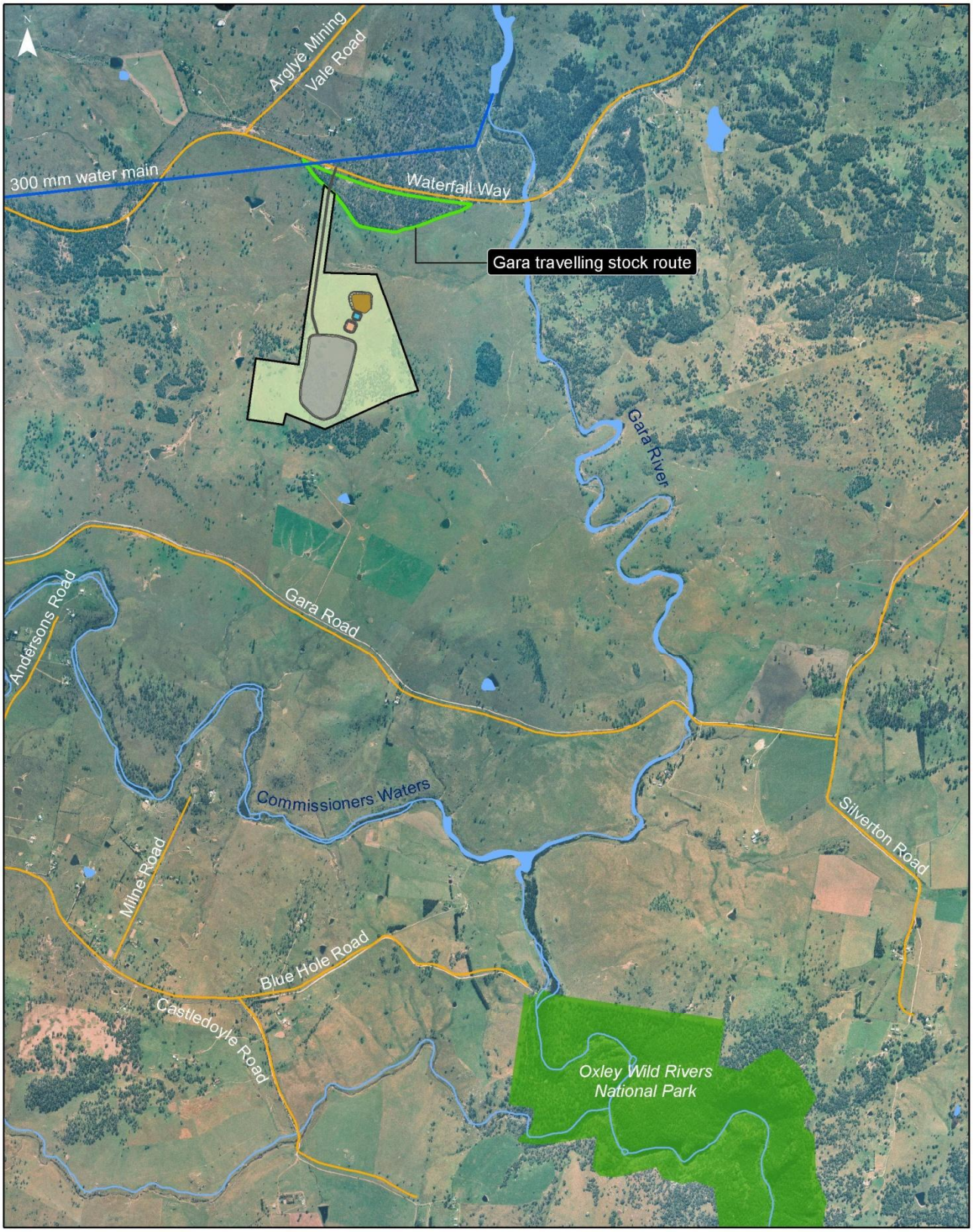

Biodiversity offset area
Landfill footprint
Leachate pond
Sedimentation basin
Dry basin
NPWS estate

Road
Travelling stock route
Permanent watercourse

ARMIDALE DUMARESQ COUNCIL - ARMIDALE REGIONAL LANDFILL FACILITY

PROJECT SITE - LOCAL CONTEXT

Source: EA Systems (2007), AECOM (2007), Map Data (2008)

0 250 500 1000 m

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Fig. **2**

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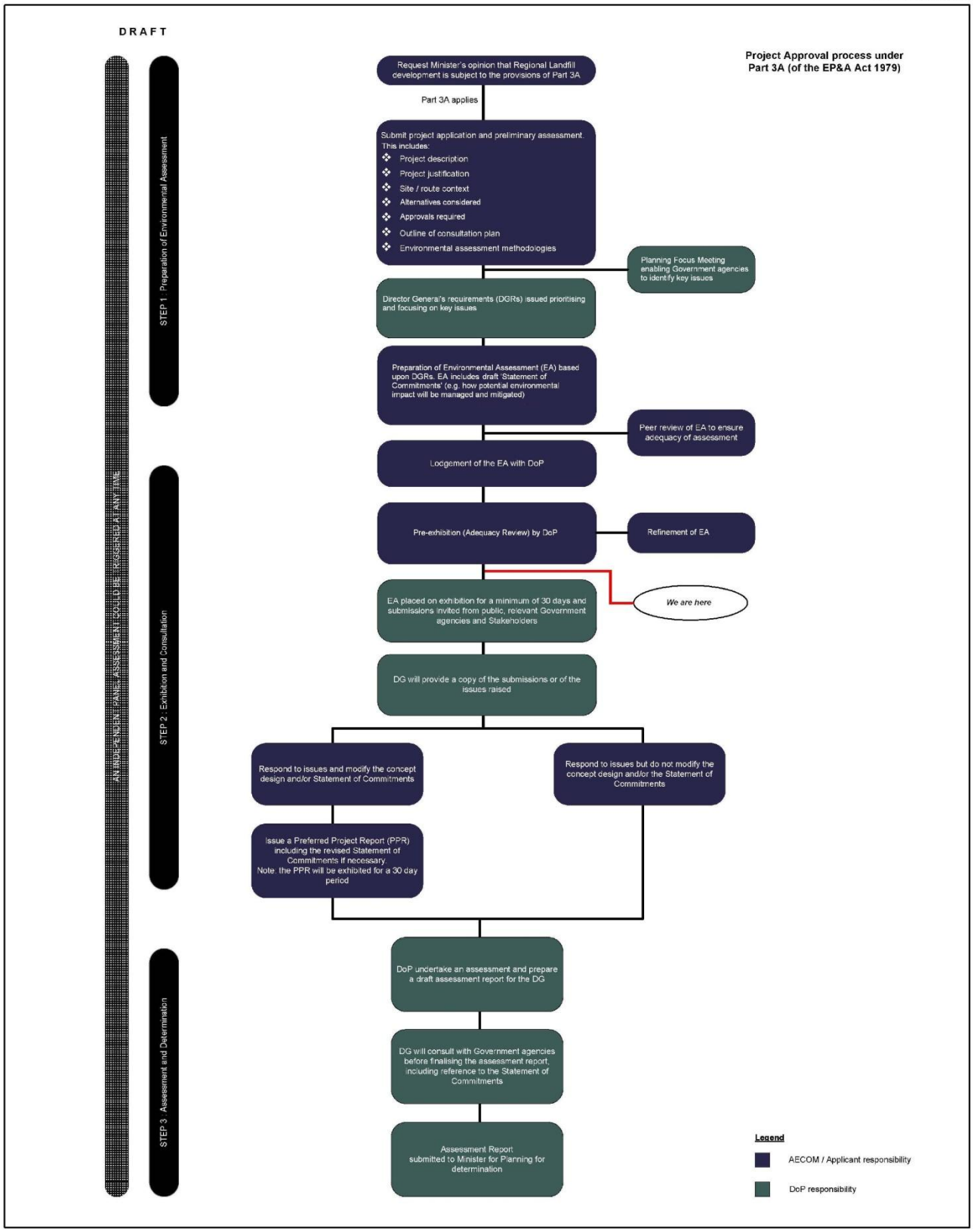

ARMIDALE DUMARESQ COUNCIL - ARMIDALE REGIONAL LANDFILL FACILITY
APPROVAL PROCESS

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Fig. **3**

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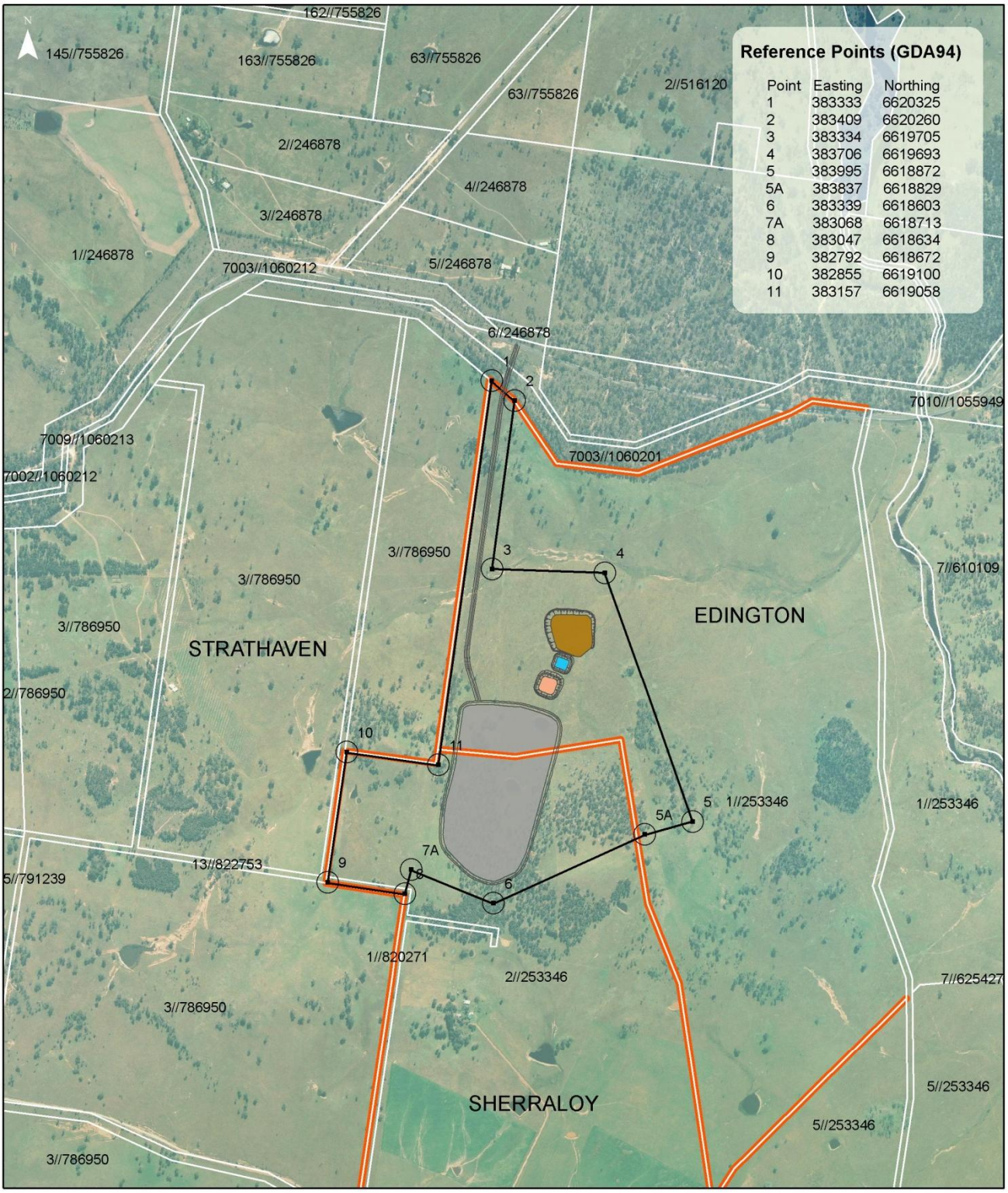
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Reference points
Biodiversity offset area
Landfill footprint
Leachate pond
Sedimentation basin
Dry basin
Relevant property boundary
ARMIDALE DUMARESQ COUNCIL - ARMIDALE REGIONAL LANDFILL FACILITY
PROPERTY BOUNDARIES
Source: EA Systems (2007), AECOM (2007), Map Data (2008)
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Fig: 4

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1.4 Site Description

1.4.1 Regional Context

The Project Site is located less than four kilometres north of the Gara Gorge, which lies on the eastern escarpment of the Northern Tablelands and is part of the Great Dividing Range. The proposed landfill facility would be located in one of several drainage depressions that form the catchment to an unnamed creek that ultimately flows into the Gara River, about 1 kilometre to the east of the Project Site.

As can be seen from the aerial photography presented in **Figure 2**, a large proportion of the land surrounding the proposed development site has been cleared for agriculture. Much of the remaining lands comprise eucalypt regrowth, or trees up to 150 years old. Past grazing practices have severely limited understorey regrowth in these areas.

Significant land uses within the wider area surrounding the Project Site include the following (refer **Figure 1**):

- Oxley Wild Rivers National Park, 4 kilometres to the south-east of the site which contains features such as Cathedral Rock and the Wollomombi Waterfall, the highest in NSW.
- Cunnawarra and Carrai National Parks are located further to the east of the site, beyond the Oxley Wild Rivers National Park.
- The towns of Armidale and Uralla located approximately 12km to the west and 25km to the south-west of the site, respectively. Armidale has a population of around 25,000 within the LGA and contains the New England Regional Art Museum and the University of New England. Uralla was established in 1851 and has a population of approximately 6,000.
- The New England Highway located just west of Armidale, linking the towns of Hexham (just north of Newcastle) and Wallangarra (on the NSW / Queensland border).

1.4.2 Site Location and surrounding areas

The Project Site is located approximately 12 kilometres east of the City of Armidale along Waterfall Way (**Figure 2**) and is within the New England Tablelands Bioregion. The site is located to the south of the Gara TSR, west of the nearby Gara River and to the north of Commissioners Waters. **Plate 1** shows the portion of the site on which the proposed landfill facility would be located and provides an indication of the area's landform and overall rural setting.

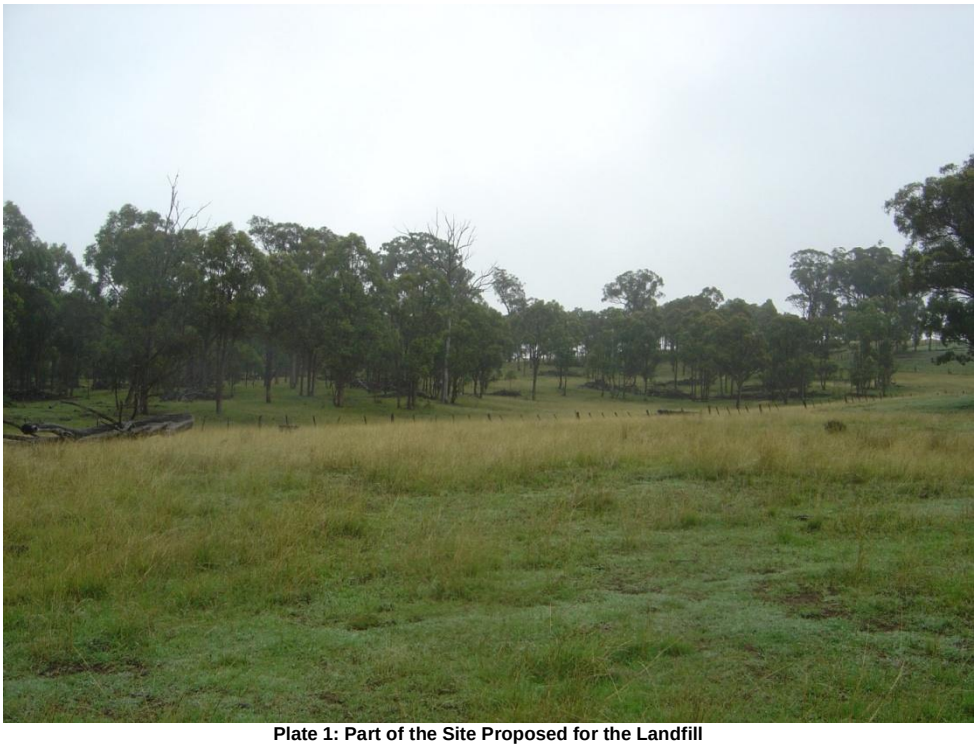


Plate 1: Part of the Site Proposed for the Landfill

1.4.3 Key attributes of the surrounding areas

Topography

The terrain that surrounds the Project Site is generally undulating. The land is at a higher elevation to the north and south and gradually slopes towards a low lying area in the middle portion of the property. This lower area is characterised by an intermittent unnamed creek that flows in an easterly direction towards the Gara River (refer **Figure 2**). From this low lying area, the land slopes up towards the higher gradients of the proposed landfill footprint. Beyond the proposed landfill footprint, to the south, the land gradually slopes towards Gara Road and to the east falls towards the Gara River.

Climate

Climate data from the Bureau of Meteorology (Armidale Airport: Station No. 562238; and University of New England: Station No. 056037). Key climate characteristics include:

- Average annual rainfall of 832 mm per annum.
- Mean monthly minimum temperature range from 0.5°C (July) to 14°C (June).
- Mean monthly maximum temperature range from 13°C (July) to 27°C (January).
- Average number of frost days is 97 per annum.

Hydrology

The Gara River flows from north to south to the east of the Project Site. The minimum distance between the Gara River and the proposed landfill footprint is approximately 1000m.

Two unnamed intermittent drainage lines flow easterly towards the Project Site from the neighbouring property Strathaven. These unnamed drainage lines flow in westerly and south-westerly directions, merging to form a single gully which passes to the north of the Project Site and then joins the Gara River northwest of the Project Site.

The Gara River catchment is a major catchment in the local area. The Gara River flows into the Macleay River, and the mid and lower reaches form part of the Oxley Wild Rivers National Park and the Gondwana Rainforests of Australia World Heritage Area. Commissioners Waters also flows into the Gara River from the east upstream of the Oxley Wild Rivers National Park.

Vegetation

Five vegetation communities have been identified within and surrounding the Project Site:

1) Stringybark woodland advanced regrowth

   This partially cleared woodland is dominated by New England stringybark regrowth. This community is common and widespread in the New England region, although endemic to the region.

2) Cleared grasslands

   This community is dominated by native grasses and is common and widespread on private land, but generally in a heavily grazed condition.

3) Sedgeland

   Sedgelands generally occupy the shallow drainage lines running through the grassland. This community is common and widespread in low-lying damp areas but on private land is generally in a heavily grazed condition.

4) Wetland (dams)

   Farm dams within and around the Project Site support an artificial assemblage of wetland plants both around the edges and in the water.

5) Box gum woodland

   Box gum woodland occurs on the Gara TSR that adjoins the northern boundary of Edington. This community is an EEC (*TSC Act* 1995) and is listed as Critically Endangered (*EPBC Act 1999*).

Fauna

The surrounding land is largely cleared and used for grazing livestock, however there are scattered fragments and patches of woodland. The wooded areas within the Project Site are utilised by a variety of birds including two species of threatened woodland birds, the Speckled Warbler (*Pyrrolaemus saggitata*) and the Diamond Firetail Finch (*Stagonopleura guttata*). A Little Eagle (*Hieraaetus morphnoides*) nest was also observed in the Stringybark Woodland.

Log piles resulting from clearing between 10 and 20 years ago provide potential habitat for ground dwelling native fauna, particularly reptiles. However, they also provide shelter for high densities of rabbits, foxes, feral cats and blackberries.

Key Site Attributes

Key attributes of the site and its surrounding areas that have influenced key aspects of the design of the landfill and its associated infrastructure requirements are as follows:

- Overall distance to the Gara River (located approximately one kilometre to the east).
- The significant distance from the Oxley Wild Rivers National Park World Heritage Area (located 4 kilometres to the south-east).
- The location of the Gara TSR. The Gara TSR is a partially protected remnant of good quality native vegetation located along Waterfall Way and the northern boundary of the Edington property.
- The nature of existing vegetation on the Project Site, providing potential habitat for various fauna species. These vegetated areas are located within the Gara TSR area and within an area to the immediate south of the Project Site.
- The proximity to existing rural residential dwellings (located within two kilometres of the Project Site, to both the west and south).

The Project Site as shown in **Figure 4** has been selected to minimise potentially adverse land use impacts, as well as severance of existing property boundaries due to either the proposed location of the landfill facility or its access corridor. For example, the route proposed to provide access to the landfill area would be aligned to run adjacent to the eastern boundary fence of the adjoining property known as 'Strathaven' in order to minimise the impacts on the existing agricultural land uses of the properties known as 'Edington' and 'Sherraloy'.

Approximately 86 hectares of land would be acquired by Council for the proposal. Of the 86 hectares, approximately 20 hectares would be occupied by the proposed landfill facility (landfill footprint, site buildings, leachate and surface water management measures and the access road from Waterfall Way) and 61 hectares would form part of a biodiversity offset area.

1.5 Land Ownership and Existing Development

The Project Site is proposed to incorporate portions of the Sherraloy and Edington properties (refer **Figure 4**). Edington is identified as Lot 1 DP 253346. Sherraloy comprises Lot 2 DP 253346 and Lot 1 DP 820271. These lots would be subdivided and appropriate portions, totalling 86 hectares, would be formally acquired by Council to facilitate the proposed landfill facility. This subdivision process forms part of Council's overall development proposal which is the subject of this EA.

Both 'Sherraloy' and 'Edington' have been previously developed as agricultural properties and are currently used as pasture land for intermittent cattle grazing. 'Sherraloy' also contains a rural residential dwelling occupied by the landowner. Council's proposed acquisition of parts of both of these properties and its subsequent use of the subject land for the proposed landfill facility, would not require significant alteration of any of the existing land uses currently being carried out within the residual portions of either property.

Seven small farm dams are also scattered across the Sherraloy property and two dams are located on the Edington property. The proposed landfill footprint and its associated buffer areas would be located on land in which two small farm dams on the Edington property are located.

Cadastral boundaries of affected properties are shown in **Figure 4**.

1.6 Land Classification

A system of five land classes is used by the former NSW Department of Primary Industries (DPI), now the Department of Industry and Investment (DII), to classify land with respect to its potential suitability for agricultural use.

The majority of the surrounding land within a two kilometre radius of the Project Site (as well as the majority of the land within the proposed landfill footprint) is classified by DII as "suitability Class 4", defined as "land suited to grazing but not cultivation. Overall level of production is comparatively low due to major environmental constraints". Class 4 land is regarded as potentially being suitable for only rain fed (i.e. not irrigated) grazing pasture.

The vegetated areas situated within the proposed landfill footprint are classified as "suitability Class 5", defined as "land not suited for agriculture or only light grazing". That is, this land would generally only be suited to support light native pasture grasses, if used for agricultural purposes.

1.7 Surrounding Development

The property known as 'Strathaven' is located immediately to the west of the Project Site. Strathaven contains an olive grove, estimated to be approximately seven hectares in area. This is believed to be the only significant "non-grazing" agricultural land use within the immediate vicinity.

Apart from the existing residence located about 410 metres south of the proposed development, within the portion of the Sherraloy property that is not proposed for acquisition for the development site, other existing land uses within a one (1) kilometre radius of the proposed landfill footprint are as follows:

- To the north of the site lies agricultural land used for sheep and cattle grazing, the TSR and Waterfall Way.
- To the south and east lies the Gara River (including a dry creek that flows from west to east through the site toward the Gara River), agricultural land used for sheep and cattle grazing, and other vegetated areas.
- To the west lies agricultural land used for sheep and cattle grazing and other vegetated areas, including the olive grove on the neighbouring Strathaven property.

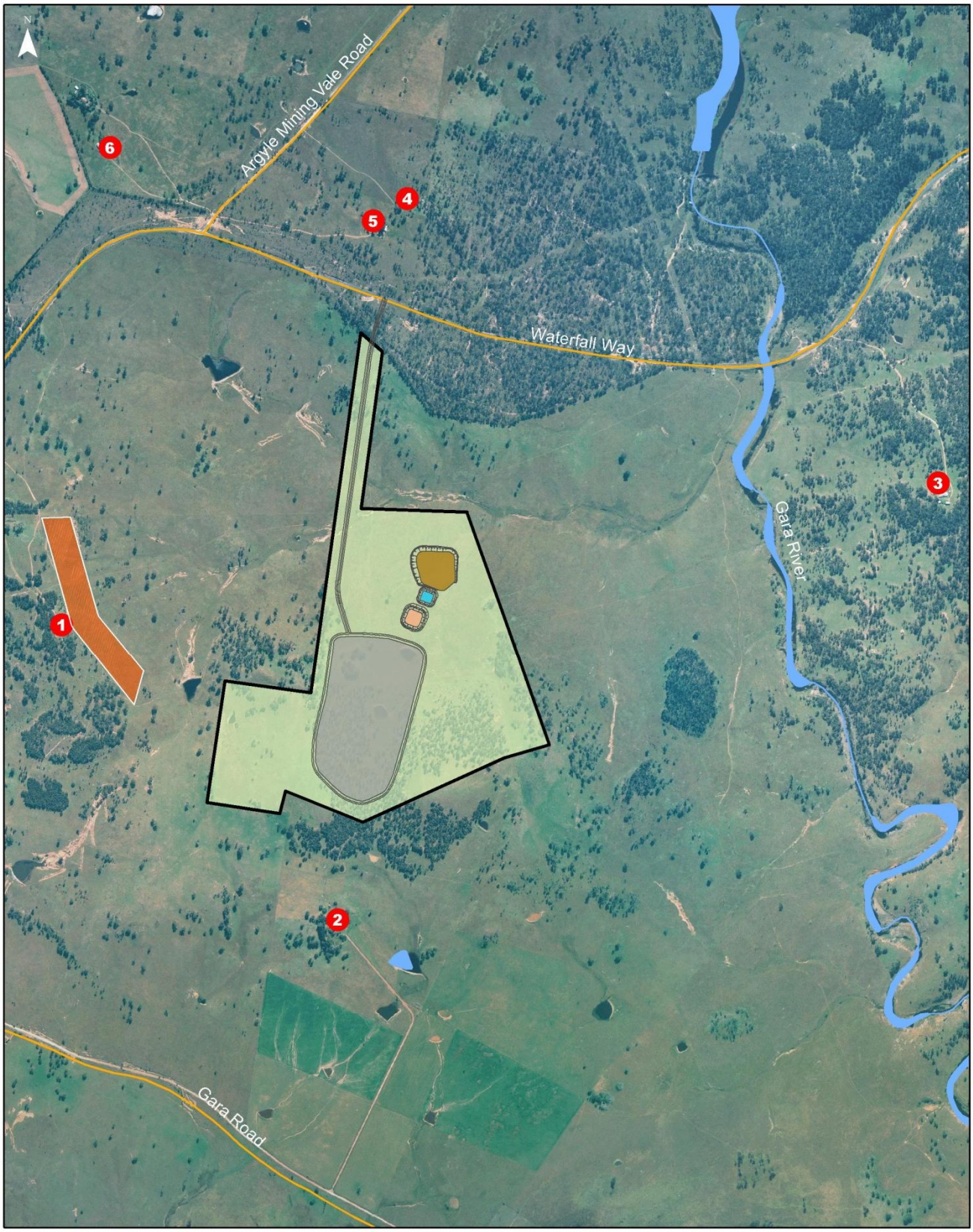
Surrounding development and sensitive receivers are shown on **Figure 5**.

1.7.1 Nearby Residential Receivers

The most significant potential receivers of any offsite impacts from the Project Site are the residential dwellings located closest to the site. The locations of all dwellings within a two kilometre radius of the site are shown on **Figure 5** and are also listed in **Table 1** (property owners' names have not been listed within this document for privacy reasons). Potential impacts to all receivers have been investigated and are discussed in **Section 8.0**.

Table 1: Residential Properties (Receivers) around the Proposed Landfill Site

	Property/Receiver Name	Address	Direction and Distance from Proposed Landfill Footprint
1	Strathaven	1060 Waterfall Way, Armidale NSW 2350	West – 950 metres
2	Sherraloy	600 Gara Road, Armidale NSW 2350	South – 410 metres
3	Riverton	1352 Waterfall Way (also known as Grafton Rd), Armidale NSW 2350	East – 1.9 kilometres
4	-	52 Argyle-Mining Vale Road, Argyle via Armidale, NSW 2350	North – 1.5 kilometres
5	-	8 Argyle-Mining Vale Road, Argyle via Armidale, NSW 2350	North – 1.4 kilometres
6	-	7 Argyle-Mining Vale Road, Argyle via Armidale, NSW 2350	Northwest – 1.9 kilometres


AECOM
N
Argyle Mining Vale Road
Waterfall Way
Gara River
Gara Road
6
4
5
3
1
2
1 Sensitive receivers
Biodiversity offset area
Landfill footprint
Leachate pond
Sedimentation basin
Dry basin
Olive grove (approximate location)
Permanent watercourse
ARMIDALE DUMARESQ COUNCIL - ARMIDALE REGIONAL LANDFILL FACILITY
LOCATION OF SENSITIVE RECEIVERS
Source: EA Systems (2007), AECOM (2007), Map Data (2008)
0 150 300 600 m
FEB 2010
60011672
Fig. 5

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1.8 Project Approval Process

1.8.1 Approvals Process to Date

The *Environmental Protection and Biodiversity Conservation Act 1999* (*EPBC Act*) governs the Commonwealth EA process and provides protection for matters of National Environmental Significance (NES), including Australia's World Heritage properties.

The *EPBC Act* defines proposals that are likely to have an impact on matters of NES as a "controlled action" and also requires a referral to be made to the Commonwealth Minister for the Department of Environment, Water, Heritage and the Arts (DEWHA) for a determination about whether the proposed action is considered to be a controlled action. In October 2007, the Minister declared that the project is a controlled action under the *EPBC Act*.

The proposed development therefore requires approval under the *EPBC Act*. Assessment requirements of the Commonwealth have been incorporated into the formal requirements of the NSW State Government. While the State process is the primary mechanism for assessment, the project will ultimately be reviewed for approval at both State and Commonwealth levels on this basis.

Further discussion regarding the planning approvals process and other legislative matters is contained in **Section 6.0**. Details of consultation undertaken with the NSW planning authorities are contained in **Section 7.0**.

1.8.2 Stages of Project Development

The preparation and submission of an EA is only one aspect of the process involved in the development of a new landfill facility. The process of identifying a suitable location for the proposed landfill facility evolved over a period of approximately 10 years. The site selection process undertaken and the evaluation of sites are detailed in **Section 4.2**.

The process involved in the development of a new landfill facility is summarised in **Table 2**.

Table 2: Project Stages and Tasks for the Development of a New Landfill

Project Stage	Tasks	Notes
Investigate Facilities at Waste Transfer Station	Additional AWT investigations	Refer to **Section 2.0**.
Consultation	PFM 09/06/2005 Receive DGRs 25/10/2005 Community consultation Consultation with authorities PFM 22/10/2008 Receive new DGRs 20/11/2008	Refer to **Section 6.0** and **7.0**.
Pre-Planning Studies	Detailed survey Preliminary hydro-geotechnical investigation Additional groundwater investigation Flora and fauna assessment - Autumn Flora and fauna assessment - Spring AECOM lodges Site Suitability findings Council confirmation to proceed	Refer to **Section 8.0** for results of pre-planning studies that have been used to assess the potential environmental impacts.
Preparation of EA	Preliminary design of landfill Detailed concept design of landfill Environmental studies undertaken EA undertaken	Refer to **Sections 5.0** and **8.0**.
Planning Approval	Submit Final EA to DoP Public exhibition (minimum 30 days) DoP determination Prepare preferred project report (if required) DoP assessment and determination	After completion of the EA.

Project Stage	Tasks	Notes
Land Valuation and Acquisition	Revaluation of land requirements for development / acquisition Negotiation with private landowner(s) Acquire land through negotiation process Alternatively undertake just terms process Acquire land through just terms process Plan registration, subdivision certificate	Subject to planning approval.
Detailed Design	Landfill Water Management (Surface Water, Leachate etc) Roads Submit detailed design of the landfill facility to Council Council to review detailed design Finalise detailed design	The EA and Planning consent will influence the detailed design to ensure potential environmental impacts are minimised and mitigated.
Environmental Licence	Preparation / finalisation of LEMP Prepare EPL application to DECCW/ EPA Council to review Submit licence application to DECCW / EPA DECCW / EPA review and prepare licence Receipt of DECCW / EPA licence	Draft LEMP has been prepared and is being considered for consistency with this EA.
Construction	Contractor procurement Construction Commissioning Handover	Construction will be undertaken in accordance with the recommendations and SoC outlined within this EA and the conditions imposed by the EPL.

1.8.3 Correlation of the EA to the LEMP

A LEMP is a documented plan that outlines procedures proposed for the environmental management, monitoring, reporting and contingency measures that should be applied for appropriate management and operation of a landfill facility. The LEMP is an important guiding document that is used by DECCW (i.e. specifically the EPA, part of DECCW) in their administration and regulation of any licensed landfill.

A draft LEMP has been prepared and will be finalised as part of the detailed design process. The draft LEMP is presented in **Appendix B** and discussed further in **Section 9.2.3.**

Environmental management measures, during both construction and operation of a landfill identified in the EA would be included in the LEMP.

1.9 Structure of this Report

This EA has been structured to present the findings of the EA and consultation processes employed so far during this project.

The EA is presented in four volumes. Volume 1 comprises the sections identified in **Table 3**. Volumes 2 to 4 comprise appendices of technical studies and supporting documentation, relevant to this EA. Due to the period of time over which this EA has been prepared, technical reports and studies have been prepared between 2005 and 2010. These studies have been accepted as supporting documents to this EA.

Table 3: Outline of Report Structure

Section	Issues Addressed
Section 1 Introduction	Provides an introduction and context for the proposal, outlines the project objectives, describes the key attributes of the proposal and presents an overview of the EA process.
Section 2 Background and Project Need	Describes the project need. This section provides information on the existing waste management facilities operated by Council and the associated need for a new landfill facility. This section also provides a rationale behind Council choosing to develop a landfill facility that would be suitable for the receipt of wastes from other regional LGAs.
Section 3 Project Justification	Provides further justification for the project and information about its significance, the consideration of other options and an overview of the benefits and potential impacts associated with the site proposed for the landfill facility.
Section 4 Review of Alternatives and Site Selection Process	Addresses the alternatives assessed relating to site selection including the 'do nothing' option. The community consultation undertaken during the site selection process is also discussed in this section.
Section 5 Project Description	Describes the project and details the concept design, construction, staging, operation, closure and rehabilitation of the landfill facility.
Section 6 Planning Framework	Describes the planning context and approval process.
Section 7 Consultation	Describes the consultation process undertaken with all key stakeholders, in accordance with the requirements of the *EP&A Act* and provides details of the issues raised during this process.
Section 8 Environmental Impact Assessment	Provides details of the environmental impacts assessment undertaken. It describes the existing environment, outlines potential environmental impacts resulting from the construction and operation of the proposed landfill facility, and presents appropriate mitigation measures to avoid or ameliorate potential impacts.
Section 9 Draft Statement of Commitments	Provides a draft SoC by Council for the project and provides details of the environmental monitoring, management and reporting process that will be undertaken.
Section 10 Residual Risk Assessment	Provides a Risk Assessment for the proposed landfill facility.
Section 11 Sustainability	Provides information on the sustainability issues and initiatives related to the proposal.
Section 12 Conclusion	Presents the key findings and conclusions of this EA.
Section 13 References	Provides a list of the reference documents used in this EA.

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2.0 Background and Project Need

This section provides information on the existing waste management facilities available to Council, the need for a new landfill and the rationale behind Council's decision to seek to develop a new landfill (i.e. with the capacity to receive wastes from other nearby LGAs).

2.1 Strategic Context

2.1.1 Regional alliances and regional context

Armidale Dumaresq Council is the proponent for the development of the proposed landfill facility which would service the Armidale-Dumaresq, Guyra, Uralla and Walcha LGAs (the former New England Strategic Alliance of Councils (NESAC). Armidale Dumaresq and Guyra Councils would deliver waste to the proposed landfill facility immediately following commissioning and Uralla and Walcha Councils would commence delivering waste as soon as existing landfills resources reach their capacity. This is expected to occur in around four years time for Uralla and about 10 to 15 years for Walcha.

2.1.2 Regional Strategies

The Northern Inland Regional Waste (NIRW) group is a voluntary local government networking group specifically developed to address waste management issues on a regional level. The NIRW Group has 13 member councils within the north-west and New England regions of NSW, including Armidale Dumaresq, Guyra Shire, Uralla Shire and Walcha Councils (NIRW, 2008).

The NIRW group develops initiatives specific to waste management, tailored to a regional and local level. NIRW waste management programmes include those relating specifically to metal waste, greenwaste, "drumMUSTER" (collection of empty chemical drums) and reduction of illegal dumping and littering impacts. The objectives of the NIRW Group are to:

- *Develop and implement regional programs that achieve a sustainable balance between the region's social, economic and environmental needs.*
- *Encourage partnerships and cooperation between member councils and external stakeholders in a collaborative approach to addressing sustainability issues for the overall benefit of the Region.*
- *Identify and investigate all opportunities for coordinated approaches in the provision of waste management services and the achievement of waste avoidance and waste minimisation within the region.*
- *Consider all waste management issues affecting member councils, where possible, and to speak as one voice in response to State and Federal Government initiatives or directives.*
- *Prevent the generation of waste and promote awareness by commerce and industry with the ideal being – what is good for commerce and industry is good for the environment.*
- *Maximise the recovery, recycling and reuse of resources from waste whilst addressing the concept of renewable energy along with a change of thinking (NIRW, 2008).*

The proposed landfill facility would service the waste management needs of several LGAs within the region, as opposed to the development of multiple, smaller scale landfills for each individual council area. The proposal is therefore considered to be a more favourable waste management solution and is consistent with the NIRW Group's third objective, to "*identify and investigate all opportunities for coordinated approaches in the provision of waste management services …"*.

2.1.3 Local Strategies

The need for a new landfill was first highlighted within the report *Waste Management Strategy for the Council of the City of Armidale* prepared by Council in June 1993. The Strategy clearly identified that "*locating, purchase and implementation of a new long-term landfill site is a very high priority*". Further, the Strategy noted that "*any new landfill site would be subject to stringent environmental regulations and ideally should be located within reasonable proximity to Armidale, but away from populated areas*".

The proposed location for the new landfill facility is consistent with this Strategy. It is located within reasonable proximity to Armidale City (i.e. approximately 12 kilometres) but also away from the more densely populated areas of the City. Only a small number of single, rural residential dwellings are located within a 2 kilometre radius of the proposed site (refer **Figure 5**).

The Armidale City and Dumaresq Shire Councils formally amalgamated on 21 February 2000. Armidale Dumaresq's current strategic goals for waste management are reflected within the amalgamated Council's 2003 *Waste Strategic Business Plan*. The purpose of the Business Plan was to develop strategies for the solid waste business in accordance with the aims of Government, Council and the Community. Council's overall strategic goals for waste management are as follows:

- *To see a continuous decline in the amount of waste generated.*
- *The recovery of resources from waste to be optimised.*
- *Residual waste left after recovering resources to be managed in the most environmentally responsible manner.*

The *Waste Strategic Business Plan 2003* documents Council's commitment to waste minimisation and to the identification of alternative methods for waste disposal. A key strategic focus in the Business Plan is to investigate and report on alternative waste processing and disposal methods (i.e. alternatives to landfilling). Council's commitment to reduce the total amount of residual waste disposed to landfill in the future is reflected in the following strategic aims:

- *Ensure maximum reuse of disposed goods.*
- *Ensure maximum recycling of recyclable materials.*
- *Establish minimum household targets for recycling.*
- *Investigate and encourage the recovery and use of materials and components from building and demolition sites.*
- *Continue to provide uniform kerbside collection containers.*

Council's commitment to resource recovery is also consistent with the NSW State Government's *Waste Avoidance and Resource Recovery Strategy 2007*. One of the key result areas in this Strategy is to increase the recovery and re-use of materials collected from the municipal waste stream from 26% in 2000 to 66% by 2014.

Council's commitment to implement a long-term resource recovery programme by diverting municipal waste from landfill is also consistent with the State Government's strategic targets.

Waste Management Committee

Council's Waste Management Committee has been active in the region since at least 1993, when it was first formed to advise on the development of a waste management strategy for the (then) Armidale City Council. Since the amalgamation of Dumaresq Council and Armidale City Council in 2000, the Waste Management Committee has continued to be active.

The Committee was established to provide advice on issues relating to waste management and minimisation including provision of adequate and appropriate services, facilities and equipment. In particular, the objectives of the Committee (Council, 2004) are to:

- *Provide recommendations relating to the Waste Management Strategy.*
- *Recommend priorities for action to be undertaken by Council in relation to waste management issues.*
- *Provide recommendations relating to the ownership financing and management of any proposed service, facility or equipment.*
- *Identify community education needs in relation to waste management matters.*
- *Provide a forum for discussion and community input to waste management issues.*
- *Identify other relevant matters.*

The Waste Management Committee currently comprises the following:

- Up to two elected representatives of Council.
- Council's Utilities Operations Manager, or other appropriate nominee(s).
- Up to six community representatives.

Membership of the Committee is reviewed after each local government election cycle (i.e. every four years), or at the time that any vacancy occurs. The Committee currently meets every month and will continue to advise Council on waste management matters and assist in the strategic oversight of Council's waste management programmes.

The Committee is also considered to be an effective forum in which the community may take part, for the purpose of providing input to decisions relating to waste management.

2.1.4 Regional Landfill

The proposed landfill facility as a regional facility, would appropriately service the waste management needs of all Armidale Dumaresq, Guyra, Uralla and Walcha councils over its lifespan. The development of a regional landfill is considered to be the most efficient waste disposal solution for this region due to the following:

- Improved economies of scale:
  - A landfill's operational and environmental cost effectiveness increases as the waste volumes entering the facility increases (per tonne of waste landfilled).
- Limited area to be impacted:
  - By having a single managed waste disposal facility, as opposed to numerous, smaller landfills.
- Ease of regulation:
  - Due to consolidation of operations within a single area, rather than at multiple sites.
- Increased environmental protection:
  - Due to conservative engineering design standards, monitoring and reporting.

2.2 Existing Waste Management

Details of the existing waste management facilities / collection services that are available within the relevant LGAs are provided in **Table 4**. It should be noted that, within this EA document, the term "waste management" also refers to the collection, sorting (into both re-usable / recyclable and residual fractions), storage, transportation and ultimate disposal of municipally collected waste materials.

The existing Armidale Waste Management Centre, on Long Swamp Road in Armidale, is the largest in the local area and comprises:

- Materials Recycling Facility (MRF) including the Resource Recovery Centre.
- Waste Transfer Station (WTS).
- Landfill (Solid Waste Class I).

The operation of the Armidale Waste Management Centre and other available waste management facilities are discussed in the following sections.

On 2 July 2007 Armidale Dumaresq Council also extended its domestic waste collection service to the rural area around Armidale which was previously serviced by private contractors, on a needs basis.

2.2.1 Landfills

Landfilling will continue to be the predominant means of residual waste disposal available to the Armidale Dumaresq, Guyra, Uralla and Walcha LGAs until new processing and disposal options can be identified and implemented. The limited capacity of existing landfills within these LGAs illustrates the need to provide a long term waste disposal solution within this region.

Council's existing landfill is located off Long Swamp Road about 4 kilometres to the south-east of the Armidale City centre, near the City's LGA boundary at the Waste Management Centre. This facility has operated since 1961 and has approximately one year of capacity available for landfilling waste.

Guyra Shire Council has already closed its main landfill facility and now only waste collected from the local areas around Tingha and Ben Lomond are diverted to Guyra Shire's two small landfills at these locations. Accordingly, most of Guyra Shire's waste is now taken to the existing Armidale Waste Management Centre. Guyra Shire Council intends, under the current proposal, to utilise the proposed landfill facility.

Uralla Shire Council landfill has capacity to accept waste for up to a further 15 years. Uralla Shire's continued use of its current site beyond approximately 2013 would require further development within an existing woodland area that is considered to be potentially environmentally sensitive and is highly likely to be considered to be part of a listed Endangered Ecological Community (EEC). Uralla Council has therefore expressed its interest in using the proposed landfill facility when the currently developed portion of its site reaches its final capacity.

Walcha Council operates a landfill facility with a predicted remaining life of approximately 15 years.

Table 4: Existing Waste Collection Services

Council	Waste Type	Receptacle and Capacity	Collection Frequency
Armidale Dumaresq	MSW (household)	140L, red lidded 'wheelie' bin	Weekly
	MSW (commercial premises and public places)	240L bins	Weekly
	Greenwaste (garden waste)	240L , green bins	Fortnightly
	Recyclables	450x350x300mm crates (with lid) for cartons, metals, plastics and glass; and 450x350x300mm crates (with lid) for clean cardboard and paper; and No maximum limit / extra fees for total number of crates that residents/businesses may utilise	Weekly (i.e. alternate fortnights for each crate)
Guyra Shire	MSW (household)	140L bins	Weekly
	MSW (public place)	Variable bins throughout the city	Weekly, or as required
	Recyclables	Various 52L crates for recyclables	Weekly
Uralla Shire	MSW (household)	55L, 120L or 240L bins	Weekly
	Recyclables	Several 52L crates for recyclables	Weekly
Walcha	MSW (household)	240L 'wheelie' bin	Weekly
	Recyclables	Several 52L crates for recyclables	Weekly

Source: Extracted from State of the Environment Report (Southern New England Tablelands Region, 2004)

2.2.2 Resource Recovery Facilities

As documented within its *Waste Strategic Business Plan 2003*, Council is committed to effectively reducing the amount of waste that requires disposal to landfill. Council's commitment is demonstrated by its existing waste management and resource recovery (i.e. recycling) activities.

Council proposes to maintain and improve its existing resource recovery services over the long term, throughout the proposed period of operation of the proposed landfill facility, including the continued operation of Council's existing WTS and all its component resource recovery operations. Armidale Dumaresq Council currently uses a 'crate-based' collection system, as it has been demonstrated that this system provides a significantly lower contamination rate than the current NSW average. This is due to Council's collection contractor being able to visually monitor and manually reject non-conforming material at the kerbside, before loading appropriate recyclable materials on to the collection truck. This system consistently allows for only about 3% rejected material. Guyra, Uralla and Walcha Councils also all currently use a similar, crate-based recyclable collection system.

Materials Recycling Facility

The Armidale Waste Management Centre already incorporates a highly efficient MRF for the separation of recyclables from the various incoming waste streams.

It should be noted, however, that Council's kerbside collected, domestic waste stream (i.e. the content of its 140 litre, red-lidded 'wheelie' bins) is not currently able to be sorted. This material currently is directed straight to landfill.

The facility uses a combination of mechanised and manual sorting / separation techniques, including various skip bins and other designated materials disposal points to enable appropriate pre-sorting of various recyclable materials from incoming waste, both by residents and by Council's MRF staff (refer **Plates 2, 3, 4** and **5**). The MRF's sorting and collection facilities are able to separate and store all the following resources / materials:

- Paper, cardboard, plastic beverage containers and packaging, glass, aluminium and steel cans which are sorted and separated via the MRF.
- "E-waste" is separated from all other waste, on delivery to the MRF. All E-waste is stockpiled for transport offsite and component breakdown and then appropriate recycling of component parts / materials.
- Other metals (including all metal auto parts) are separated into a large skip for ferrous (iron based) metals and a smaller skip for all other non-ferrous metals (for example, copper, brass or aluminium).
- Greenwaste is separated into one large skip for general garden waste, tree prunings, etc, and another large skip for all other timber. Other timber mainly consists of sawn timber from building / demolition wastes, as well as some timber from old furniture, etc. Greenwaste is mulched and made available for sale to the public or commercial operators at the transfer station.
- Concrete and other bulky masonry products are stockpiled separately for crushing for reuse as road gravels / roadbase in Council's road building / maintenance activities.
- Heavy plastics, car batteries, paints, oils and other chemicals are separated into various smaller skip bins or other specific disposal facilities.
- Mixed waste – three skips are available for general non-recyclable waste, for disposal in landfill.

Resource Recovery Centre

Council's suite of recycling facilities currently operating at the Armidale Waste Management Centre also include its "Resource Recovery Centre", comprising a second-hand shop where any re-usable / saleable goods that can be recovered from the waste stream are offered for sale, at nominal prices. The Resource Recovery Centre is operated by a contractor who is responsible for the recovery of potentially useful materials. Council staff also assist with the process of selecting potentially useful materials.

Council's MRF is monitored by a contracted community group that recycles computers and other "E-waste" materials (including all computer hardware, video display units (VDU) and other electronic equipment like printers, photocopiers and fax machines, etc). The group currently operates from facilities within the MRF building but will soon have its own separate premises.

All waste not able to be sorted into any of the above categories must then be assumed to be putrescible waste (including all the contents of its red-lidded 'wheelie bins', as discussed above). All putrescible waste is currently disposed in the existing landfill space. The proposed landfill facility on Waterfall Way would only accept this fraction of Council's total waste stream.

Council manages the transfer station operations and a contractor (Armidale Recycling Services) operates the MRF (**Plate 5**) which is also located at this site.

It should be noted that there would be no public access to the proposed landfill facility. Only a strictly limited number of Council waste transport trucks and other operational / construction vehicles would access the landfill. No recycling or other waste separation / treatment activities are proposed to occur at the proposed landfill site.

Waste Transfer Station

Former (non-licensed) landfill facilities that have been converted to WTSs operate at the following locations within Armidale Dumaresq's rural areas:

- Tilbuster.
- Ebor.
- Wollomombi.
- Hillgrove.

These smaller WTSs service Council's rural communities outside the city limits of Armidale. Receptacles for the collection of both domestic waste and recyclables are available at each transfer station. Recyclables collected weekly include paper/cardboard, steel and aluminium cans, glass and plastic bottles. Waste materials collected at these transfer stations are then routinely transported to the Armidale Waste Management Centre. It is not proposed that these separate facilities should be subject to any substantial changes, other than progressive process improvement, when and where available, within the foreseeable future.

Plate 2: Armidale Waste Management Centre Disposal Bays

Plate 3*:* Chemicals, Cooking Oil, Paints and Batteries for Recycling at the Armidale Waste Management Centre

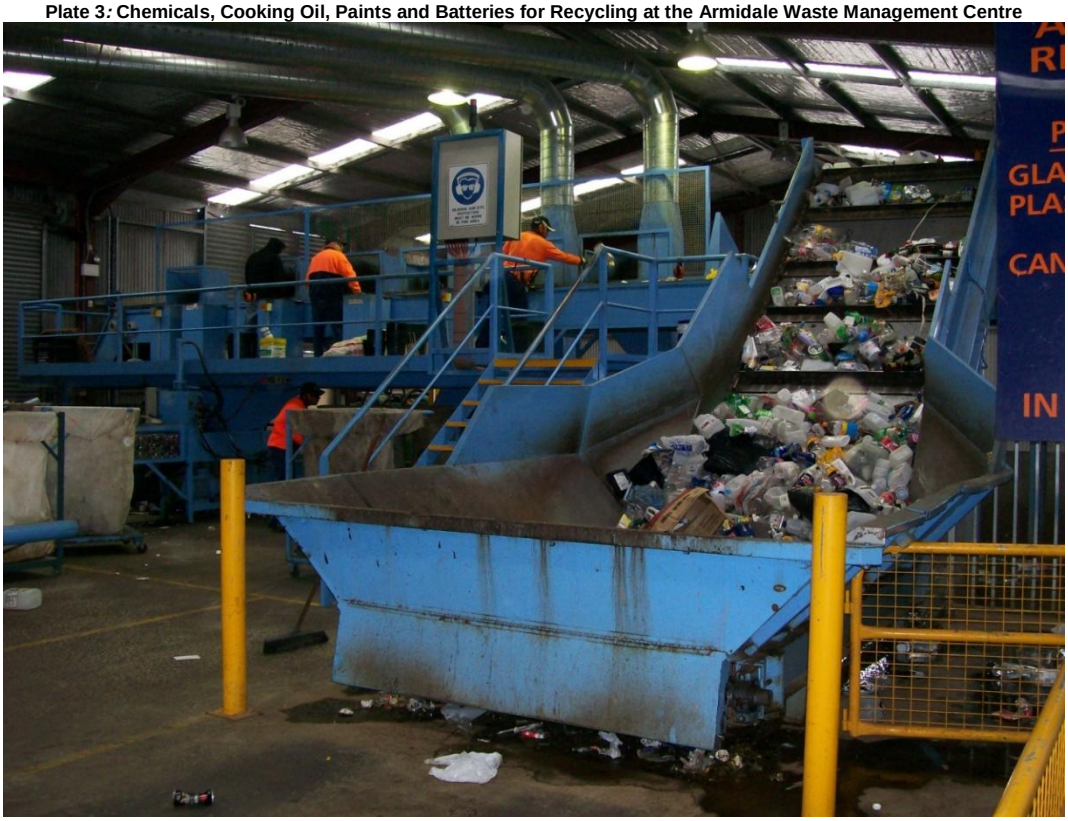

Plate 4: Sorting of Recyclable Waste at Armidale Waste Management Centre

Plate 5: Plastics and Container Recycling at the MRF, Armidale Waste Management Centre

In the future Council also intends to further process (i.e. treat) all putrescible wastes at the Waste Management Centre. This is intended to be within a proposed AWT facility, however it should be noted that any possible future establishment of an AWT facility at Waste Management Centre does not form part of this proposal. If established, it is intended that an AWT facility would employ appropriate waste treatment technology to render all putrescible wastes received into either a saleable "compost" type product or a residual waste material that would no longer be considered as "putrescible". The residual, non-putrescible waste would then be landfilled at the proposed landfill facility, in accordance with DECCW's "General solid waste (non-putrescible)" criteria.

2.2.3 Chemical Collection

The Annual NIRW Chemical Collection Campaign is conducted annually in July/August. The campaign is conducted to collect unwanted farm and household chemicals. There are various collection sites within the NIRW Member Council region. These sites are manned and operated by trained Council staff. In 2006, the following quantities of unwanted farm and household chemicals were collected during the campaign from regional councils:

- Armidale Dumaresq Council – 7,035.8 kg.
- Guyra Shire Council – 500.5 kg.
- Uralla Shire Council – 84 kg.
- Walcha Shire Council – 117.1 kg.

The drumMUSTER programme is another collection scheme run by NIRW. The programme focuses on non-returnable rigid metal and plastic containers used in the packaging of crop protection and animal health products.

Other specific collection schemes which operate within specific industries in the region include:

- Return Unwanted Medicines (RUM) programme. This is operated by pharmacies in the interest of appropriate and safe disposal of unwanted and out-of-date medicines. It is an ongoing programme.
- Silver recovery from photographic processing laboratories.
- Oil disposal and recovery from service stations.
- Potentially infectious wastes collection from medical practices.
- Independent arrangements with specialised waste service operators for waste that requires specialised treatment for disposal.

2.3 Waste Classification

The wastes to be disposed at the proposed landfill facility are classified under the DECCW's *Waste Classification Guidelines* (2008) as "General solid waste (putrescible)" materials. This classification may include any of the following waste types:

- Household waste that contains putrescible organics.
- Waste from litter bins collected by or on behalf of local councils.
- Manure and night soil.
- Disposable nappies, incontinence pads or sanitary napkins.
- Food waste.
- Animal waste.
- Grit or screenings from sewage treatment systems that have been dewatered so that the grit or screenings do not contain free liquids.
- Any mixture of the wastes referred to above.

Wastes would include household domestic waste (i.e. kerbside collections from residential areas via Council's 140 litre, red lidded 'wheelie' bins), other solid waste collected from commercial premises and municipal generated waste (e.g. local council-collected waste from street sweeping, litter bins and parks).

2.4 Waste Profile

2.4.1 Waste Volumes Directed to Landfill

The proposed landfill facility would constitute a Regional Landfill as it is proposed to service the LGAs of Armidale Dumaresq, Guyra, Uralla and Walcha, comprising a total area of 11,860 square kilometres and servicing a population of approximately 35,350. The proposed landfill facility has a total design capacity for 750,000 tonnes of putrescible waste over the proposed life span of the landfill (50 years) and would receive up to approximately 15,000 tonnes of waste per annum through existing waste collection activities.

Information about the volume of waste proposed to be landfilled by the four participating LGAs is discussed below.

The Annual Topographic Survey Map of Armidale Dumaresq's Existing Landfill for the Period of 1998 to 2005 **(survey commissioned by AECOM)**

This report provides information on waste deposited (volume basis) into the existing landfill during the subject period. An annual topographic survey was undertaken to calculate the annual volume change within the landfill mass. Overall, the average annual volume change was calculated to be approximately 24,208 m^3, including some daily waste cover, bunds, etc which are not part of the actual waste stream. It is generally considered that a fifth of the total annual volume change constitutes these "non-waste" materials (i.e. cover materials and bunding / other materials).

The Control Survey Results in the report clearly indicate that there is a trend for the relevant sector of the populations of Armidale Dumaresq and Guyra to generate a volume of approximately 20,000 m^3 of waste per annum.

Council Survey (2005 – 2008)

The most recent Council survey in relation to waste (**Table 5**) shows that from 2005 to 2008 some 124,225 m^3 (averaging 41, 408 m^3 / annum) of waste was received at the existing landfill. This represents a higher rate than the pre 2005 period, which shows an average 24, 208m^3 / annum (a total 193 663 m^3 over the period) of waste received at the landfill. This difference can be attributed in part to three major construction projects that have been undertaken in Armidale during the more recent period (2005 – 2008) resulting in significant volumes of waste being deposited into the landfill. The projects included the remediation of a gasworks site and the construction of two major shopping complexes within the town centre.

Table 5: Control Survey Waste Volumes Directed to Landfill at the Armidale Waste Management Centre (Long Swamp Road) between 1998 and 2005 and 2005 and 2008

Control Survey Results	
Date of Update Survey	**Volume Added to Landfill**
5 November 1998	22,600 m^3
25 November 1999	29,600 m^3
30 November 2000	25,904 m^3
29 November 2001	24,715 m^3
29 November 2002	23,730 m^3
30 November 2003	25,588 m^3
30 November 2004	28,978 m^3
21 August 2005	12,548 m^3
Total (1998 – 2005)	193,663 m3 (24,208 m^3 / annum)
to November 2006 (interpolated)	46,266 m^3
to November 2007 (interpolated)	46,266 m^3
30 November 2008	31,693 m^3
Total (2005 – 2008)	124,225 m3 (41,408 m^3 / annum)

2.4.2 Waste Type

Waste from within the Armidale Dumaresq, Guyra, Uralla and Walcha region can be expected to be generated from commercial, industrial, domestic and construction and demolition wastes. Domestic waste estimates and collected recyclables, for Armidale Dumaresq and Guyra councils are provided in **Table 6** and **Table 7**, respectively.

Table 6: Domestic Waste Collected 2004-2009

Waste Type	**Domestic Waste Collected (tonnes)***				
	2004-2005	**2005-2006**	**2006-2007**	**2007-2008**	**2008-2009****
General Waste	8754.5	5604.8	3420.4	3389.5	1757.3
Other Waste	12953.9	17856.9	18882.7	13623.6	12277.7
Total Waste	21718.4	23461.7	22303.1	17013.1	14035.0

Source: Armidale-Dumaresq Council

* Figures are for Armidale and Guyra only due to data availability

** Reduction in general waste due to more accurate measurement plus reclassification of certain waste. Reduction in overall total due to the completion of several major construction projects in Armidale.

Table 7: Recyclables Collected 2005-2009

Waste Type	Recyclables (tonnes)			
	2005-2006	2006-2007	2007-2008	2008-2009
Domestic*	1968.2	3167.5	3408.8	3749.8
Greenwaste	6496.4	5862.0	5256.3	3603.3
B & D Waste**	6080.7	7654.7	4913.3	4719.2
Metals	1048.3	661.7	779.1	363.8
Other Recyclables	838.1	1272.2	1868.8	569.6
Total Recyclables	16431.7	18618.1	16226.3	13005.8

Source: Armidale-Dumaresq Council

* 06/07 domestic recyclables figure is for Armidale only. All other years include Armidale and Guyra.

** Building and Demolition Waste.

The majority of waste disposed within the proposed landfill facility would comprise household domestic waste (i.e. kerb side collections) and municipal generated waste (e.g. waste from street sweeping, litter bins and parks). The waste types that may be accepted at the proposed landfill, in accordance with DECCW requirements for a General solid waste (putrescible) landfill are detailed in the draft LEMP (**Appendix B**).

It is noted that although the landfill is intended to be licensed as a general solid waste (putrescible) landfill, Council intends in the future to consider off-site waste processing technologies (AWTs) that would effectively remove the putrescible fraction from all waste received, prior to landfilling of the non-putrescible fraction.

2.4.3 Future Waste Profile

Table 8 shows that over the 2000 to 2006 period the population in the member LGAs has shown very little change. This trend is expected to continue into the foreseeable future and has therefore been assumed for the EA.

Table 8: Population 2000 - 2006

LGA	Population						
	2000	2001	2002	2003	2004	2005	2006
Armidale Dumaresq	24,944	24,807	24,780	24,657	24,558	24,611	24,533
Uralla Shire	6,019	6,099	6,076	6,021	6,031	6,075	5,989
Guyra Shire	4,430	4,475	4,484	4,453	4,434	4,460	4,402
Total	34,393	35.381	35,340	35,131	35,023	35,146	34,924

Source: ABS

Waste data has been recorded at the weighbridge at the Armidale Waste Management Centre, including all waste from domestic, Council and commercial operations. Trends over recent years show a relatively stable total volume of waste being disposed to landfill each year. Over the past two years (July 2007 to June 2009) an average of 15,500 tonnes of waste was sent to landfill each year with a pronounced downward trend in the second year as major construction projects in Armidale came to an end. Based on this data an assumed estimate of 15,000 tonnes per annum has been used as the proposed landfill tonnage for the concept design of the proposed landfill.

Future waste disposal trends are also directly dependant on the actual recycling rates achieved by each council and its residents. Armidale Dumaresq's recycling rate has increased steadily over the past 5 years and currently stands at 48.1% of total waste. It is not envisaged that these high standard recycling rates would decline within the foreseeable future. Indeed it is anticipated that these rates would improve over time.

In addition, the community's current practice of disposing of recyclable packaging via kerbside collections may also find more appropriate alternatives in the future. This would allow Council to scale back the intensity of its resource recovery activities. It is not within the scope of this EA process to attempt to more fully consider this issue, other than to state that the participating Councils are committed to waste education initiatives and have extensive recycling infrastructures in place. Councils have stated that having a new landfill facility in operation will not affect the effort they put into recycling.

2.5 Need for a new landfill

2.5.1 Extension to the Waste Management Centre landfill

On 21 July 2004, the EPA received an application from Council for the variation of its EPL No. 5860, which permits the operation of the landfill at the Waste Management Centre on Long Swamp Road. The requested variation was to extend the area of the current landfill into part of Lot 2 DP 808124 to accommodate waste volumes not greater than 20,000 tpa as the landfill was nearing capacity. Approval was subsequently granted and the EPL varied to reflect the revised capacity. Council already had development consent (DA 261/90) for the landfill at the Waste Management Centre, which was issued on 15 July 1991.

Discussions are still ongoing between Council and DECCW with a view to exploring new ways to extend the life of the existing landfill space, however, the approved extension for the landfill at the Waste Management Centre is only an interim measure to provide additional capacity until a new waste disposal facility can be constructed.

2.5.2 Demand for Landfill Space

As previously mentioned in **Section 2.2.1**, the member Councils have varied remaining capacity as outlined in **Table 9**.

Table 9: Operational Life of Existing Landfills in the Region

LGA Landfill	Approximate Operational Life Remaining
Armidale Dumaresq (Armidale Waste Management Centre)	1 year
Guyra Shire Council	Main landfill = 0 years (closed)
Uralla Shire Council	Existing = 4 years Extension* = 15 years
Walcha Council	15 years

* Uralla Shire's continued use of its current site beyond approximately 2013 would require further development within an existing woodland area that is highly likely to be considered to be part of a listed EEC.

Although Guyra Shire diverts waste to two small landfills at Tingha and Ben Lomond, most of its waste is taken to the existing Armidale Waste Management Centre. Given the remaining operational life of the landfill at the Armidale Waste Management Centre (approximately one year), a new regional landfill facility is needed to alleviate the demand and short term available capacity at Uralla and Walcha, and provide long term regional capacity.

2.5.3 Future Requirements

Whilst the region currently has three main landfills in operation, the proposed landfill facility is expected to accept a similar volume of waste to that of the existing Waste Management Centre (approximately 14,035 tonnes in 08/09).

The implementation of waste minimisation measures in the future is expected to reduce substantially the volume of waste to landfill in the region. The size of the proposed landfill facility was considered in the context of the existing and future waste profile and has been designed to accept up to an estimated 15,000 tonnes per annum of general waste, and up to 750,000 tonnes over its lifespan.

Should the proposed landfill facility be approved, the existing landfill at the Waste Management Centre would close and all waste for landfill would be diverted to the proposed landfill facility. Similarly, other existing landfills in the LGA would either consider closure prior to, or once existing capacities have been reached and divert waste to the proposed landfill facility.

3.0 Project Justification

3.1 Significance of the Proposal

The proposed landfill facility is considered to be a socially and economically significant proposal from both a local (i.e. Armidale) perspective and from a broader New England Tablelands perspective.

Current predictions suggest that the population within this region will not significantly change in the near future (**Section 2.4.3**). However, landfills in a number of neighbouring LGAs are reaching their operational capacity and the existing landfill at the Armidale Waste Management Centre is predicted to reach its final capacity in 2010. As a result, there is a need for a new landfill to be built.

3.2 Consideration of Other Options

Alternatives to the proposed landfill option are discussed in **Section 4.0** and include:

- The 'Do-nothing' option. Not finding a workable alternative to the use of the existing Long Swamp Road landfill site will result in Council having no viable local waste disposal options in less than one year's time.
- AWT technologies, including mechanical / biological technologies and/or thermal treatment.
- Landfilling (i.e. at other sites within, or outside the Armidale Dumaresq LGA).

The currently proposed location of the proposed landfill facility was identified and assessed following a comprehensive site selection process that identified 11 different sites within the former NESAC area that had potential to be developed as a landfill site (refer **Section 4.2**). The preferred "Sherraloy" option is being assessed within this EA document.

A key aspect of Council's overall waste management strategy is that the Armidale Waste Management Centre remains fully operational so that existing waste processing practices may continue to ensure the most efficient operation of any finally adopted disposal options. Council is also committed to improving its already high standard of separation, reuse and recycling rates by adopting, wherever feasible, more efficient practices and technologies at the Waste Management Centre, and/or within the wider operational areas of its NESAC partners.

3.3 Benefits and Impacts of the Proposed Landfill Site

Following is a summary of the benefits and impacts of the proposed landfill site.

3.3.1 Biophysical

The Project Site currently contains woodland vegetation that is listed as an EEC. Approximately 20 hectares of this habitat type would need to be cleared to enable construction and operation of the landfill. The access to the Project Site from Waterfall Way would traverse the Gara TSR which contains box-gum woodland vegetation community, also a listed EEC. Several threatened plant and animal species are also known to occur in these areas. Therefore, in consideration of the impact to the existing vegetation communities at this site, an appropriate offset area of compensatory vegetation/ habitat has been proposed as an integral component of this proposal. A Vegetation Management Plan (VMP) will be prepared prior to the operation stage of the proposed landfill facility. The offset area is proposed to be developed at a 3:1 ratio and would thus protect and regenerate approximately 61 hectares of other land within the boundaries of the overall Project Site. The proposed compensatory habitat would surround the proposed landfill footprint, connect to the Gara TSR and would remain connected to existing habitat corridors in order to promote biodiversity on a regional scale. Active programmes to eradicate introduced predators and other feral and pest species within the total offset area would help to ensure that the site does not act as a source population for any of these species, which would otherwise result in impacts to far broader areas than currently is the case.

Measures proposed to minimise erosion and sedimentation, retain all potentially contaminated water and leachate on site and prevent groundwater contamination would ensure that downstream water quality would not be significantly impacted by the proposed landfill facility.

3.3.2 Economic

Two permanent jobs would be created during the operational phase and up to 15 other short term employment opportunities during the construction phase.

The option of transporting waste from a city of 25,000 people (Armidale Region) to another regional landfill site (Tamworth or Coffs Harbour) over 100 kilometres away is deemed uneconomical and would be subject to the cities of Tamworth and Coffs Harbour favourably accepting waste from another region. The added cost to the local ratepayer could also be significant.

3.3.3 Social

Two residences near the proposed landfill facility would be potentially affected by the proposal. However noise, dust and odour modelling shows the proposed landfill facility would have minimal impact on these residents. Similarly, the visual assessment indicates that the proposal would not have a significant impact on the visual amenity of the local area (refer to **Section 8.0** for a detailed assessment of all potential impacts of the proposed development).

3.4 Sustainability

This proposal is considered to address the principles of ESD as it:

- Meets the objectives and goals established within relevant State, regional and/or local waste minimisation or management strategies.
- Demonstrates economic efficiency in meeting short and long term community requirements for waste minimisation and management.
- Meets relevant environmental performance requirements, including improved conservation or protection of natural resources in conjunction with reduced environmental costs.

3.5 Conclusion

The proposed landfill facility is considered to be fully justified due to:

- A genuine need for a landfill site in the region.
- Long-term biophysical benefits arising from the project.
- Relatively minor social or economic impacts.
- Compliance with the criteria for sustainability.

4.0 Review of Alternatives and Site Selection Process

This section provides a summary of the review of a number of alternatives to landfilling as well as a summary of the site selection process that determined the finally proposed site location. A review of the preliminary studies undertaken to confirm the site's suitability is also provided.

4.1 Review of Alternatives to Landfilling

As previously mentioned in **Section 2.5.1,** the approved landfill extension for the Waste Management Centre at Long Swamp Road is only an interim measure to provide additional capacity until a new landfill facility can be constructed. Another extension to the existing site would not provide adequate capacity to accommodate future regional demand, and has hence not been considered as a feasible alternative to the project.

4.1.1 Identification of Alternatives

Workshop

A review of potentially feasible alternatives to landfill was conducted by Council in 2002, at the same time as the site selection investigations were also being conducted (refer **Section 4.2**). This review was completed as part of a Council workshop process, the outcomes of which were presented in a discussion paper entitled *Council Workshop Strategy for Obtaining a Site for a New Regional Landfill* (Armidale Dumaresq Council, February 2002).

The discussion paper identifies four alternatives to landfilling. These are listed in **Table 10** and are commonly known, established technologies. A summary of the advantages and disadvantages associated with each of these alternatives is also presented within **Table 10**.

The initial review concluded that it:

> *"would appear there was not a known and readily available alternate process for treating Armidale's waste and a suitable landfill should be pursued immediately."*

Council remains committed to minimising the total amount of waste directed to landfill. Further investigations into alternatives to landfilling were more recently carried out, however it is believed that notwithstanding new technologies and a commitment to recycling and reuse, there would always be residual waste that would require final disposal as landfill.

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Table 10: Review of Alternatives to Landfill, 2002

Company	Description	Advantages/Disadvantages
Bedminster Digester	A mechanical (rolling drum) composting process, which receives household waste and in 10 to 14 continuous processes converts the garbage to a useable compost and an inert residue of about 20% of initial material by weight.	Overriding disadvantage is the capital and ongoing operating costs. Indicative costs provided (2002) would be in the order of $10M capital and ongoing operating and energy costs, together with the need for a smaller landfill for inert material.
WTT B.V Holland	A cellular composting process whereby individual concrete cells are loaded and allowed to "cook" for 14 days. The cells are then mechanically unloaded and sieved to provide compost and inert material.	Due to construction costs, it was thought to be uneconomical by the company for the relatively small quantities to be processed by Armidale (and surrounding councils).
Eco Waste Pty Ltd in association with Brandown Pty Ltd	Process where existing landfills are re-excavated in cells approximately eight to ten years after deposition and covering. It is anticipated that the putrescible wastes would have composted naturally in that time and be recoverable as a composting material, leaving only inert material. The excavated waste would 'free up' around 80% of the volume to enable re-deposition of new waste.	Tests were carried out in older areas of the landfill at Armidale Waste Management Centre (Long Swamp Road). It was found however that the material excavated was not suitable as a compostable material, as it was still very moist and odorous.
VCU Technology Pty Ltd	Vertical Composting Unit (VCU).	Advantage – The VCU can be installed in a very small area and hence has a small footprint. There could therefore be a possibility to install the VCU at/or adjacent to the landfill site at the Armidale Waste Management Centre. Disadvantage – the process is only suitable for compostable material, and not municipal putrescible waste material. The process would also require manual up front sorting, to remove plastics, tin and glass from the municipal waste stream before it could enter the VCU.

Source: Council Discussion Paper, February 2002

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Business Plan

Council has documented its commitment to waste minimisation and to pursuing alternative waste disposal methods within its *Waste Strategic Business Plan 2003* for waste management. A key strategic focus of Council's Business Plan is to investigate and report on alternative waste processing and disposal methods (i.e. alternatives to landfilling). As documented within the Business Plan, Council's commitment to reduce the amount of residual waste disposed to landfill, over the long term, is to be achieved through the following strategic actions:

- *Ensure maximum reuse of disposed goods.*
- *Ensure maximum recycling of recyclable materials.*
- *Establish minimum household targets for recycling.*
- *Investigate and encourage the recovery and use of materials and components from building and demolition sites.*
- *Continue to provide uniform kerbside collection containers.*

Council's commitment to resource recovery is consistent with the NSW government's *Waste Avoidance and Resource Recovery Strategy 2007* (Waste Strategy). One of the key result areas in the Waste Strategy is to increase recovery and use of materials from the municipal waste stream from 26% in 2000 to 66% in 2014. Council's commitment to implement a long-term resource recovery programme by diverting municipal waste from landfill is consistent with these targets. Council is also committed to developing progressively stringent annual targets that would be compatible, at a local level, with current government policy targets for waste reduction and recycling.

Waste Management Committee

The Waste Management Committee is considered to be an important forum to enable discussion, deliberation and the formulation of appropriate recommendations to Council with respect to emerging technologies and/or improved methodologies that may result in alternatives to landfill, for example the diversion of waste to landfill. The Waste Management Committee has coordinated and conducted site visits of waste management facilities in the region, with an aim being to enable a better understanding for Council of the processing of putrescible wastes to form compostable material.

Site Visits

Representatives from Council, including the Mayor, in conjunction with the advisory Waste Management Committee have undertaken site visits of existing waste management facilities. The purpose of these site visits was to understand alternatives to landfilling and to see them in practice.

A tour was undertaken around January 2005 to waste management facilities located at Grafton, Coffs Harbour, Port Macquarie and Port Stephens that were utilising state of the art processing techniques. The purpose of the tour was to understand how other Councils around the Council regions manage their waste. It was acknowledged that the other regional councils had populations larger than Council. The commitment and intent to reduce waste to landfill was evident in the waste management facilities and how they were run. Council acknowledged during the tour, the possibility of drawing on the latest waste technology similar to that inspected and adapting it to local conditions.

Expression of Interest

Council proposed to explore the options of adding a process to enable the removal of organics and putrescibles from the waste stream and produce a useful saleable product.

In April 2005, Council called for Expressions of Interest (EOI) to conduct trials of equipment and processes that would enable Council to operate its proposed landfill as a "non-putrescible" landfill (i.e. in order to accept only "inert" or non-putrescible waste). EOIs were called to conduct trials for a 12 month period at the existing landfill at the Armidale Waste Management Centre. EOIs were received from the following companies:

- Coastplan Consulting.
- WSN Environmental Solutions.
- Spartel Pty Ltd.
- Cleanaway Pty Ltd.

- EWT Pty Ltd.
- Biomass Solutions Pty Ltd.
- SITA Environmental.

Council concluded that the cost to Council to conduct a suitable trial of any of the proposed processes would be prohibitive. From the submitted EOI's, the "Gore Cover" process seemed to be the most potentially attractive offer to Council. The Gore Cover system uses a hi-tech composting process to de-compose a high quality greenwaste feed. A site visit was conducted in October 2005 to observe the Gore Cover system in operation at a trial at premises of Camden Soil Mix. Council decided to defer conducting its own trials, pending the results and evaluation of the Gore Cover trial near Camden.

4.1.2 Do Nothing Option

Although alternative methods of waste management, such as minimising waste, waste recovery and recycling of materials will reduce the overall volume of waste needing to be disposed of as landfill, within the foreseeable future there remains a need to dispose of the residual waste to landfill. Some alternatives to landfill such as incineration have been used in the past and continue to be in other locations (almost exclusively overseas), where the identification of usable landfill space is not possible. Incineration of residual waste, even with the use of some of the best technologies in the world, is not considered to be either economically feasible or acceptable in terms of potential impacts to the environment in this location.

Regardless of technology, within the foreseeable future there will always be residual waste that will require disposal in an environmentally and economically acceptable manner. If the proposed landfill facility is not ultimately approved to operate, it is envisaged that some of the consequences would include the following:

- Deviation away from Council's *Waste Strategic Business Plan 2003*. The Plan has developed strategies for the solid waste management in accordance with the aims of Government, Council, and Community.
- A lost opportunity to provide a regional landfill, taking into consideration the benefits that a regional landfill can provide.
- A requirement to find an alternative waste disposal method for both Armidale Dumaresq and Guyra Shire.
- Economic cost of transporting waste outside the Region probably to Tamworth or Coffs Harbour.
- Loss of employment opportunities.
- Loss of the security of a long term disposal solution.

4.1.3 Additional Studies into Alternative Waste Technology

As noted previously, Council is committed to reducing waste to landfill through the application of Alternative Waste Technology (AWT). AWT refers to technologies such as Mechanical Biological Technologies (MBT), thermal treatment or a combination of both MBT and thermal treatment. Council has demonstrated its commitment via its active pursuit of AWT processes over a number of years.

Council requires that during its investigation and preliminary design processes for the proposed landfill facility, all practical options for additional waste processing and separation facilities that may be available in the marketplace are identified and their feasibility assessed for incorporation at the Armidale Waste Management Centre.

4.1.4 Transport to another Landfill

If the proposed landfill facility did not proceed, it is probable that waste from the region would be disposed of to either Tamworth or Coffs Harbour, these being the closest, potentially available landfills. Any proposal that involves landfilling Armidale / Guyra waste at either the Uralla Shire or Walcha Shire facilities is not considered to be viable as both facilities are quite small, non-standard landfills with a very limited operational life. Should the proposed landfill facility not be situated in the (former) NESAC region the implications would include the following:

- Greater haulage costs from Armidale.
- Greater environmental and social impacts of transporting regional waste to another region.
- Decreased landfill life of surrounding regional landfills.
- A still unresolved need to provide a long-term waste disposal solution for the region.

Considering the above, transporting waste to another landfill is not considered to be a practical option.

4.2 Alternative Site Assessment

4.2.1 Landfill Siting Studies

A site selection process was undertaken since the mid 1990's which identified a total of over 50 sites for investigation. The site selection process was based on:

- Consultation with Real Estate agents regarding availability for sale of appropriate sites.
- Consultation with the Department of Mineral Resources regarding the availability of current and former extractive industry sites.
- Consideration of sites within appropriate geological areas.

A summary of the site identification and selection process that has been undertaken is as follows:

- 1996 – Preliminary Regional Landfill Siting Study produced by Brian J Mackney & Associates Pty Ltd. Mackney & Associates' report aimed to reduce the areas under consideration for the siting of the proposed landfill by eliminating unsuitable areas and identifying key selection criteria in order to focus on specific areas of maximum potential. The study sought initially to eliminate various unsuitable areas and to then identify key selection criteria in order to focus on areas of maximum potential. The report concluded that site geology and hydrogeology were the key factors that should influence the selection of any site for a landfill facility within this region of northern NSW.
- 1996-1998 – Following consultation with local real estate agents from 1996 to 1998 regarding the actual availability of potentially suitable lands, seven sites were identified as being consistent with the recommended geological criteria and hence were noted as potentially suitable landfill sites.
- 1998 – The Joint Councils Regional Landfill Advisory Committee was formed between (the former) Armidale City and Dumaresq Shire Councils, with support from Uralla Shire Council. The Committee considered and eventually decided against a number of landfill site options, based on the preliminary assessment studies conducted to date.
- February 2001 – The amalgamation of Armidale City and Dumaresq Shire Councils resulting in the formation of Armidale Dumaresq Council and the disbanding of the Joint Councils Regional Landfill Advisory Committee.
- June 2002 – A Landfill Siting Study by the NSW Department of Public Works, using aerial photography identified two additional sites. Based on the study, a property "Ballantrae", off Miningvale Road was recommended as the preferred site.
- Early 2003 – Following objections and debate on the selection of "Ballantrae" as the preferred site, Council endorsed the formation of the Armidale Dumaresq Landfill Community Consultative Committee (ADLCCC). The Committee was formed to consider the issues relevant to the siting of a landfill as well as other waste issues. The Committee contributed to the development of selection criteria and weightings for the site evaluation process that were then used within a subsequent report entitled Regional Landfill Siting Study (Maunsell Australia, March 2004).
- 2003 – A review was undertaken by Maunsell of various site selection studies. A report was produced entitled Review of Criteria and Strategy Used for Locating Sites for a Regional Landfill Report (Maunsell Australia, September 2003).
- 2004 – Maunsell in its report entitled *Regional Landfill Siting Study* (Maunsell Australia, March 2004) (**Appendix C**) evaluated eleven sites, including the original nine previously investigated, a new site, known as Site 10 that was then being offered for sale and also another "site" that combined Sites 3 and 4 (see **Table 11**). The report recommended that Site 7 (Sherraloy) was the most suitable site for a new landfill and includes details of all 11 sites that were evaluated (see **Appendix C**). Initially only 10 sites were evaluated however "site 4A", a combination of Sites 3 and 4, was also considered in the final evaluation.
- 2004 – Final Site Selection – Council and ADLCCC adopted a recommendation that Site 7 (referred to below as 'Sherraloy', but actually encompassing portions of two separate farmland properties, 'Sherraloy' and 'Edington') as the preferred site for the proposed landfill. Site 7 is the subject of this EA. ADLCCC then disbanded, as its primary purpose was to conduct and conclude the above site selection process.

Table 11: Sites Selected for Site Evaluation (Final Stage)

Site Number*	How Selected	Site Area	Development Area
Site 1: 'Metz'	An existing basalt quarry and mining area	14.41 hectares	14.41 hectares available
Site 2: 'Bannaweera'	Farmland. Disused Basalt Quarry south of the site	761.2 hectares	100 hectares required plus an additional 1.5 hectares for road access
Site 3: 'Tillbuster West'	Directly adjoins the southern boundary of Site 4	231.7 hectares	Approximately 100 hectares required plus 2.0 hectares for road access
Site 4: 'Annaleey'	Directly adjoins the boundary of Site 4	644.6 hectares	Approximately 100 hectares required plus 2 hectares for road access
Site 4a: 'Annaleey' and 'Tillbuster West'	Directly adjoins the boundary of Site 4	876.3 hectares; (225 hectares for sale plus negotiable land area required from 'Annaleey'	Approximately 100 hectares required
Site 5: 'East Mihi'	Farmland	463.2 hectares	Approximately 100 hectares required
Site 6: 'Pinaroo'	Farmland property	474.7 hectares	Approximately 100 hectares required
Site 7: 'Sherraloy'	Encompassing parts of two farmland properties (i.e. 'Sherraloy' & 'Edington')	467.9 Hectares (total area)	Total site area of approximately 100 hectares required
Site 8: 'Waioma'	Farmland, two properties available	169.6 hectares	Approximately 100 hectares required plus 6.0 hectares for access road (if required)
Site 9: 'Miningvale Road'	Farmland	555.3 hectares (236 hectares for sale-site recently divided)	Approximately 100 hectares required plus 8.0 hectares for access road (if required)
Site 10: 'Greenhill'	Farmland	Not identified in report	100 hectares required

* As identified in the report Regional Landfill Siting Study (Maunsell Australia, March 2004)

4.2.2 Site Selection Process

The document *Landfilling – EIS Guidelines* (DUAP, September 1996) states that the principles relating to the site selection for landfill site proposals must give consideration as to whether:

- The location has been identified in any strategic waste management plan.
- The land use is permissible.
- Environmentally sensitive areas are avoided.
- The use is compatible with nearby land uses.

These principles were used to develop appropriate criteria and weightings for the assessment of the potential landfill sites identified. For each of the primary criteria, a number of sub-criteria were discussed, with potentially measurable critiques.

The *Regional Landfill Siting Study* (Maunsell Australia, March 2004) in **Appendix C** provides detail of the site selection process.

The study involved a desktop review of the 11 sites, including a review of the following information sources:

- Available existing site investigations and evaluations.
- Relevant LEP zoning plans for the site and surrounding land.
- Topographic maps.
- Geological maps.
- Groundwater maps / existing bore information.
- Other relevant and available information.

Information that assisted with the evaluation against the site selection sub-criteria (refer **Appendix C**) was noted and recorded for weighting and evaluation purposes. Field inspections and local consultation (where possible) were undertaken for each site in order to determine any local site issues that were not evident from the desktop study.

Assessment Criteria

Table 12 outlines the criteria and sub-criteria used to assess the 11 potential landfill sites as identified in **Appendix C**.

Table 12: Assessment Criteria for Potential Landfill Sites

Primary Selection Criteria	Sub-Criteria	
Strategic Planning Guidelines	EPA Guidelines	DUAP Guidelines
Statutory Planning Issues	Council Zoning Aims and Objectives	SEPPs Other Constraints
Ground and Surface Water Environment	Regional Geology Local Geology Hydrology/Groundwater Land Capability Leachate Control	Flooding Surface Water Control Erosion Protection Distance from Waterways
Level of Service	Distance to Areas Serviced Required Land Area Level of Site Access	Needs of Processing, Handling, Recycling Level of Existing Road Service Bush Fire Hazard
Adequacy of Service	Infrastructure	
Local Amenity and Environmental Considerations	Visual Amenity Flora and Fauna Land Environment Land Compatibility Noise	Orientation Atmospheric Protection Landfill Gas Control
Site Features Required	Topography/Terrain	Capacity To Accept Defined Waste
Set-up Costs	Land Area Requirement Land Cost	Infrastructure Costs Leachate Control
Operational Costs	Compaction Transfer Operations	Operation and Maintenance

Primary Selection Criteria	Sub-Criteria	
Social Issues	Regional Economy Sensitive Land uses Land Values Tourism	Agriculture Future Development Heritage

Source: *Regional Landfill Siting Study* (Maunsell Australia, March 2004)

Weightings

The relative importance of each primary criteria was "weighted" (i.e. prioritised) using a 1-10 scale, ranging from "relevant" (assigned a weighting of 1) to "essential" (assigned a weighting of 10). The weightings assigned to each of the primary criteria are shown in **Table 13**.

Table 13: Primary Criteria Weightings

Primary Selection Criteria	Weighting
Strategic Planning Guidelines	1
Statutory Planning Issues	10
Ground and Surface Water Environment	10
Level of Service	10
Adequacy of Service	4
Local Amenity and Environmental Considerations	6
Site Features Required	4
Set-up Costs	4
Operational Costs	6
Social Issues	4

Source: Regional Landfill Siting Study (Maunsell Australia, March 2004).

The weightings were determined during the review conducted of the *Preliminary Regional Landfill Siting Study* (Mackney & Associates, 1996), as discussed in Maunsell AECOM's report entitled Review *of Criteria and Strategy Used for Locating Sites for a Regional Landfill Report* (September, 2003) and as reviewed by Council at that time, in consultation with the ADLCCC. Weightings were also adjusted as a result of this consultation. The final weightings adopted in the site selection process are as per **Table 13**.

Evaluation and Results

In evaluating the sites, each of the primary selection criteria was assessed in terms of the sub-criteria and assigned a relative ranking using a 1-10 scale, ranging from 'poor' (assigned as 1) to 'ideal' (assigned as 10). The ranking for site suitability was assigned according to the scale shown in **Table 14**.

Table 14: Ranking for Site Suitability

Ranking	Importance
10	Ideal
9	
8	Very Good
7	
6	Good
5	
4	
3	Fair

Ranking	Importance
2	
1	Poor

The evaluation of each site involved multiplying the relative primary criteria weighting against the site suitability ranking in a site evaluation matrix (refer to **Appendix C** for further detail). The total of these values for all of the criteria becomes the score for that site. Therefore the highest possible score a site can obtain is 590, while the lowest possible score is 59.

Results of the evaluation process are presented in **Table 15**.

Table 15: Site Selection Assessment Results

Primary Criteria	Evaluation Score	Comparative Suitability Ranking
Site 7 – Sherraloy	372	1
Site 4A (Site 3& 4 combined)	340	2
Site 8 – Waioma	328	3
Site 9 - Miningvale Road	322	4
Site 2 – Bannaweera	304	5
Site 4 – Tillbuster	292	6
Site 1 - Metz Quarry	278	7
Site 3 – Annaleey	272	8
Site 5 - East Mihi	266	=9
Site 6 – Pinaroo	266	=9
Site 10[1] – Greenhill	0	NA

([1]) The Regional Landfill Siting Study (Maunsell Australia, March 2004) stipulated that while the majority of the "Site 10" property is zoned General Rural 1(a), much of the land area that is potentially suitable for landfilling (i.e. within an area of natural depression) is likely to be located within the Arterial Road Corridor zoned Rural 1(2), covering a 400 metre wide corridor where "landfilling" is a prohibited activity. The Study notes that even if the landfill was designed to avoid the prohibited (road corridor) area, vehicular access from the highway and the proximity to a watercourse would then become "potentially restrictive issues." The report recommends that "this evaluation and site (should) not be pursued due to the potentially prohibitive zoning" without further considering the more detailed selection criteria process undertaken for all other sites.

Using the adopted criteria and weightings, Site 7 was recommended to be the most suitable site for a future landfill facility due to the following advantages:

- The site was not included in any areas deemed sensitive or unsuitable by *Strategic Planning Guidelines*.
- The site was located within a preferable geological area.
- Underlying metasediments should provide an adequate barrier to groundwater movement through the site.
- Site topography and local geology appears to lend itself well to long term control and monitoring of leachate.
- Views are generally protected from surrounding land towards the west, south and east by existing vegetation, with partially inhibited views towards the north.
- Use as landfill should not impact on surrounding land use provided the landfill is managed correctly and adequate buffer distances are maintained.
- Relatively low bush fire hazard exists as the area is largely clear of vegetation.
- Haulage costs amongst the lowest of the sites evaluated due to shorter distances to areas serviced (taking into account average haulage levels) and good quality road access.

It should be noted that the site assessment was undertaken with the intention that there was no predetermined threshold within the score-line that would indicate an 'ideal' site or a 'poor' site. For example, a site that may score 450 does not necessarily represent an 'ideal' location for the siting of a landfill, however it was considered to be a more suitable site than those that score lower. In this regard, the site with the highest overall score was noted to be the 'preferred' site, relative to the other sites included in the evaluation.

4.2.3 Further site suitability assessment and justification

In addition to the above, initial outcomes of geotechnical investigation carried out by E.A. Systems Pty Limited indicated that soil and groundwater conditions at Sherraloy would be suitable for the siting of a landfill. More detailed findings of the Hydro-geotechnical Investigation and Flora and Fauna Studies are summarised in **Section 8.0**, and **Appendix D** and **Appendix E**, respectively.

Armidale, including LGA as well as most of the township of Guyra are located within the catchment of the World Heritage Area, Oxley Wild Rivers National Park. All sites investigated therefore also fall within this catchment. Hydro-geotechnical investigations undertaken for Site 7 (**Appendix D**) conclude that the landfill void is unlikely to encounter any groundwater or subsurface flows.

Potential sites outside the Gara River catchment were investigated in both Dumaresq Shire and Uralla Shire as part of the study. However these sites were not considered feasible due to poor ratings on significant criteria such as suitable geology and ground and surface water environment, as they drain to more highly stressed inland river systems.

4.2.4 Consultation

The site selection process and community consultation occurred simultaneously. For effective ownership of any future landfill site by the community, the process by which the site is selected should involve the people who have to live with and by it. As such, the community consultation process was an important part of both setting site selection criteria and in evaluating sites against these criteria.

A public meeting was held at the Council Town Hall on the 29 January 2003, to discuss the proposed landfill facility. More than 150 local people attended the meeting. During the meeting, Council's General Manager outlined the background, future processes and mechanisms that would be used as the project proceeded. It was concluded at the public meeting that a community consultative committee (ADLCCC) would be formed to work with Council on the choice of a new landfill site.

The ADLCCC was formed around May 2003 as a medium for various stakeholders to provide input into the site selection process. The overall aim of the ADLCCC was:

> *To assist in developing a new landfill site and the associated integration of waste disposal strategies for the Armidale Dumaresq Council and surrounding communities.*

EOIs were called from the local community to sit on the ADLCCC. Ten members of the community were endorsed by Council. Membership of the ADLCCC was constituted as follows:

- Three Council representatives.
- Six stakeholder representatives from the three potential landfill sites under consideration at the time (Sites 7, 8 and 9).
- One independent Chairperson.
- Five members of the public.

A meeting of the ADLCCC was held on 4 September 2003 to discuss the site selection process. This was undertaken as part of the review of site selection studies completed up until this date by Maunsell (refer to **Appendix C**). It was established, from the meeting, that the ADLCCC members believed the important siting issues were:

- Environmental issues.
- Social Issues.
- Technical issues.
- Aesthetics.
- Site Aspect.
- Demographics.
- Protection of amenity and health.
- Odour, noise, dust, seepage.
- Visual amenity.
- Effect on native flora and fauna.
- Vermin.
- Proximity to National Park.
- Access (physical, utilities and communication).
- Impact on tourism.
- Impact on neighbouring agricultural practices.
- Impact on large scale future development due to potable water supply.

Consultation with the ADLCCC contributed to the development of primary criteria and weightings for the site selection evaluation in the subsequent *Regional Landfill Siting Study* (Maunsell Australia, March 2004) included as **Appendix C**.

As part of the consultation process, the draft *Regional Landfill Siting Study* was presented to both Council and the ADLCCC at a special ADLCCC meeting on 8 December 2003, in order to address any concerns regarding the evaluations and 'fine-tune' the rankings according to any further recommendations prior to issuing the final version of the report. A motion was passed by the ADLCCC to release the draft report for public comment. Submissions were received from ADLCCC members and other stakeholders. These submissions were reviewed and the relevant information incorporated into the report and the selection criteria re-evaluated as necessary.

ADLCCC accepted the findings of the *Regional Landfill Siting Study* and recommended to Council that Site 7 be adopted as the selected site. Council then resolved to pursue the establishment of a new landfill on this site and the ADLCCC was disbanded.

Further community consultation has been ongoing since the site selection process. The community have been informed at key stages throughout the project's development of the opportunity to provide feedback on community environment and other issues. **Section 7.0** details the community consultation activities conducted as part of this EA process.

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5.0 Project Description

This section provides more detailed information about the design and operation of the proposed landfill facility, from its concept design phase through to its final closure and the proposed, ongoing site rehabilitation works. The project description also directly refers to the contents of the Draft LEMP for the proposed landfill facility (refer **Appendix B**), which has been developed in response to the DGRs for the proposal (refer **Appendix A**).

5.1 Overview

The proposed landfill has been designed as five individually developed and operated "cells", each having an expected lifespan of approximately 10 years, based on current waste generation and expected filling rates. The proposal would consist of the following main components:

- Leachate Barrier System.
- Leachate Collection and Conveyance System.
- Leachate Pond.
- Sedimentation Basin.
- Dry Basin.
- Internal Access Road.
- Biodiversity Offset Area.
- Diesel Storage Tank and bunded area.
- Site Amenities Building, including staff toilets, staff lunch room, office, first aid / OH&S facilities (eye wash facilities and fire extinguishers, etc) and car parking spaces for both staff and visitors.

The access road to the landfill is proposed to be a single lane carriageway from its intersection with Waterfall Way to the wheel wash location adjacent to whichever cell is operational at that time. A site layout plan is provided in **Figure 6**. The proposed landfill footprint and its associated buffer areas would be located on land in which two small farm dams on the Edington property are located.

5.2 Landfill Design

The proposed landfill facility has been conceptually designed and would be constructed in accordance with the *Environmental Guidelines: Solid Waste Landfills* (EPA, 1996). The proposed landfill has been conceptually designed as a conventional landfill to be constructed (for the most part) above natural ground level. Some limited excavation within the landfill footprint would be required for construction of the leachate collection system; to provide clay soils required as a construction material for the leachate barrier system; to provide other suitable soils required for intermediate and final cover of waste materials; and for final capping of the landfill. The final depth required for excavation would be determined by the actual geology of the site, however the excavation would not extend into hard rock. The final depth would also consider the local hydrogeology of the site as described by the findings of the investigation provided in **Appendix F**. The final depth for each waste cell would be determined during the detailed design phase when more detailed, site specific information about the site's underlying geology has been considered.

5.2.1 Cell Design

The proposed landfill would be divided into five cells, each of approximately equal volume. For design purposes, the cells have been numbered 1, 2, 3, 4 and 5, according to the order in which they are currently proposed to be constructed (i.e. Cell 1 is envisaged to be the first to be constructed / filled). Each cell has been designed to contain approximately 211,000 m^3 of waste and cover material, assuming a waste compaction density of 0.85t/m^3 and incorporating 20% cover material (measured as gross space). This equates to a useable life for each cell of approximately 10 years, based on the currently envisaged landfilling rate of 15,000 tpa.

The dimensions of each cell would vary as the depth available for landfilling would alter in accordance with each cell's location within the site. The cells that are proposed to be located lower in the existing valley (i.e. Cells 4 and 5) would have a smaller base, but greater depth than the cells proposed to be located higher in the valley (i.e. Cells 1 and 2). It is envisaged that cells would be in the order of 80 metres wide, 275 metres long and 14 metres high (deep) as shown on **Drawing CI-110** in **Appendix G**. A cross section of the landfill design is shown in **Figure 7**.

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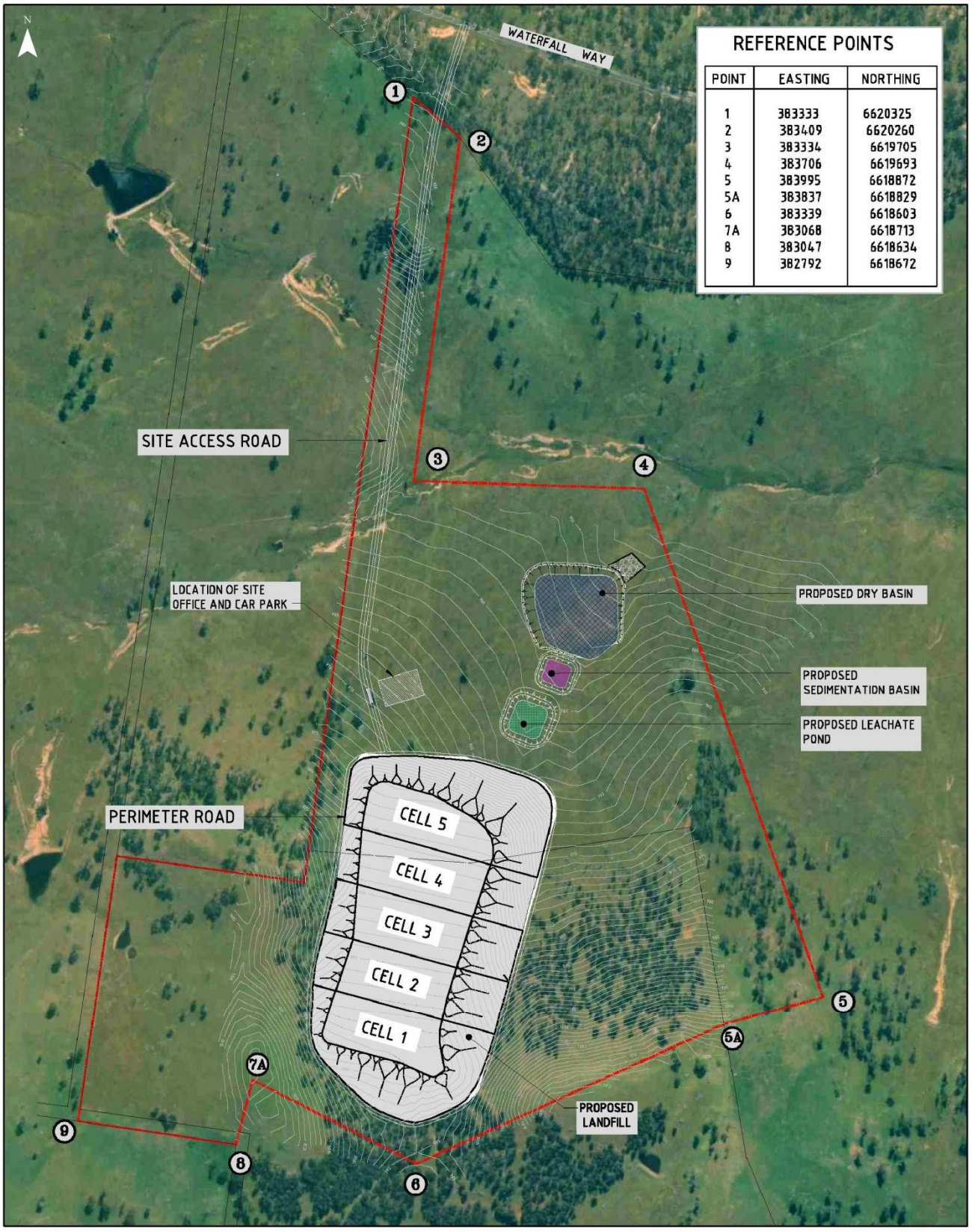

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INDICATIVE SITE LAYOUT PLAN

Source: AECOM (2008)

0 50 100 200 m

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Fig. **6**

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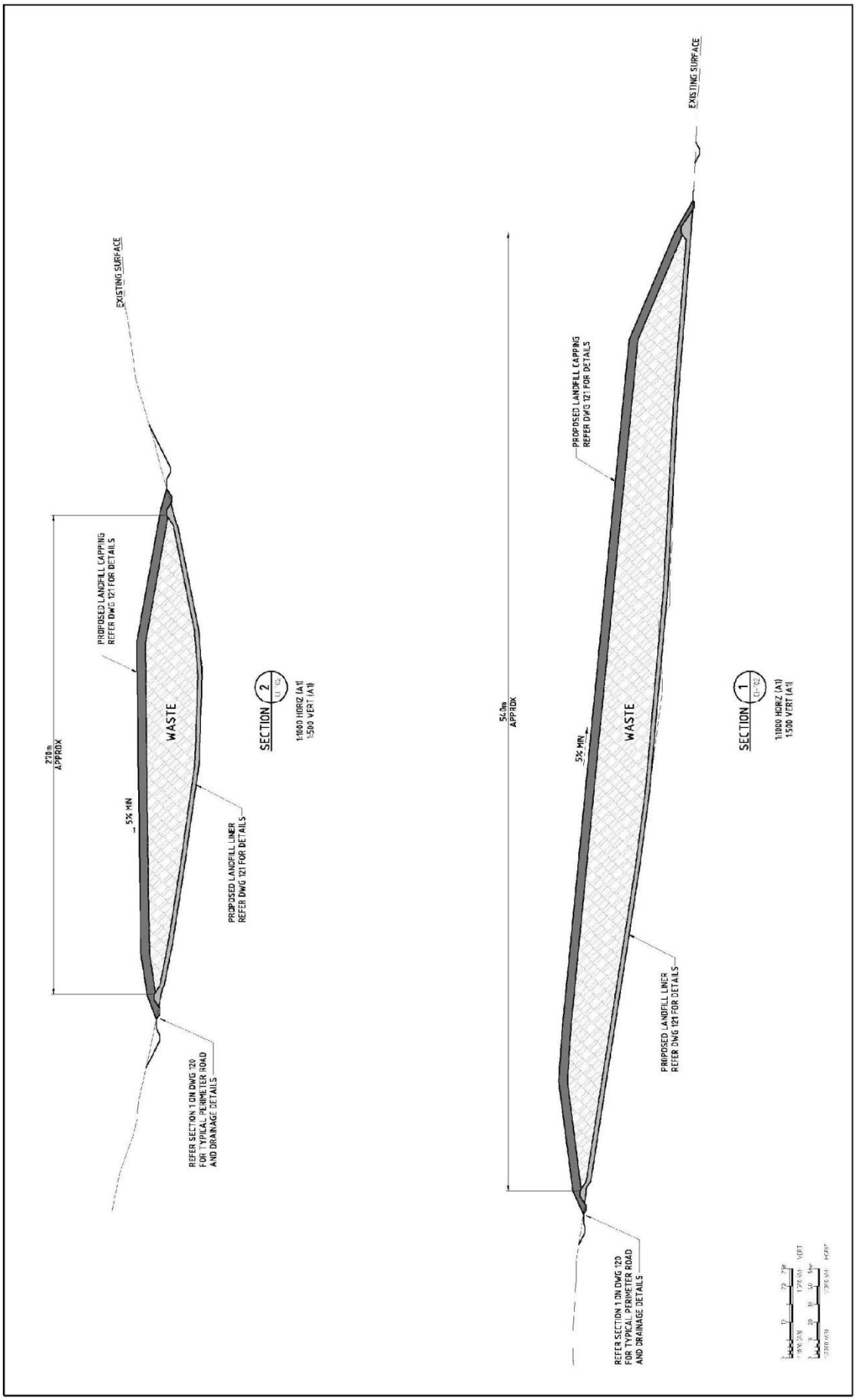
AECOM
EXISTING SURFACE
PROPOSED LANDFILL CAPPING
REFER DWG 121 FOR DETAILS
270m
APPROX
5% MIN
WASTE
PROPOSED LANDFILL LINER
REFER DWG 121 FOR DETAILS
REFER SECTION 1 ON DWG 120
FOR TYPICAL PERIMETER ROAD
AND DRAINAGE DETAILS
SECTION 2
1:1000 HORIZ (A1)
1:500 VERT (A1)
EXISTING SURFACE
PROPOSED LANDFILL CAPPING
REFER DWG 121 FOR DETAILS
540m
APPROX
5% MIN
WASTE
PROPOSED LANDFILL LINER
REFER DWG 121 FOR DETAILS
REFER SECTION 1 ON DWG 120
FOR TYPICAL PERIMETER ROAD
AND DRAINAGE DETAILS
SECTION 1
1:1000 HORIZ (A1)
1:500 VERT (A1)
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CROSS SECTION OF LANDFILL DESIGN
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5.2.2 Leachate Barrier System

The leachate barrier system to be installed at the site would conform to the Benchmark Technique Number 1. It is currently envisaged that this would consist of a 900 mm thick layer of recompacted clay with a permeability of less than 10^{-9} metres per second (m/s), as a minimum requirement. The finally installed leachate barrier system may also exceed these minimum permeability criteria, in order to create further surety of the ongoing integrity of the barrier.

If there are insufficient volumes of appropriate clay material available from site excavation works to construct the required recompacted clay liner (to be determined during the detailed design phase), then an alternative composite clay / synthetic barrier system would be installed such as a landfill liner compromising a clay layer in combination with an artificial liner such as a Geosynthetic Clay Liner (GCL) or a High Density Polyethylene (HDPE) layer (or other equivalent). Any such composite barrier system would also be subject to approval by DECCW and would meet or exceed the minimum Benchmark Technique requirements.

If required, it is anticipated that any such composite barrier design would consist of the following:

- A clay bedding layer with minimum thickness of 300 mm and permeability of less than 10^{-9}m/s;
- A 1.5 mm thick HDPE with a permeability of less than 10^{-11}m/s would overlay the clay layer.

The leachate barrier system would contain leachate over the period of time that the waste poses a potential environmental risk, that is, the time until Final Storage Quality (FSQ) is achieved.

5.2.3 Leachate Collection and Conveyance System

An appropriate leachate drainage layer would be installed above the leachate barrier layer to enable leachate to be collected within the landfill and transported away via the conveyance system. The leachate drainage layer would consist of either a layer of 300 mm thick rounded river gravel or a suitable DECCW approved alternative. If required, any such alternative would consist of either a similar “gravelly” product, or an appropriate geomembrane layer. Final decisions about the actual nature of the leachate drainage layer would be made during the detailed design phase of the project, but would nevertheless still be dependent upon the availability of appropriate materials.

The leachate collection and conveyance system to be installed would consist of a series of slotted collection pipes draining via gravity to one of five leachate collection sumps (**Drawings CI-110** and **CI-111** in **Appendix G**). Each landfill cell would have a longitudinal gradient greater than 1% and a transverse gradient greater than 3% (such that leachate flows from the edge of the landfill footprint to the central area and towards the leachate sumps).

The leachate would be collected in the leachate sumps and be pumped to the leachate pond located to the north of the landfill footprint. **Drawings CI-110** to **CI-114** (**Appendix G**) show the progressive development of these cells and other ancillary infrastructure, including the location of the leachate pond.

The leachate pond would enable evaporation of as much as possible of the pure water component of the leachate, leaving the particulate and dissolved contaminants within the pond, to be transported off-site for re-processing/recycling and/or to a DECCW approved disposal site, if required. The pond would be sized to ensure leachate or other contaminated water would be wholly contained within the Project Site and there would be no discharge of leachate to the receiving environment (see **Section 8.3.3**).

5.2.4 Leachate Pond

Leachate generation rates would be determined by hydraulic modelling and water balance calculations. The leachate pond would then be sized accordingly. A freeboard of 300mm has been allowed comprising 150mm to capture the 1 in 25 year, 24hr storm volume from direct rainfall over the pond surface and an additional 150mm for wave action on the water surface without overflowing and would be surrounded by a compacted clay bund. The bund would have a capacity greater than 110% of the capacity of the leachate pond. The hydraulic head (i.e. water pressure) of the leachate would be maintained via the use of level monitoring devices at less than 300 mm above the landfill liner. The requirements for the lining of the leachate pond would be as for the leachate barrier system, described previously.

The proposed landfill has been conceptually designed to enable leachate to be reinjected into the active landfill or irrigated over landfilled areas which have been overlain by intermediate cover.

5.2.5 Landfill Gas Management

"Landfill gas" is the gaseous component of the various bi-products of the breakdown of organic wastes and other matter, over time, within a landfill mass. Landfill gas is made up a number of odourous and non-odourous gases, but mainly comprises methane (CH_4). Methane is an odourless, colourless gas which may be burned as a fuel source, if collected in sufficient quantities. Methane is a significant GHG (refer **Section 8.6**) which, if produced in any significant quantities, would need to be managed appropriately in order to not contribute to other off-site impacts.

The gas generated by the landfill would be contained by the leachate barrier system, by the covering of waste and by site capping and revegetation. The installation of a landfill gas extraction system is not considered necessary based on the type and volume of waste to be accepted at the facility. Nevertheless, during the initial operational phase of the proposed development, the landfill's performance with respect to landfill gas production and other associated matters would be assessed and the results discussed with both the DECCW and DoP. Once the filling of Cell 1 is complete, landfill gas monitoring (perimeter well testing) would be conducted to determine if the amount of gas produced requires the installation of a gas extraction/control system. The installation of a gas extraction/control system would be required if perimeter well testing shows methane concentrations that exceed 1.25% of methane (measured as volume/volume) or 25% of the Lower Explosive Limit (LEL). All landfill gas "condensate" (i.e. liquids associated with the production of landfill gas) that would be collected by the landfill gas extraction system) would be managed as leachate.

Two suitable options for gas extraction/control would be:

- the application of a methane oxidation cap; or
- passive venting and using a filter (e.g. activated carbon or the like) to reduce emissions.

The methane oxidation cap is a "biological' cap that is used in preference to the standard compacted clay type of cap. It relies on a biomass that oxidises CH_4 as the landfill gas permeates through the soil media that constitutes the cap. Extensive research into this type of capping demonstrates a reduction in methane emissions from landfills of up to 10 times over a standard compacted clay cap. Research is currently being undertaken in Australia as part of the Australian Alternative Capping Assessment Program, which aims to amend the national capping requirements so that smaller landfills have an alternative to the prescriptive expensive caps that DECCW typically suggest.

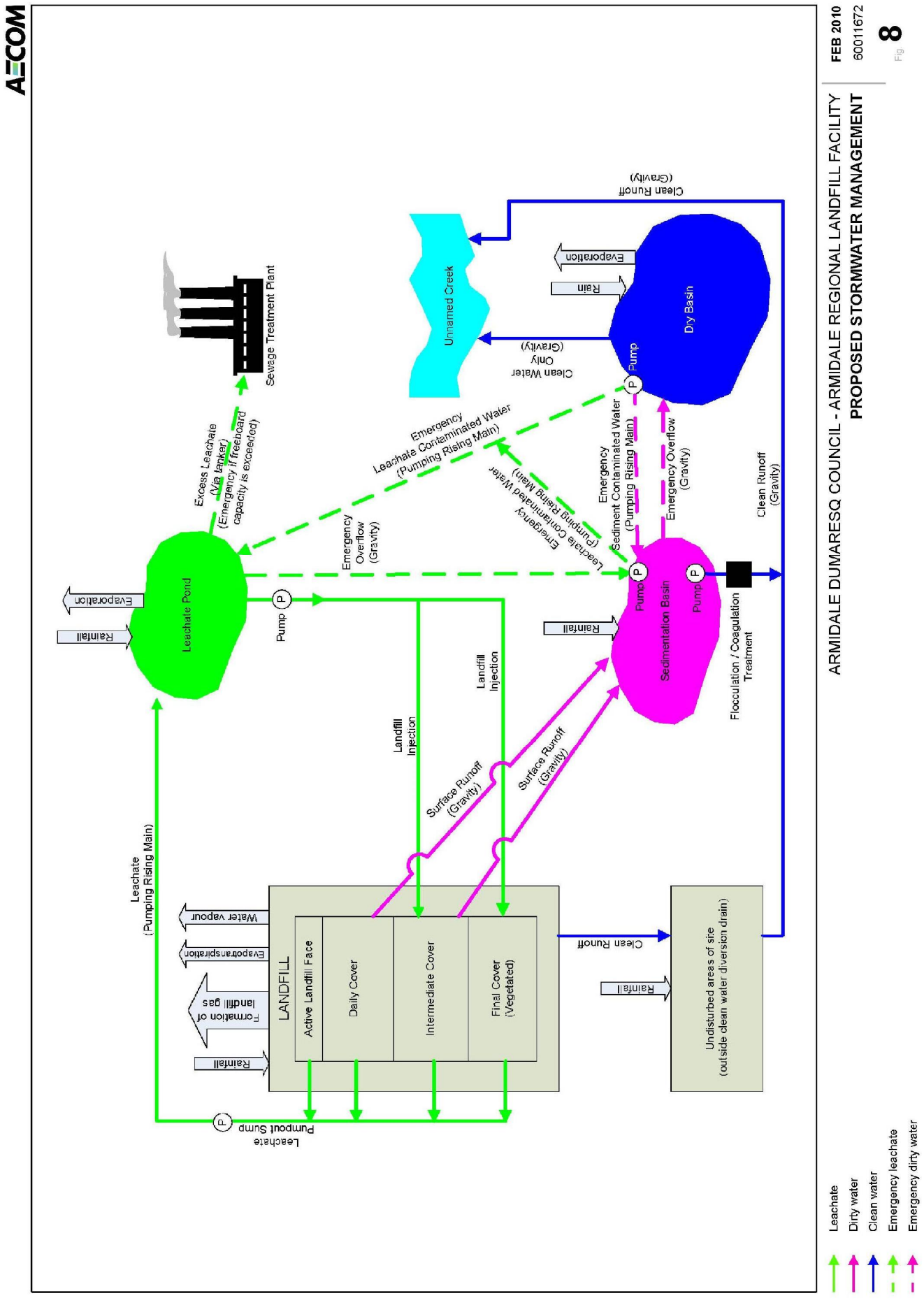
It is recommended that methane generation be monitored after the landfill is operating to determine whether there is sufficient methane produced to necessitate collection .The monitoring data would be assessed to consider whether the installation of a retro-fitted landfill gas system is required for electricity generation.

In the event there is insufficient landfill gas to generate electricity but there is sufficient volume to warrant collection, the gas would undergo thermal oxidation, via flaring. If flaring is to be undertaken, non-methane organic compounds (NMOC) emissions would be quantified by the landfill operator, in strict accordance with the Benchmark Technique Number 11, prior to and following any flaring activities taking place.

5.2.6 Stormwater Management

In order to minimise the potential for stormwater run-off from entering into the area of the landfill, the location proposed for the landfill footprint is at the highest elevation within the stormwater catchment. The provision of appropriately sized stormwater diversion drains and bunding is also an important part of the landfill design (see **Section 8.3.3**). The proposed stormwater management is shown in **Figure 8**.

All stormwater that falls onto the site will be classified as either "clean" stormwater, "dirty" stormwater or "leachate", as per the following definitions.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ARMIDALE DUMARESQ COUNCIL - ARMIDALE REGIONAL LANDFILL FACILITY
PROPOSED STORMWATER MANAGEMENT
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Fig 8
Clean Runoff (Gravity)
Unnamed Creek
Evaporation
Rain
Dry Basin
Pump
Clean Water Only (Gravity)
Sewage Treatment Plant
Excess Leachate (Via tanker) (Emergency if freeboard capacity is exceeded)
Emergency Leachate Contaminated Water (Pumping Rising Main)
Emergency Contaminated Water (Pumping Rising Main)
Emergency Overflow (Gravity)
Clean Runoff (Gravity)
Emergency Overflow (Gravity)
Leachate Pond
Emergency Leachate Contaminated Water (Pumping Rising Main)
Sedimentation Basin
Pump
Rainfall
Evaporation
Flocculation / Coagulation Treatment
Landfill Injection
Landfill Injection
Surface Runoff (Gravity)
Surface Runoff (Gravity)
Leachate (Pumping Rising Main)
LANDFILL
Active Landfill Face
Daily Cover
Intermediate Cover
Final Cover (Vegetated)
Water vapour
Evapotranspiration
Formation of landfill gas
Rainfall
Clean Runoff
Rainfall
Undisturbed areas of site (outside clean water diversion drain)
Leachate Pumpout Sump
Leachate
Dirty water
Clean water
Emergency leachate
Emergency dirty water

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Clean stormwater

For the purposes of this EA, “clean” stormwater includes all waters which would fall on undisturbed areas outside the outer batter of the cell’s perimeter or “dirty” water drain and on all other undeveloped areas of the proposed landfill site. “Clean” stormwater also includes future surface runoff from finally capped and revegetated landfill cells. All clean stormwater would be diverted around the landfill footprint into the existing unnamed intermittent creek to the north of the Project Site. It is not envisaged that there should be any need for other treatment and/or containment of this clean stormwater.

Dirty stormwater

“Dirty” stormwater is water which falls on any disturbed and operational areas of the landfill, but which has not come into contact with any waste materials. Dirty stormwater may contain suspended sediments and as such would be diverted to the proposed sedimentation basin to the north east of the landfill footprint, in which sediments would settle out. Appropriately treated, clarified surface water from the sedimentation basin is intended to be reused on-site for dust suppression purposes and for irrigation of on site vegetation, where and when required.

Leachate

“Leachate” is defined as any water that has been in contact with waste and therefore would be potentially contaminated, including all water flowing from the proposed leachate collection system. Leachate includes all rainfall that would infiltrate through the landfill, both within the “active” filling areas and any finally capped areas. Leachate also includes any contaminated waters disposed by injection into the landfill, as well as any moisture contained within either the waste or any cover materials.

The leachate pond would contain, store and treat all collected leachate. In the unlikely or “emergency” case where the leachate pond overflows, all overflow waters would drain to the permanent sedimentation basin for emergency storage and appropriate treatment. The use of a dry basin may also be required to provide emergency containment, but only in very large storm events, i.e. greater than the 1 in 100 year event. In the event that the leachate pond and/or sedimentation pond overflow to the dry basin, leachate from the dry basin would be pumped back to either the sedimentation basin or leachate pond for treatment, once there is sufficient capacity in these ponds, and no leachate or dirty water would be released to the environment.

A Water and Leachate Management Plan (WLMP) has been prepared for the Project Site addressing surface water and leachate management and providing a suite of mitigation measures to minimise impact to the receiver environment (see **Section 8.3.3**).

5.3 Landfill Construction

The proposed landfill’s various site works, individual cells, ongoing management and final closure activities would be progressively conducted / constructed over a number of years, thus allowing for the incremental use of available materials and the more efficient planning for resource use. The site’s diversion drains, internal access roads and material stockpiles would be established, moved, removed and remediated stage by stage, as required over the total life of the landfill to final closure.

Construction of the proposed landfill would consist of the following general steps:

- Site preparation.
- Cell preparation.
- Liner and leachate collection system construction.
- Filling and cover.
- Final capping and site remediation.

Individual construction periods for discreet activities would always be less than 26 weeks duration. Potential impacts from construction activities are discussed in **Section 8.0**.

5.3.1 Construction Hours

Construction hours of the landfill would be between:

- 7am to 5pm Monday to Friday.
- 8am to 1pm Saturday.
- No work will occur on Sundays or on Public Holidays.

The Contractor may be able to work outside these normal hours with the prior permission of DECCW and only with appropriate noise and other pollution mitigation measures in place.

5.3.2 Site Preparation

Site preparation activities would aim to minimise the area to be disturbed and would include the following specific activities:

- Removal of existing fences, where necessary.
- Progressive removal of vegetation, where necessary, and 2 small farm dams.
- Installation of new fences around the boundary of the site and all required buffer zones.
- Construction of the access road and site entrance.
- Installation of erosion and sediment control measures.
- Installation of site services and amenities including power, telephone, sheds and water tanks.

The expected construction traffic on to / off the site during any 'worst case' timeframe is expected to be limited to the following movements over each weekday:

- Up to 10 construction trucks (total of 20 movements per day).
- Up to five passenger vehicles to and from site (total 10 movements per day).

5.3.3 Cell Preparation

Cells would be progressively constructed, commencing with Cell 1 near the southern end of the site, to enable a more efficient use of all required resources, as well as to minimise the overall level of disturbance to existing site vegetation.

Cell preparation activities would consist of the following:

- Clearing of existing vegetation.
- Excavation and storage of topsoil for cover/rehabilitation (capping).
- Excavation and storage of clay for liner.
- Excavation and storage of remaining material for cover.
- Preparation of cell foundation/load bearing surface.
- Allow a minimum 3% longitudinal fall across the site.
- Recovery of clay suitable for use in the liner.
- Recovery of topsoil and other soil material which would be stockpiled for suitable future use as cover material.

The sub-surface profile of the site consists of topsoil, clay, gravely clay, weathered rock and then hard rock. Excavation of any part of the site would typically cease when the top portion of the weathered rock is encountered. Any suitable clay reserves that are able to be found on the site would be used for the construction of the liner and for part of the capping layer. All excavated topsoil would be stockpiled separately for later establishment of the final vegetation layer of the capping. All remaining suitable material, including gravely clay and weathered rock would be utilised for either daily or intermediate cover.

5.3.4 Liner and Leachate Collection System Construction

The liner and leachate collection system would be constructed in accordance with the Quality Management Plan which would be prepared at the detailed design stage or immediately prior to the construction of the cell.

Construction activities would consist of:

- Construction of external bunds.
- Installation and compaction of landfill liner compromising a clay layer in combination with an artificial liner such as a GCL or a HDPE layer (or other equivalent) and construction of inter-cell clay bunds to enhance leachate collection.
- Placement of leachate collection pipes.
- Construction of leachate collection sumps.
- Installation of drainage material.

For the purpose of the draft LEMP, it is proposed that the leachate barrier system would be constructed in accordance with Benchmark Technique Number 1. The clay would be placed in maximum 150 mm lifts to ensure consistency of compaction and moisture and thereby ensure optimal performance of the barrier.

If, at the time of detailed design, a more complex, composite leachate barrier system is to be used, DECCW approval would be sought and the draft LEMP and EPL would be amended accordingly.

5.4 Landfill Facilities

5.4.1 Access Road

Site Access

Three options for entry into the proposed landfill site have been identified, the approximate locations of which are indicated on **Figure 9**. The three proposed access routes were identified as follows:

- Route 1 follows the existing TSR.
- Route 2 is the most direct route into the site.
- Route 3 avoids the TSR.

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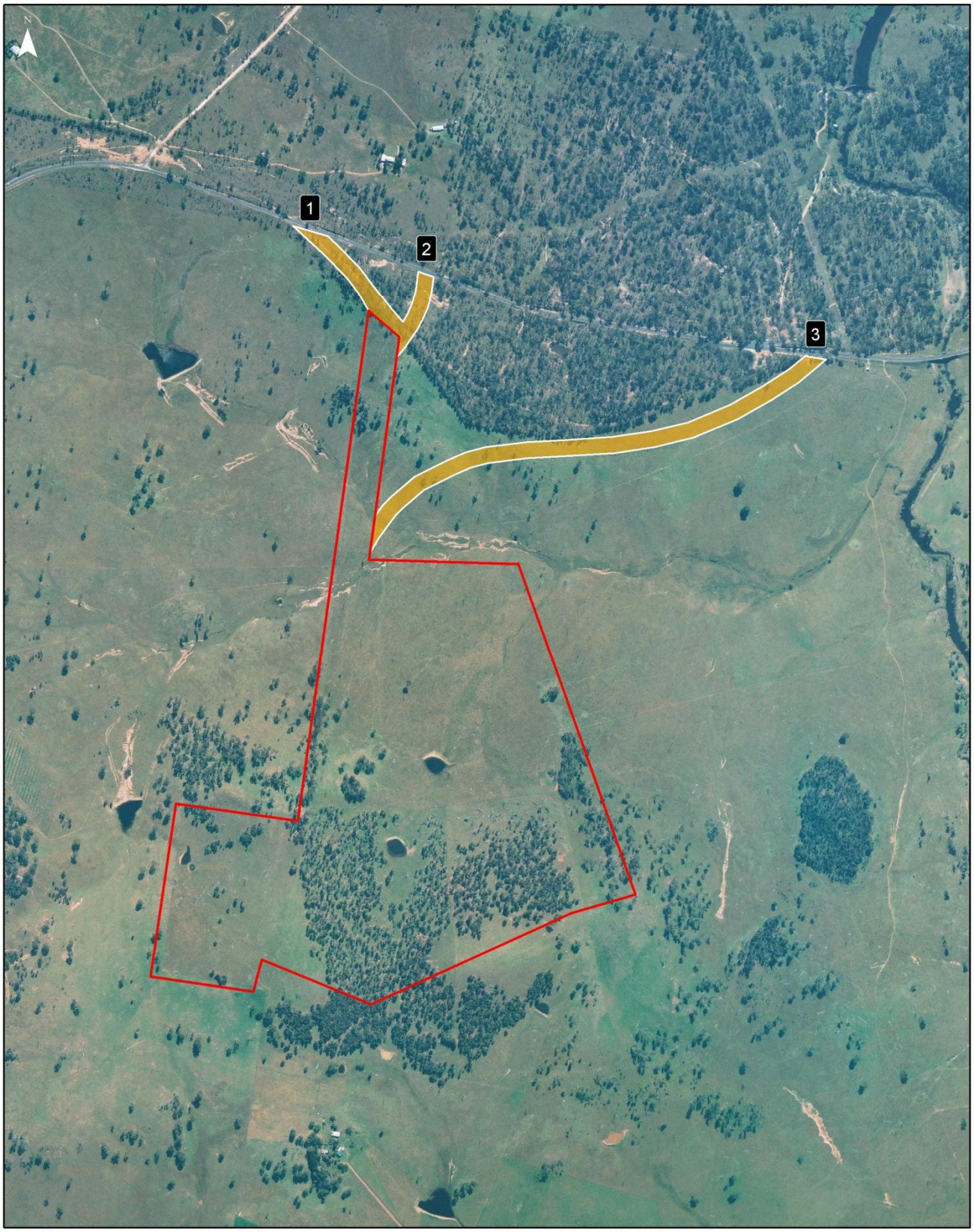

Project site
Access route

ARMIDALE DUMARESQ COUNCIL - ARMIDALE REGIONAL LANDFILL FACILITY
ACCESS ROUTE OPTIONS
Source:

0 100 200 400 m

FEB 2010
60011672
Fig. **9**

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A review has been undertaken to identify the constraints associated with each of these three possible route options. The potential implications associated with each have been identified, taking the following aspects into consideration:

- Flora and Fauna - Considerations were informed by the results of the flora and fauna surveys undertaken on-site within the TSR area (**Section 8.8**).
- Traffic - The results of the Traffic Impact Assessment that specifically addressed details with respect to the configuration of the proposed intersection (**Section 8.14**).
- Cost - Indicative costs associated with each option were calculated.
- Noise - A comparative noise assessment was undertaken for the three access route options (a more detailed noise analysis was carried out on the finally adopted access route).

The constraints review of the access route options is presented in **Table 16**.

Table 16: Constraints review of access route options

Aspect	Issue	Applicable to Access Route Options	Implications
Fauna	Habitat value assessed as high in the TSR and therefore significant impacts with removal.	1 and 2	Potential impacts to habitat value in terms of fragmentation and reduced connectivity. This may threaten species populations.
	Threatened bird species: • Speckled Warbler • Diamond Firetail. • Hooded Robin.	1 and 2	Potential impacts to vulnerable species under the *NSW Threatened Species Conservation Act 1995* (*TSC Act*).
	Threatened mammal species: • Koala. • Eastern bent-wing bat.	1 and 2	Potential impacts to vulnerable species listed under the *TSC Act*.
	Habitat connectivity	2 and 3	Option 2 would traverse through the centre of the TSR – isolating a small fragment to the west from the larger fragment to the east. Option 3 will create a barrier between the TSR and the compensatory habitat.
Flora	Threatened flora species: • Narrow-leaved black peppermint.	1	Species vulnerable under both the *TSC Act* and the *EPBC Act*. It will be necessary to ensure that the access track is 30 metres from any of the marked species (refer **Figure 9**). This would not be possible for Option 1.
		2	Vulnerable species listed under both the *TSC Act* and the *EPBC Act*. It may be possible to ensure that the access track is 30m from any of the marked species (refer **Figure 9**).
	EEC: • Box-Gum Woodland	1	EEC listed under both the *TSC Act* and the *EPBC Act*. If Option 1 was to be pursued, a referral may be required to the Commonwealth Minister for the Environment and Heritage, for assessment and approval.
		2	Listed as an EEC under both the *TSC Act* and the Commonwealth *EPBC Act*. If Option 2 was to be pursued, a referral may be required to the Commonwealth Minister for the Environment, for assessment and approval. Note: Option 2 would go through an already cleared area of land and would require less tree disturbance than Option 1.

Aspect	Issue	Applicable to Access Route Options	Implications
Traffic	Intersection	1	Option 1 has a potential issue with line of sight with the access/egress located along the existing TSR as a result of the sharp bend located west of the site of the habitat of various threatened bird species, including: - Speckled Warbler. - Diamond Firetail. - Hooded Robin
		2	Based on available technical data, it is expected that the traffic impacts associated with Option 2 should be minimal.
		3	Option 3 has potential grade issues associated with the upward incline of Waterfall Way, east of the Gara River. Any intersection proposed on the low point on the road for vehicles turning left on to Waterfall Way (from the proposed landfill site) may be problematic due to traffic travelling west down the incline.
Cost	Construction of the access road	3	Greater costs associated with having to construct an access road that is approximately 1.25km longer in length than the other Options 1 and 2. Agricultural land segregation; loss of connectivity between TSC and offset compensatory habitat; and additional land take required to construct the road.
Noise	Increased noise	3	Increased noise impacts due to increase in road traffic movements (length through site).
		1	Increased noise impacts to Strathaven property, as road would traverse parallel to site property boundary in this area.

Option 2 was selected as the preferred route as it:

- Provides a safe access point for local traffic.
- Provides a more direct route, would be the least expensive and would result in less noise impacts.
- Would have less impact on land use / property severance, in comparison with Option 3.
- Avoids clearing of the Narrow-leaved black peppermint, a vulnerable species protected by NSW and National environmental legislation.

The access road to the proposed landfill site would be a single lane carriageway some 1.8 kilometres long between the landfill site and the closest public roadway, Waterfall Way (RTA State Road MR 76, also known as Grafton Road). The access road would traverse the TSR from Waterfall Way and run parallel to the western boundary fence adjoining the Edington and Strathaven properties. All vehicular access to the site would be via Waterfall Way. It is not proposed to allow any routine public access to the proposed landfill for either waste disposal or other purposes. The access road would be bitumen sealed from the intersection with Waterfall Way to a wheel wash located near the landfill footprint.

Figure 6 shows the indicative location of the proposed access road. The access road would continue along the western boundary of the site and have a T-junction intersection with Waterfall Way. The required T-junction intersection with Waterfall Way would be designed as discussed in **Section 8.14.3**.

The proposed on-site access roadway would traverse a number of creek crossings and drainage lines. Adequately sized culverts would be provided at all creek crossings and drainage lines which would be designed so as not to impede flows generated by a 1 in 100 year storm event.

Intersection Design

The proposed location for the Option 2 access road as it would intersect with Waterfall Way is considered to meet Austroads criteria for Approach Sight Distance (ASD) and Safe Intersection Sight Distance (SISD) of 265 metres for a 100 km/h roadway. The SISD includes an additional 15 metres to take into account the 3.4% grade from the proposed intersection location to a crest located approximately 300 metres to the west. The total distance of approximately 280 metres from the highest point provides sufficient sight stopping distance for a driver of a vehicle travelling along Waterfall Way to react to vehicles entering and exiting the proposed landfill site.

The Traffic Impact Assessment (see **Section 8.14**) recommends that the T-junction intersection of the proposed access road with Waterfall Way should be based on a Type B (Austroads) right turn arrangement, in order to assist heavy vehicles negotiate left in/left out turns and provide an auxiliary (right turn) passing lane.

5.4.2 Perimeter Road

In addition to the main access road, a perimeter road would be located along the boundary of the landfill footprint for tipping and maintenance access to the active landfill cell.

5.4.3 Signage

Signage would be placed in appropriate locations on the site, clearly indicating the following issues:

- Speed limits.
- Direction to tipping area.
- Types of waste permissible.
- Site owner.
- 24 hour contact telephone number.
- No public access to the landfill.

5.4.4 Fencing and Security

A perimeter fence would enclose the proposed landfill, the diesel storage tank (used to service on-site equipment), staff amenities, leachate and stormwater ponds. The site would have a gate that would be locked outside of normal operational hours, or when the site is unattended. Members of the public would not have direct access into the landfill. Vehicles would only be able to access the site by passing through the site gate.

The proposed offset area (refer **Section 5.4.8**) would be fenced with wildlife-friendly fencing and a cattle grid would also be built into the access road to prevent cattle movement.

5.4.5 Amenities

Staff amenities would be located in a single storey demountable building and would comprise:

- Toilets for landfill staff.
- Staff lunch room.
- Site office.
- First aid /OH&S facilities (e.g. eye wash facility, fire extinguishers).
- Associated workshop and storage shed for materials and maintenance equipment.
- Staff and visitor parking.

The staff amenities would be located adjacent to the access road to the site, on the eastern side to ensure efficient movement on and off the site. The car park would be located adjacent to the amenities building, and would be hardstand with a suitable drainage system to manage surface water runoff.

5.4.6 Water Supply

Detailed water requirements would be estimated during the detailed design stage of the Project. It is not intended to use surface water run-off, farm dams or groundwater sources to meet the new landfill water requirement needs. The sedimentation basin and dry basin would be used for environmental management purposes (refer **Section 8.3.3**), namely runoff capture, dust suppression and stormwater control.

Water required for operational needs and in the amenities building would be supplied by rainwater tank(s) which would be installed on site to collect rainwater from the roof of the site amenities building. During dry periods, extra potable water supplies may be sourced from the 300mm water main that runs from Gara Dam to Armidale along Waterfall Way at the intersection of the access road.

To provide adequate fire fighting capacity to satisfy relevant building and other safety standards, the detailed design of the site would include appropriate provision of fire fighting water as part of the total water supplies to be stored on site.

5.4.7 Services

Electricity and communication services would be provided at the site. Sewage from staff amenities would be treated either via the use of a self composting toilet or otherwise temporarily stored within a septic tank and then pumped off site for appropriate treatment with other municipally collected sewage materials.

Diesel fuel would be stored on site for use in plant and machinery. The diesel would be stored in a tank with associated fittings and pipelines designed to comply with Australian Standard AS1940:2004 (Storage and Handling of Flammable and Combustible Liquids). The tank would be contained within a bunded area which would not be linked to any other part of the site. In accordance with industry standards, this bund would have a capacity of 110% of the tank's capacity in order that any potential spill would be fully contained within the bund, without any risk of overflow.

Suitable fire fighting apparatus and infrastructure such as fire hydrants, fire extinguishers and sprinkler systems would be provided within the buildings as needed and specified during the detailed design phase.

5.4.8 Biodiversity Offset Area

A 50 metre buffer zone has been included into the design of the proposed landfill facility. A Biodiversity Offset Area of approximately 61 hectares has also been included in the design of the Project Site. This offset area would surround the proposed landfill footprint and access route and would include:

- Stringybark woodland.
- Sedgeland.
- Grassland.
- Wetland.

A Biodiversity Offset Management Plan (**Appendix H**) has been developed for the site which details the objectives, management and monitoring measures associated with the Biodiversity Offset Area.

5.5 Landfill Operation

5.5.1 Alternatives Considered

Waste would either be placed in the proposed landfill and compacted or baled at the existing WTS within the Armidale Waste Management Centre prior to being transferred to and placed in the proposed landfill. The baling of waste at the WTS is currently being considered by Council and would involve the automated/mechanical compaction and wrapping/encapsulation of the waste (using a plastic landfill bale wrap material approved by the DECCW). Wrapped bales would then be transported to the landfill working face by trucks and forklifted into place. Since the landfilling of baled waste has no exposed work face and the bales can be easily stacked on top of each other, it is proposed that the lift heights for the waste can be up to 6 metres high. This proposed use of baling would also have the added benefit of minimising the need for daily and intermediate cover at the proposed landfill, thus reducing the various impacts of winning, transporting, storing and placing this cover material. It would also reduce the proposed landfill's longer term operational impacts. The viability of any future use of waste baling techniques has not been confirmed.

If baling of the waste is not viable, unbaled waste would instead be placed within the proposed landfill footprint and be compacted in lift heights of approximately two metres. All unbaled waste would be compacted insitu to approximately 0.85t/m^3. Daily cover would be placed in accordance with the procedures outlined in Benchmark Technique Number 33. This EA has assumed that unconsolidated waste would be placed in the proposed landfill cells and compacted insitu.

5.5.2 Landfill Cell Operation

Landfill cell operations would be as follows:

- The open tipping face would be designed (i.e. sized) according to the needs (i.e. the operating dimensions) of the actual vehicle(s) being used by Council to deliver waste to the site.
- Given the limited number of vehicles that would be used to deliver waste to the landfill site each day (approximately three individual vehicle trips per day), the tipping face would need to be no greater than 5.0 metres wide by 6.5 metres long.
- Daily cover material 150 mm deep would be applied over the waste at the end of each day. Daily cover would be applied in an appropriate manner to minimise odour emissions and to discourage vermin, but also in a manner that would readily allow removal prior to commencement of the following day's tipping activities. Alternative daily cover material such as foams, plastic sheeting or tarpaulins may also be used, where approved by the DECCW, and if it can be shown that the use of these techniques is economically viable at this site.
- Intermediate cover of 300 mm would be applied over landfilled surfaces in areas that are not going to be used for more than the next 90 days. Intermediate cover would typically be applied in sections and would be applied and compacted in a manner that minimises the absorption of rain and discourages the transport of sediments. Intermediate cover would either be removed or "punctured" prior to any recommencement of landfilling over previously covered areas.
- Waste would be compacted to approximately 0.85 t/m^3 using a waste compactor and/or other machinery, in consideration of the weight of the waste.

5.5.3 Filling/ Staging Plan

The landfill concept design proposes that filling would commence in the south (i.e. at Cell 1) of the overall proposed landfill footprint area and extend towards the north (towards Cell 5), with the final landfilling area located at the north of the landfill footprint area (refer to the landfill staging Cells 1- 5, indicated on **Figure 6** and in **Appendix G**), according to the following proposed staging plan. It should be noted that the following is indicative only and these activities may not necessarily be carried out strictly in accordance with the list order below. Should Council consider any alternative waste technologies prior to actual landfilling, volumes of waste being landfilled will decrease significantly with a flow on impact to the life of the landfill.

Filling Sequence

0-5 years:

- Access road and site entrance to be cleared, grubbed and constructed.
- Screening trees planted along the access road.
- Security fence to be installed.
- Sedimentation basin constructed.
- Eastern area of Cell 1 cleared, grubbed and excavated.
- Cover material and clay won from excavation stockpiled separately on future Cell 2 (western area).
- Foundation for eastern area of Cell 1 prepared.
- Liner and bund for eastern area of Cell 1 constructed.
- Leachate collection infrastructure (collection pipes, drainage material) for eastern area of Cell 1 constructed.
- Leachate pond constructed.
- Leachate collection sump constructed.
- Leachate collection infrastructure for the eastern area of Cell 1 connected (i.e. pipes connected to sump, sump connected to leachate pond).
- Permanent sedimentation basin constructed.

- Filling of eastern area of Cell 1 in 2m lift heights.
- Western area of Cell 1 cleared, grubbed and excavated.
- Cover material and clay won from excavation stockpiled separately on future Cell 2 (western area).
- Foundation for western area of Cell 1 prepared.
- Liner and bund for western area of Cell 1 constructed.
- Leachate collection infrastructure (collection pipes, drainage material) for western area of Cell 1 constructed.
- Leachate collection infrastructure for Cell 1 connected.

6-10 years:

- Intermediate cover applied to eastern area of Cell 1.
- Filling of western area of Cell 1 in 2m lift heights.
- Filling of Cell 1 to final landform.
- Intermediate cover applied to all of Cell 1 area.
- Any remaining material stockpiled on future Cell 2 (western area) to be moved to future Cell 3 (western area).
- Eastern area of Cell 2 cleared, grubbed and excavated.
- Cover material and clay won from excavation stockpiled separately on future Cell 3 (western area).
- Foundation for eastern part of Cell 2 prepared.
- Liner and bund for eastern part of Cell 2 constructed.
- Leachate collection infrastructure (collection pipes, drainage material) for eastern area of Cell 2 constructed.
- Leachate collection sump 2 constructed.
- Leachate collection infrastructure for the eastern area of Cell 2 connected.

11- 15 years:

- Filling of eastern area of Cell 2 in 2m lift heights.
- Reinjection of leachate into Cell 1 area.
- Western area of Cell 2 cleared, grubbed and excavated.
- Cover material and clay won from excavation stockpiled separately on future Cell 3 (western area).
- Foundation for western area of Cell 2 prepared.
- Liner and bund for western area of Cell 2 constructed.
- Leachate collection infrastructure (collection pipes, drainage material) for western area of Cell 2 constructed.
- Leachate collection infrastructure for the western area of Cell 2 connected.

16- 20 years:

- Reinjection of leachate into Cell 1 area continues.
- Intermediate cover applied to eastern area of Cell 2.
- Filling of western area of Cell 2 in 2m lift heights.
- Filling of Cell 2 to final landform.
- Intermediate cover applied to all of Cell 2 area.
- Final capping applied to Cell 1 area.
- Any remaining material stockpiled on future Cell 3 (western area) to be moved to future Cell 4 (western area).
- Eastern area of Cell 3 cleared, grubbed and excavated.
- Cover material and clay won from excavation stockpiled separately on future Cell 4 (western area).
- Foundation for eastern part of Cell 3 prepared.
- Liner and bund for eastern part of Cell 3 constructed.

- Leachate collection infrastructure (collection pipes, drainage material) for eastern area of Cell 3 constructed.
- Leachate collection sump 3 constructed.
- Leachate collection infrastructure in the eastern area of Cell 3 connected.
- Leachate collection sumps 1 and 2 connected to permanent leachate pond.

21- 25 years:

- Filling of eastern area of Cell 3 in 2m lift heights.
- Reinjection of leachate into Cell 1 and Cell 2 area.
- Western area of Cell 3 cleared, grubbed and excavated.
- Cover material and clay won from excavation stockpiled separately on future Cell 4 (western area).
- Foundation for western area of Cell 3 prepared.
- Liner and bund for western area of Cell 3 constructed.
- Leachate collection infrastructure (collection pipes, drainage material) for western area of Cell 3 constructed.
- Leachate collection infrastructure for the western area of Cell 3 connected.

26- 30 years:

- Reinjection of leachate into Cell 1 and Cell 2 area continues
- Intermediate cover applied to eastern area of Cell 3.
- Filling of western area of Cell 3 in 2m lift heights.
- Filling of Cell 3 to final landform.
- Intermediate cover applied to all of Cell 3 area.
- Final capping applied to Cell 2 area.
- Any remaining material stockpiled on future Cell 4 (western area) to be moved to future Cell 5 (western area).
- Eastern area of Cell 4 cleared, grubbed and excavated.
- Cover material and clay won from excavation stockpiled separately on future Cell 5 (western area).
- Foundation for eastern part of Cell 4 prepared.
- Liner and bund for eastern part of Cell 4 constructed.
- Leachate collection infrastructure (collection pipes, drainage material) for eastern area of Cell 4 constructed.
- Leachate collection sump 4 constructed.
- Leachate collection infrastructure in the eastern area of Cell 4 connected.

31- 35 years:

- Filling of eastern area of Cell 4 in 2m lift heights.
- Reinjection of leachate into Cell 1, Cell 2 and Cell 3 area.
- Western area of Cell 4 cleared, grubbed and excavated.
- Cover material and clay won from excavation stockpiled separately on future Cell 5 (western area).
- Foundation for western area of Cell 4 prepared.
- Liner and bund for western area of Cell 4 constructed.
- Leachate collection infrastructure (collection pipes, drainage material) for western area of Cell 4 constructed.
- Leachate collection infrastructure for western areas of Cell 4 connected.

36- 40 years:

- Reinjection of leachate into Cell 1, Cell 2 and Cell 3 area continues.
- Intermediate cover applied to eastern area of Cell 4.
- Filling of western area of Cell 4 in 2m lift heights.
- Filling of Cell 4 to final landform.
- Intermediate cover applied to all of Cell 4 area.
- Final capping applied to Cell 3 area.
- Any remaining material stockpiled on future Cell 5 (western area) to be moved to outside of the landfill footprint area.
- Eastern area of Cell 5 cleared, grubbed and excavated.
- Cover material and clay won from excavation stockpiled separately outside of the landfill footprint area.
- Foundation for eastern part of Cell 5 prepared.
- Liner and bund for eastern part of Cell 5 constructed.
- Leachate collection infrastructure (collection pipes, drainage material) for eastern area of Cell 5 constructed.
- Leachate collection sump 5 constructed.
- Leachate collection infrastructure for the eastern area of Cell 5 connected.

41- 45 years:

- Filling of eastern area of Cell 5 in 2m lift heights.
- Reinjection of leachate into Cell 1, Cell 2, Cell 3 and Cell 4 area.
- Western area of Cell 5 cleared, grubbed and excavated.
- Cover material and clay won from excavation stockpiled separately outside of the landfill footprint area.
- Foundation for western area of Cell 5 prepared.
- Liner and bund for western area of Cell 5 constructed.
- Leachate collection infrastructure (collection pipes, drainage material) for western area of Cell 5 constructed.
- Leachate collection infrastructure for the western area of Cell 5 connected.

46- 50 years:

- Reinjection of leachate into Cell 1, Cell 2, Cell 3 and Cell 4 area.
- Intermediate cover applied to eastern area of Cell 5.
- Filling of western area of Cell 5 in 2m lift heights.
- Filling of Cell 5 to final landform.
- Final capping applied to Cell 4 area.
- Final capping applied to Cell 5 area.

The irrigation of the intermediately capped areas would sustain the growth of grass and some small plants that would be required to manage wind and water erosion. No trees would be planted, as tree roots can damage the capping layer. Trees can also be difficult to remove when the landfill is finally completed. It should be noted that all run-off from the irrigation of these areas would be collected, contained and treated as leachate.

Stockpiles of material intended for cover or capping would be stored “one cell ahead” of the currently used active landfilling area, as per the details of the filling / staging plan outlined. For example, when Cells 1 and 2 are being filled, material would be stockpiled on the footprint of Cell 3. Any excess material not required for the filling of Cells 1 and 2 would then be moved downhill to the next cell for future use. Excess cover material may also be used for final capping.

5.5.4 Filling and Cover

Each cell would be separated from adjacent cells by permanent inter-cell bunds. As each cell is filled with waste, inter-cell clay walls would be progressively constructed above the waste height to contain all waste and leachate. Cover material would be applied to waste at the end of each day's landfilling.

Typical daily filling activities consist of the following:

- Placement and compaction of waste.
- Application of daily cover over waste at the end of each day's filling.
- Removal or puncturing of daily cover prior to placement of waste.
- Application of intermediate cover where required.

5.5.5 Landfill Capping

Intermediate cover would be applied over any landfilled areas that would be exposed for more than 90 days. The intermediate cover would comprise 300 mm of cover material that has been sufficiently compacted, but would still allow the absorption of irrigated leachate.

The application of final capping over the landfilled areas would commence within 30 days of the final landfill height being reached in that cell, if weather permits. Final landfill capping would progress with the availability of further suitable capping material.

Once final capping of any individual part of the landfill area has been completed, the area would be revegetated with shallow rooted native grasses and shrubs that are of local provenance. This would return the landfill footprint to its pre-existing land-use condition, suitable for agricultural purposes.

The capping system would be constructed in accordance with Benchmark Technique Number 28. The capping system currently proposed would consist of the following:

- A revegetation layer, approximately one metre thick. The final capped landfill would be revegetated with appropriate grasses and possibly with shrubs. A suitable layer of soil of appropriate but varying thickness that would suit the root depth of any proposed vegetation would be required to avoid potential root damage to the sealing layer. Shrub species would be carefully chosen with this potential in mind.
- A 300 mm thick, gravel drainage layer (with permeability of not less than 10^{-5} m/s) beneath the revegetation layer that would drain water that passes through the revegetation layer away from the sealing layer, in order to prevent water ingress into the landfill mass.
- A 0.5 metre thick layer of clay would form the sealing layer, preventing ingress of surface water. This clay would have a permeability less than 10^{-8} m/s.
- A gas drainage layer would be located immediately above the waste. A number of gas vents would be keyed into this gas drainage layer to keep gas levels close to the landfill mass below the required LEL and to ensure that such gas is directed in a controlled manner away from the landfill.
- A sealed bearing surface would consist of rolled and compacted intermediate capping, which would be in place immediately after completion of landfilling at each cell to its final, maximum height.

It has been assumed that, as a minimum, the procedures outlined in Benchmark Technique Number 28 would be used. However it is noted that in the future, DECCW approval may be sought to use various other demonstrably better capping techniques that may be available at the time of capping design.

5.5.6 Proposed Operational Conditions

Operating Hours

The normal operating hours of the landfill would not be outside the DECCW recommended hours of 6am to 5:30pm Mondays to Fridays and from 8am to 6:30pm Saturdays. The landfill would generally operate between the hours:

- 7am and 5:30pm Monday to Friday.
- 8am and 6:30pm Saturday.

The landfill would only operate on Sundays and public holidays in the case of emergencies.

Equipment

Construction and operation of the landfill footprint and development of each individual cell would typically utilise the following machinery:

- Excavator.
- Dozer.
- Water Cart.
- Compactor.
- Grader.
- Tipper Truck.
- Truck.
- Scraper.

Heavy machinery would be maintained offsite and mobilised on site when required. The water cart would be maintained on site as necessary.

Staff and Organisational Structure

Figure 10 indicates the proposed staffing and organisational structure proposed for the operation of the landfill. The structure may be amended to suit the operational requirements of the site as required.

All staff would be made aware of the manner in which the site is to be operated and managed to ensure compliance with the LEMP, the consent conditions and the EPL for the site.

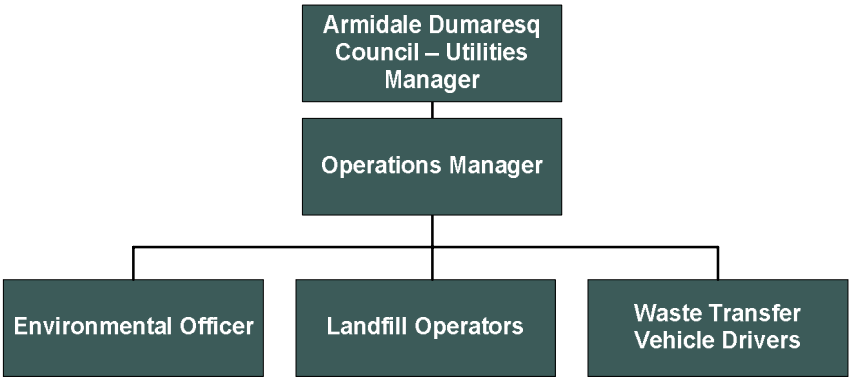

Figure 10: Proposed Staffing and Organisational Structure

Landfill Operation Responsibility

The day to day operation of the proposed landfill facility would be the responsibility of the Operations Manager. The Operations Manager would be employed by Council or another party on behalf of Council. The operators would be responsible for the daily operation of the landfill to ensure compliance with the landfill licence, development conditions, all relevant regulations and the LEMP. The Operations Manager would also ensure that all of the monitoring, repairs and maintenance are carried out at the site in accordance with the LEMP.

This structure may differ, should Council elect to use a Contractor to manage the site on its behalf or operate the waste transfer vehicles. A Contractor would work under a contract stating strict key performance indicators to ensure correct operation.

Litter and Illegal Dumping Control

The final LEMP would include control measures to prevent litter and illegal dumping. Litter would be controlled on a day to day basis by using a combination of the following measures:

- Portable litter fences around the tipping face.
- Ensuring that all wind blown litter that leaves the site is retrieved.
- Regular inspection of all litter fences, perimeter fences and gates.
- Clearing of litter from fences and gates as required.
- Signage of entry and exit gate to advise transport operators that they can be fined for any litter on public roads resulting from their improper transport of waste.

The following covering procedures would be implemented at the landfill site:

- Waste would be covered at the end of each day's landfilling activities with 150mm of cover material approved by DECCW or alternative daily cover as approved by DECCW.
- Removal or puncturing of daily cover prior to placement of waste.
- Application of intermediate cover to a depth of 300mm over surfaces which will be exposed for more than 90 days.
- Removal or puncturing of intermediate cover prior to placement of waste.

The final operating procedures would address illegal dumping and may include signage around the perimeter of the site.

Waste Accepted at the Landfill

The total volume of material to be landfilled at the proposed landfill facility would be approximately 15,000 tpa. In order to allow the initial commencement of landfilling operations, it is Council's intention to seek an operating licence to landfill General Solid Waste (putrescible) material, including putrescible material and other general waste recognised by the DECCW under this "putrescible" definition for general solid wastes. It is Council's longer term objective, however, to begin operating the landfill, as soon as possible in the future (and then until final closure) only as a General Solid Waste (non-putrescible) facility, when appropriate additional off-site sorting and/or treatment technologies are able to be procured and successfully employed.

Schedule 1 of the *POEO Act* contains the following definition of General Solid Waste (putrescible) materials:

> *general solid waste (putrescible) means waste (other than special waste, hazardous waste, restricted solid waste or liquid waste) that includes any of the following:*
>
> *a) household waste containing putrescible organics,*
>
> *b) waste from litter bins collected by or on behalf of local councils,*
>
> *c) manure and nightsoil,*
>
> *d) disposable nappies, incontinence pads or sanitary napkins,*
>
> *e) food waste,*
>
> *f) animal waste,*
>
> *g) grit or screenings from sewage treatment systems that have been dewatered so that the grit or screenings do not contain free liquids,*
>
> *h) anything that is classified as general solid waste (putrescible) pursuant to an EPA Gazettal notice,*
>
> *i) anything that is general solid waste (putrescible) within the meaning of the Waste Classification Guidelines,*
>
> *j) a mixture of anything referred to in paragraphs (a)–(i).*

It should be noted that car tyres are not currently accepted for landfill disposal at the Armidale Waste Management Centre. Car tyres must therefore be disposed by other methods, off site. As car tyres are not part of the existing waste stream at the Armidale Waste Management Centre, it is unlikely the proposed landfill facility would accept or dispose of any car tyres.

All greenwaste collected by Council would continue to be composted or mulched at the existing landfill at the Armidale Waste Management Centre and made available for re-use. Greenwaste would not be disposed of in the proposed landfill facility, except whenever significantly contaminated loads of materials are collected (i.e. contaminated by the inclusion of "foreign" or otherwise uncompostable matter / objects).

The Armidale Waste Management Centre would continue to separate all clean, recyclable material from other wastes that would be directed to landfill. All potentially recyclable material that is separated from other wastes would continue to be recycled, including glass and plastic bottles, all recyclable metals and "E-waste" (i.e. electronic waste, mainly consisting of obsolete home or office computing hardware).

Waste would be received at the proposed landfill facility in trucks travelling from the Armidale Waste Management Centre. All trucks heading for the proposed landfill facility would first be weighed at the Armidale Waste Management Centre weighbridge and records would be kept and filed in accordance with the DECCW's required waste regulatory system (see **Section 5.6**).

It is estimated that the traffic flow to and from the proposed landfill facility would be a minimum of approximately six vehicles per day. This estimate is based on the following:

- Three waste transportation vehicles, transporting waste from the Waste Management Centre to the proposed landfill for disposal.
- One heavy truck transporting cover material to the landfill.
- Two staff (passenger) vehicles.

Outside normal operational hours the perimeter fence of the landfill facility would be locked at the entrance gate to prevent any vehicles from entering and exiting the landfill without generating a permanent record.

5.6 Waste Screening

5.6.1 Procedures for Acceptance of Waste at the Armidale Waste Management Centre

The principal waste screening process would occur at the Armidale Waste Management Centre. The waste screening process would involve:

- Clear identification and classification of waste materials prior to arrival at the WTS.
- Use of a fully approved weighbridge (at the WTS), calibrated and stamped annually, to accurately record weights of waste delivered.

The generator, transporter or Armidale Waste Management Centre staff would be requested to assess and classify the material prior to its arrival at the proposed landfill facility. The above information would be reviewed by the Operations Manager, including a check of analysis used to assist in the classification. Any queries would be referred back to the generator, transporter or Armidale Waste Management Centre staff.

The weighbridge (at the WTS) would record the following on the site database:

- Date.
- Time.
- Vehicle Registration.
- Customer.
- Gross weight, tare weight, net payload.
- Waste type.

Note: the tare weight of all vehicles (i.e. the weight of an empty vehicle) used to transport waste from the transfer station to the proposed landfill would be known and kept on record.

After vehicle / waste details have been entered at the WTS, the weighbridge operator would direct drivers from the weighbridge to the proposed landfill facility on Waterfall Way. Vehicles would be directed by the landfill operators to the appropriate tipping area. Once the vehicle has tipped its load at its specified location, the loads would be checked for conformance. Any non-conformance would be reported to the Operations Manager and the landfill operator would then address the particular disposal requirements for that load type. All deposited waste would be covered in accordance with the procedures specified in the LEMP.

5.6.2 Inspection at Disposal Point

The landfill operators would be trained to recognise wastes that are not permitted to be accepted at the site. A list of non-conforming wastes and the methods recommended for handling or movement would be developed prior to landfilling commencing at the site and will form part of the routine working procedures of the operator.

If the operator is in any doubt as to the contents of any load, the load would be left in place and the Operations Manager consulted. In the event that part of, or all of the load is to be rejected, the load would be isolated, loaded onto vehicles, returned to the Armidale Waste Management Centre and stored within skips until the appropriate action for correct disposal is determined.

The placement of waste would be monitored at all times to ensure that no liquid, hazardous or medical waste is placed in the landfill. This would be facilitated by:

- Waste checking procedures at the existing WTS and again at the proposed landfill facility to identify non-conforming wastes.
- Systems and procedures to record weights, waste type and disposal location.
- Grid system covering the site to identify waste tipping areas for future reference.

Non conformance would be recorded in the *Environmental Monitoring Annual Report* as part of the LEMP.

5.7 Environmental Management

5.7.1 Landfill Environmental Management Plan (LEMP)

A LEMP would be developed for the proposed landfill facility in accordance with the NSW EPA *Environmental Guidelines: Solid Waste Landfills* (1996). The objective of the LEMP will be to ensure that a high level of environmental performance is maintained throughout the life of the landfill. The LEMP and the management strategies outlined therein are intended for review on an annual basis or where significant changes to site operation are proposed. Where necessary, the LEMP would be modified as new and more appropriate strategies and technologies become available.

The LEMP would contain, but would not be limited to, the following:

- Statutory and other legal requirements.
- Project Site descriptions, layout, regional geology, hydrogeology, physical setting.
- The proposed landfill facility preliminary design, objectives and operational framework.
- Key environmental, operational and rehabilitation issues.
- Environmental management responsibilities and training.
- Monitoring and reporting provisions.

Prior to construction a Construction Environmental Management Plan (CEMP) would be prepared and would form part of the LEMP. The LEMP would also identify the specific environmental management measures which would govern operations of the proposed landfill facility. Some of these management measures are discussed below and detailed in **Section 8.0** of this EA.

A draft LEMP is attached as **Appendix B** and is further discussed in **Section 9.2.3**.

5.7.2 Odour Management

Odour would be managed at the proposed landfill facility by the placement of daily cover over the active tipping area. In addition, waste loads received at the proposed landfill facility that are particularly odorous may require the application of cover as soon as the load has been tipped, rather than at the end of the day. Leachate in the leachate pond would be managed to ensure that the leachate pond does not become a source of excessive odour.

Odours created at the proposed landfill facility would be managed according to the Benchmark Technique Number 36 –Odour Controls. An assessment of odour impacts is presented in **Section 8.5.3**.

5.7.3 Dust Suppression

Dust would be managed at the site by dust suppression methods including a wheel wash, sealed access road, covered loads on trucks, water spraying of the perimeter road and limited truck movements and speeds. At the tipping face, after waste is tipped and compacted, a water cart would be used as required to minimise dust generated. The exposed area of waste within the landfill would be covered at the conclusion of each day's waste transfer using soil, plastic covers or shredded green waste, or other approved alternative daily cover material. An assessment of dust impacts is presented in **Section 8.5.3**.

5.7.4 Stockpile Management

All excavated material would be stockpiled in designated stockpile areas at the Project Site. The proposed landfill facility has been conceptually designed so that the final landform would complement the existing topography of the area with the highest point of the final landfill landform, i.e. the stockpiles, being approximately 14 metres above the base of the existing ground level.

Stockpiles would be managed through the use of sedimentation and erosion control measures during both the construction and operational stages of the project, as detailed in the LEMP. These control measures would include:

- Sediment fencing.
- Drainage swales.
- Bunding around stockpiles.
- Detailed design would confirm the exact location and dimensions of the stockpiles.

5.7.5 Environmental Monitoring

Monitoring of all facets of the proposed landfill facility including air, water, noise and waste would form an integral part of the LEMP as it:

- Provides early warning of any possible contamination or breach of the capping layer.
- Ensures that the strategies and plans detailed in the LEMP are being adhered to, and if not, sets out the appropriate corrective action.
- Allows for problems or issues to be highlighted that may require the LEMP to be changed, to ensure continued effective management of the site, in line with the environmental goals.
- Provides necessary facts to fulfil DECCW reporting requirements.

A complete outline of monitoring programs would be included in the LEMP. Environmental Management and Monitoring is discussed further in **Section 9.0**.

5.7.6 Occupational Health and Safety

An OH&S Management System would be established for the proposed landfill facility. Site employees would be inducted to the OH&S Management System prior to commencing work. OH&S management is discussed further in **Section 9.2.5**.

6.0 Planning Framework

This section identifies the environmental planning controls and legislative requirements at Commonwealth, State and local levels that apply to the proposed landfill development.

The planning approval process for this project is principally governed by the requirements of Part 3A of the NSW *EP&A Act* and *State Environmental Planning Policy (Major Projects) 2005* (*SEPP 2005*). A full discussion of the whole legislative framework that is relevant to this project is provided below, as well as an outline of other strategic, policy and statutory considerations that must be addressed.

6.1 Commonwealth Legislation

6.1.1 Environmental Protection and Biodiversity Conservation Act 1999

The *Environmental Protection and Biodiversity Conservation Act 1999* (*EPBC Act*) governs the Commonwealth EA process and provides protection for matters of National Environmental Significance (NES), which include:

- Nationally threatened species and ecological communities.
- Australia's World Heritage properties.
- Ramsar wetlands of international importance.
- Migratory species listed under the *EPBC Act* (species protected under international agreements).
- Commonwealth marine areas.
- Nuclear actions, including uranium mining.
- National heritage.

The *EPBC Act* defines proposals that are likely to have an impact on matters of NES as a "controlled action". Proposals that are, or may be, a controlled action are required to be referred to the Commonwealth Minister for the Environment and Heritage for a determination as to whether or not the action is a controlled action. If the action is considered to be a controlled action, either a separate approval process would be required for those aspects of the proposal that form part of the controlled action or the Commonwealth Minister may declare that the assessment under the NSW *EP&A Act* is sufficient and therefore a separate assessment would not be required.

On 3 August 2007 details of the proposal were referred to the (former) Commonwealth Department of Environment and Water Resources (DEWR, now DEWHA), requesting that a determination be made under the *EPBC Act*. DEWR responded on 1 October 2007, declaring the project to be a "controlled action" under the *EPBC Act* and indicating that the proposal has the potential to have a significant impact on the following:

- World Heritage Properties (pursuant to Sections 12 and 15A of the *EPBC Act*).
- National Heritage Places (pursuant to Sections 15B and 15C of the Act).

The determination considered that the proposed action has the potential to have a significant impact on the downstream values of the Oxley Wild Rivers National Park which is part of the GRAWHA. These values and further discussion on the heritage significance of the Oxley Wild Rivers National Park are provided in **Section 8.12**.

The proposed development therefore requires approval under the *EPBC Act*. Assessment requirements of the Commonwealth have been incorporated into the formal requirements of the NSW State Government. While the State process is the primary mechanism for assessment, the proposal will ultimately be reviewed for approval at both State and Commonwealth levels on this basis.

In accordance with subsection 74(3) of the *EPBC Act*, the referral, together with an invitation for public submissions, was published on the Commonwealth Department's web site for 10 business days, commencing on 22 August 2007. A total of seven public submissions were received by the Department. Issues raised within the public submissions included the following:

- Potential for significant impacts on World Heritage values, National Heritage values and on listed threatened species, in the event of leakage of contaminated leachate from the landfill, or from floods overtopping bund walls and/or the leachate pond.
- Potential loss of integrity of the landfill lining system due to the effects of the mixture of chemicals that may collect within any landfill.
- Potential impacts of leachate on the quality of waters leaving the site and entering the Gara River.

In response to the submissions, a review of literature on landfill lining was undertaken. The literature review has since been updated and a Hydrogeological Assessment has been conducted to provide information about the long term performance of the landfill liner (refer **Appendix I**). The findings of the literature review and Hydrogeological Assessment are presented in **Section 8.4.4**.

6.2 State Legislation

6.2.1 Environmental Planning and Assessment Act 1979 and Environmental Planning and Assessment Regulation 2000

The *EP&A Act* and the *EP&A Regulation* provide the framework for the assessment and approval of developments proposed within NSW.

On 17 June 2005 Maunsell AECOM (now AECOM) submitted a "Form A" request for DGRs for an Environmental Impact Statement (EIS) to be prepared under Part 4 of the *EP&A Act* for the proposed landfill development. DGRs were issued to Maunsell AECOM by the (former) Department of Infrastructure Planning and Natural Resources (DIPNR) on 27 July 2005. Further DGRs for a Part 4 EIS were also issued by the (former) Department of Conservation (DEC) on 1 August 2005.

The Part 3A Amendments to the *EP&A Act* and related provisions commenced on 1 August 2005. Under the Part 3A amendments, the proposed landfill facility is now defined as a "resource recovery or waste facility" in Schedule 1 of *SEPP 2005*.

Schedule 1 of *SEPP 2005* defines "*Resource recovery or waste facilities*" as follows:

> *Development for the purpose of regional putrescible landfills or an extension to a regional putrescible landfill that:*
>
> *(a) Has a capacity to receive more than 75,000 tonnes per year of putrescible waste, or*
>
> *(b) Has a capacity to receive more than 650,000 tonnes of putrescible waste over the life of the site, or*
>
> *(c) Is located in an environmentally sensitive area of State significance.*

The proposed landfill facility has a design capacity to receive approximately 750,000 tonnes of putrescible waste over the facility's operational life of 50 years and is therefore classified as a waste facility for the purposes of Part 3A of the *EP&A Act*.

The development of the proposed landfill facility is therefore considered to be a Major Project and would now require the approval of the Minister for Planning under the requirements of Part 3A of the *EP&A Act*.

On 6 October 2005, Maunsell AECOM requested revised DGRs from the DoP for assessment of the proposal under the newly gazetted Part 3A requirements. Revised DGRs for the preparation of an EA document under Part 3A were issued on 25 October 2005, however as the DGRs expired within a period of two years and the proposal had not progressed to EA stage. A further request was forwarded to the DoP for the DGRs to be reissued. In response, the DoP in October 2007 requested a brief report to be provided to the DoP and other stakeholders providing the following:

- Description of the site.
- Project details.
- Aerial photos outlining the proposed location of the landfill.
- Surrounding site features.
- Details of the closest sensitive receivers, roads and the location of the Wild Rivers National Park;
- An environmental risk analysis.
- Confirmation of the current site zoning and a discussion of the permissibility of the proposed landfill development within that zoning.

Following subsequent liaison and correspondence with the DoP in 2008, Maunsell AECOM lodged a new, formal request with the DoP for a "Clause 6 Declaration" to be issued by the Minister for Planning, thus re-affirming the proposal's "Major Project" status (in accordance with Clause 6 of *SEPP* Major Projects). The Minster's Declaration was issued together with a request that a PEA document should be prepared and submitted to the DoP.

Planning Focus Meetings

Planning Focus Meeting (2005)

A PFM was held at the Armidale Dumaresq Council Chambers on 9 June 2005 to initially consult with the local community and other stakeholders and to seek appropriate feedback. Council's intention to prepare and lodge a DA under Part 4 of the *EP&A Act* was discussed at that meeting but this was not subsequently implemented.

Planning Focus Meeting (2008)

Following the submission of a PEA document to support Maunsell AECOM's request for issue of updated DGRs, a further PFM was held at Council's Waste Management Centre on 22 October 2008. The PFM followed an inspection of the Project Site. DoP subsequently issued updated DGRs under Part 3A of the *EP&A Act* on 20 November 2008.

6.2.2 Crown Lands Act 1989

The *Crown Lands Act 1989* provides for the management of Crown land resources in accordance with the principals of environmental protection, conservation and ecological sustainability, public use and enjoyment, as well as encouragement of multiple uses.

A licence is required under Section 34 of the Act to maintain an access easement over the TSR which is Crown land. The TSR provides access from Waterfall Way to the site, in addition to providing road access for land locked parcels adjacent to the site. Under Section 34A, the Minister is required to consult with a body managing the site, in this case the Rural Lands Protection Board (RLPB).

6.2.3 Heritage Act 1977

The purpose of the *Heritage Act 1977* (as amended 1998) (Heritage Act) is to protect and conserve non-Aboriginal cultural heritage including heritage items, sites and relics. The Heritage Act is administered by the NSW Heritage Office.

There are no listed heritage items likely to be impacted by the proposed works. Preliminary investigations have indicated that it is unlikely that an item of heritage significance would be significantly impacted as a result of the proposed work. Notwithstanding this, however, a full Indigenous and European heritage assessment has been undertaken as part of this EA. The results of this assessment are presented in **Sections 8.10** and **8.11**.

6.2.4 Native Vegetation Act 2003

The *Native Vegetation Act 2003* (*NV Act*) provides for the management and protection of native vegetation. The objectives of the *NV Act* include the management of native vegetation, prevention of broad-scale clearing, protection of native vegetation of high conservation value and encouragement of revegetation.

The Project Site contains native vegetation as defined by Section 6 of the *NV Act*. The proposed works would involve clearing of approximately 20 hectares of land.

The impacts of clearing have been assessed and are discussed in **Section 8.8**.

6.2.5 National Parks and Wildlife Act 1974

The *National Parks and Wildlife Act 1974* (*NP&W Act*) provides for the establishment, care control and management of national parks, historic sites, nature reserves, State conservation areas, Aboriginal areas and state game reserves.

The *NP&W Act* also provides for the protection of Aboriginal objects and the protection of native flora and fauna. As the project falls under Part 3A of the *EP&A Act*, once the proposal is approved under Part 3A, it is exempt from requirements for approvals required for impacting on Aboriginal sites under the *NP&W Act*. However, an assessment of the impact of the project on items protected under the *NP&W Act*, has been undertaken as part of this EA.

Potential impacts to native flora and fauna and the Oxley Wild Rivers National Park are considered in **Section 8.8** and **Section 8.12**. Potential impacts to Aboriginal places and objects and historic sites are considered in **Section 8.10**.

6.2.6 Noxious Weeds Act 1993

The *Noxious Weeds Act 1993* (*NW Act*) establishes a system for the identification and control of noxious weeds in NSW. Under the *NW Act*, the Minister for Primary Industries may declare a plant to be a noxious weed. Preliminary investigations have identified the occurrence of four noxious weed species within the broader areas surrounding the Project Site.

The potential impacts associated with the presence of noxious weeds have been assessed and are discussed in **Section 8.8**.

6.2.7 Protection of the Environment Operations Act 1997

The *POEO Act* relates to pollution management and waste disposal in NSW. The *POEO Act* also established requirements for licensing of certain activities that are listed in Schedule 1 of the Act. “Waste facilities” (specifically solid waste landfill or application sites, being landfill or application sites that receive over 5,000 tonnes per year of solid waste or solid waste and inert waste) are listed within Schedule 1 and therefore require that an EPL is obtained from the DECCW in order to operate the facility.

Clean stormwater collected at the proposed landfill facility would discharge into the unnamed intermittent creek to the north of the proposed landfill. Further consultation with the DECCW would be undertaken to confirm the need for a discharge consent licence.

A LEMP would be prepared to accompany the EPL applications. A draft LEMP has been compiled as part of this EA and is included in **Appendix B**.

6.2.8 Roads Act 1993

The *Roads Act 1993* (*Roads Act*) aims to define rights in relation to road use as well as the use of adjoining land, in addition to road function and classification. The functions and role of the RTA with respect to the carrying out of various activities on public roads are also defined under the *Roads Act*.

Pursuant to Section 138 of the *Roads Act*, consent is required to excavate or otherwise disturb the surface of a public road, remove or interfere with a structure, work or tree on a public road or connect a road (whether public or private) to a classified road.

In order to provide vehicular access to the proposed landfill site, various works will need to be undertaken that would impact on Waterfall Way. Waterfall Way is an “arterial road “, therefore consent is required from the RTA for the subject works.

6.2.9 Rural Fires Act 1997

The *Rural Fires Act 1997* (*Rural Fires Act*) provides for the prevention, mitigation and suppression of bush and other fires and the co-ordination of bush fire fighting and bush fire prevention activities throughout the State. The Act also seeks to protect human beings, property and the environment.

Under Section 63 of the *Rural Fires Act* the owner or occupier of land has the following duty:

> *to take the notified steps (if any) and any other practicable steps to prevent the occurrence of bush fires on, and to minimise the danger of the spread of bush fires on or from, that land.*

The proposed development includes approximately 61 hectares of compensatory native habitat and as such may be considered bushfire prone land. The potential impacts associated with the establishment of this habitat are discussed in **Section 8.0**.

6.2.10 Threatened Species Conservation Act 1995

The *TSC Act* provides for the conservation of threatened species, populations and ecological communities of animals and plants that are listed under the Act. The purpose of the Act is to:

- *Conserve biological diversity and promote ecologically sustainable development*
- *Prevent the extinction and promote the recovery of threatened species, populations and ecological communities*
- *Protect the critical habitat of those species, populations and ecological communities that are endangered*
- *Eliminate or manage certain processes that threaten the survival or evolutionary development of threatened species, populations and ecological communities*
- *Ensure that the impact of any action affecting threatened species, populations and ecological communities is properly assessed, and*
- *Encourage the conservation of threatened species, populations and ecological communities through co-operative management.*

Ecological investigations undertaken on the terrestrial ecology of the site have indicated the presence of several threatened species and an endangered ecological community (EEC). The direct and indirect impacts of the proposed works on all identified threatened species and EECs has been determined and are discussed in **Section 8.8** and **Appendix E**.

6.2.11 Water Management Act 2000

The *Water Act 1912* is gradually being repealed by the *Water Management Act 2000* (*WM Act*) with the only active provision relating to areas affected by Water Sharing Plans (WSP). There is no WSP in the vicinity of the proposed site; therefore the *Water Act 1912* does not apply to the proposed development.

In February 2008, the *WM Act* repealed the provision of the *Rivers and Foreshores Improvement Act 1948*, implementing provisions and approvals under the *WM Act* for development in the vicinity of water bodies.

The object of the *WM Act* is the sustainable and integrated management of the State's water for the benefit of both present and future generations. The *WM Act* sets out procedures for issuing water use approvals and water access licences and governs dealings with regard to these approvals and licences whereby they can be bought and sold in part or full. The Act also provides approvals and constraints for ‘controlled activities’ undertaken on waterfront land or land within 40 metres of a water body.

It is not intended to use surface water run-off, farm dams or groundwater sources to meet the proposed landfill facility water requirements. The sedimentation basin and dry basin would be used for environmental management purposes, namely runoff capture, dust suppression and stormwater and leachate quality control. Stormwater would be managed within the site in accordance with an approved Stormwater Management Plan.

The proposal does not require the extraction of water from a water source as defined by the Act and as such harvestable rights and the DWE Farm Dams Policy do not apply to this project. Consequently, the proposal does not call for a water use approval, water management work approval or activity approval under the provisions of the *WM Act*. The proposal is not defined as a controlled activity and is not located within 40 metres of a water body.

No approvals or permits are required under the *WM Act*.

6.3 State Environmental Planning Policies

6.3.1 State Environment Planning Policy (Infrastructure) 2007

State Environment Planning Policy (Infrastructure) 2007 (*SEPP Infrastructure*) aims to facilitate the effective delivery of infrastructure in NSW by improving regulatory certainty and efficiency through a consistent planning regime that entails the identification of the appropriate EA category and providing for consultation with relevant public authorities.

Section 121 of the *SEPP Infrastructure* states that:

> *"Development for the purpose of waste or resource management facilities, other than development referred to in subclause (2), may be carried out by any person with consent on land in a prescribed zone".*

The proposed landfill facility falls within the meaning of 'a waste or resource management facility' as defined by Clause 120 of *SEPP Infrastructure* because a:

> *"Waste or resource management facility means a waste or resource transfer station, a resource recovery facility or a waste disposal facility";*
>
> and a
>
> *"Waste disposal facility means a facility for the disposal of waste by landfill, incineration or other means, including associated works or activities such as recycling, resource recovery and other resource management activities, energy generation from waste gases, leachate management, odour controls and the winning of extractive material to generate a void for disposal of waste or to cover waste after its disposal."*

SEPP Infrastructure applies to the project as the development is zoned 1(a) General Rural under the Armidale Dumaresq LEP 2008 (LEP 2008). The prescribed zone that *SEPP Infrastructure* identifies under this Division, as relevant to this proposal, is the RU1 – Primary Production, or as stated in this Division, a land use zone that is equivalent to these zones. The Project Site is located within the 1(a) General Rural zone under LEP 2008, the objectives of which are commensurate with those of the RU1 – Primary Production zone. Accordingly, the proposed location of the proposed landfill facility is within a prescribed zone (or equivalent) and therefore satisfies this provision of *SEPP Infrastructure*.

Having regard to the above, the proposal is permissible with consent in accordance with the provisions of *SEPP Infrastructure*, and these provisions would prevail should an inconsistency arise with LEP 2008.

6.3.2 State Environmental Planning Policy No. 33 – Hazardous and Offensive Industry

State Environmental Planning Policy – Hazardous and Offensive Development (*SEPP 33*) – aims to provide definitions of hazardous and offensive industries, to ensure that in determining whether a development is a hazardous or offensive industry the consent authority has adequate information and that any measures proposed to be employed to reduce the impact of the development are taken into account.

The definitions most relevant to the proposal are set out in clause 3:

> *potentially hazardous industry means 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:*
>
> 1) to human health, life or property, or
>
> 2) to the biophysical environment,
>
> *and includes a hazardous industry and a hazardous storage establishment.*

> *potentially offensive industry means 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.*

Should it be found that a proposed development has the potential to cause risk to humans or the biophysical environment, or to emit a polluting discharge, then a Preliminary Hazard Analysis (PHA) is required.

The document, *Applying SEPP 33 – Hazardous and Offensive Development Application Guidelines* was prepared by the then DUAP in 1994 to provide assistance primarily to councils (but also to industry, consultants and other government agencies) in implementing *SEPP 33*. The *Guidelines* recommend a 'risk screening' method for determining whether a project is hazardous and provides guidance on assessing potentially offensive development projects. The screening process considers the class and volume of waste materials to be stored on the site and the distance of the storage area to the nearest site boundary.

The guidelines state that the first step to determining whether *SEPP 33* applies to a project is to consider whether the proposed use falls within the definition of 'industry' adopted by the planning instrument which applies. The proposed Project is defined as a resource recovery or waste facility (see **Section 6.1**) and therefore does not meet the definition of an industry. As such, the provisions of *SEPP 33* do not strictly apply and a PHA is not required.

6.3.3 State Environmental Planning Policy No. 44 – Koala Habitat Protection

State Environmental Planning Policy No 44 – Koala Habitat Protection (*SEPP 44*) applies to the Armidale Dumaresq LGA (refer Schedule 1 of *SEPP 44*). *SEPP 44* aims to

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

b) by requiring the preparation of plans of management before development consent can be granted in relation to areas of core koala habitat, and

c) by encouraging the identification of areas of core koala habitat, and

d) by encouraging the inclusion of areas of core koala habitat in environment protection zones.

The policy applies to land which is the subject of a Development Application (DA) and which is greater than 1 hectare in area. Whilst the proposal is not the subject of a DA, but of a Major DA, it is assumed that the policy is intended to apply to Part 3A projects and the provisions of the *SEPP* are therefore considered in relation to the proposal.

Part 2 of *SEPP 44* requires that prior to granting consent to a development on land subject to the policy, the Council must consider whether the land constitutes 'potential' or 'core' koala habitat. Core koala habitat is defined as areas which contain a resident koala population. Potential koala habitat is defined as areas of native vegetation where the trees of the type listed in Schedule 2 constitute at least 15% of the total number of trees in the upper or lower strata of the tree component. Should core koala habitat be identified, a Plan of Management is required to be prepared in respect of the habitat and any consent granted in respect of the land must be consistent with the Plan of Management.

An ecological investigation carried out by EA Systems in 2009 concluded that the site contained no 'potential' or 'core koala habitat' and therefore it is unlikely the area contains a resident koala population (refer to **Section 8.8.9** for further discussion).

As no 'core koala habitat' has been identified within the site or within any significantly affected surrounding areas, a Koala Plan of Management has not been prepared.

6.3.4 State Environmental Planning Policy No. 55 – Remediation of Land

The objective of *State Environmental Planning Policy No 55 – Remediation of Land* (*SEPP 55*) is to *"provide for a State-wide planning approach to the remediation of contaminated land. In particular, this Policy aims to promote the remediation of contaminated land for the purpose of reducing the risk of harm to human health or any other aspect of the environment"*. Clause 7 of *SEPP 55* requires a consent authority to consider whether the land is contaminated and whether it is suitable (or can be made suitable) for the proposed development.

Pursuant to Clause 7(2)(b) of *SEPP 55*, a consent authority must consider a report specifying the findings of a preliminary contamination investigation on the land where:

- A change of use occurs.
- Where that land has been previously used for an activity identified in Table 1 to the *Contaminated Land Planning Guidelines*.

Historically, the Project Site has been used for agricultural purposes and as such the proposed landfill facility represents a change of use. In addition, agricultural/horticultural activities are listed activities in Table 1 to the *Contaminated Land Planning Guidelines*.

Once final rehabilitation of the proposed landfill facility is complete, the land would retain its capability to be used as agricultural land.

6.4 Other Plans and Strategies

6.4.1 Regional Environmental Plans

It is noted that, as of 1 July 2009, Regional Environmental Plans (REPs) are no longer part of the hierarchy of Environmental Planning Instruments (EPI) in NSW. REPs have therefore not been included for discussion in this EA.

6.4.2 New England Draft Development Strategy

The *New England Draft Development Strategy* has been prepared on behalf of the former NESAC and applies to the subject site. The Draft Strategy outlines key land use policies and principles for the former NESAC LGAs and provides the planning context for the preparation of LEP provisions. The Draft Strategy has been formally endorsed by Council and has been forwarded by Uralla Shire Council to the DoP, for the Minster's consideration and approval.

The proposal is consistent with the draft land use Strategy for the region.

6.5 Local Context

6.5.1 Armidale Dumaresq Local Environmental Plan 2008 (LEP 2008)

Permissibility

The site is subject to the provisions of LEP 2008 which was gazetted on 15 February 2008. Pursuant to Clauses 10 and 14 of LEP 2008, the subject site is zoned 1(a) General Rural.

Clause 14(3) of LEP 2008 permits any development that is not specified in Clauses 14(2) or 14(4) of LEP 2008 but only with development consent.

Under Clause 4 of LEP 2008 the proposed landfill facility falls within the meaning of a '*waste disposal facility*', which is defined as:

"a building or place used for the disposal of waste by landfill, incineration or other means, including such works or activities as recycling, resource recovery and other resource management activities, energy generation from gases, leachate management, odour control and the winning of extractive material to generate a void for disposal of waste or to cover waste after its disposal."

As the proposed landfill facility is defined as a 'waste disposal facility', it is permissible with development consent, pursuant to Clause 14(3) of LEP 2008.

Zone Objectives

Clause 13(6) requires the consent authority to have regard to the objectives for development in a zone when determining an application in respect of land in that zone. In this regard, Clause 14(1) of LEP 2008 has the following objectives:

(a) To encourage sustainable primary industries now and into the future.

(b) To prevent the fragmentation of agricultural land.

(c) To avoid land use conflict.

(d) To allow for non-agricultural uses that will not restrict the use of other rural land in the locality for agricultural purposes.

(e) To protect natural ecological systems and processes.

Council would adopt best practice in the development of the proposed landfill facility to continue the high-rate of resource recovery at the WTS. The Project Site was selected after a comprehensive site selection process (refer **Section 4.0**) and would result in minimal land fragmentation or land use conflict.

The landfill design, in conjunction with the implementation of appropriate mitigative measures and responsible operation, would ensure that the proposed facility would not restrict the use of other rural land in the locality for agricultural purposes. The employment of a suite of management measures would ensure the proposal has minimal impact on natural ecological systems and processes. In this regard, the proposed landfill facility is considered to be consistent with the zone objectives for the 1(a) General Rural zone.

Subdivision provisions

The proposal includes the subdivision of part Lot 2 in DP 253346, part Lot 1 in DP 820271 and part Lot 1 in DP 253346. The portions of land would be acquired by Council and consolidated to facilitate the construction and operation of the proposed landfill facility.

Clause 14(7)(a) of LEP 2008 states that *"land within this zone may be subdivided but only with consent"*. Subdivision of the land is permissible development within the 1(a) General Rural zone with development consent.

Water cycle management provisions

Clause 14(15) of LEP 2008 states the following:

If a development will generate sewage and the land, building or work is not connected to a reticulated water supply or sewer system, consent must not be granted unless the consent authority has taken into consideration an integrated water cycle management plan and is satisfied that:

(f) the proposed water supply is adequate,

(g) the quality and quantity of surface water, especially stream flow, is maintained and if possible enhanced, and

(h) any adverse impact of water use on environmental and human health is minimised.

The proposal includes a dirty water capture and conveyance system for the site and a leachate collection and conveyance system that treats all potential waste within the facility.

Section 8.0 and other relevant parts of this EA discuss and detail proposed management measures, including the preparation of a WLMP as part of the LEMP.

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7.0 Consultation

This section discusses the consultation undertaken during the preparation of this EA. A summary of the consultation tasks undertaken in relation to the site selection is presented in **Section 4.2.4**.

7.1 Consultation Approach

7.1.1 Consultation Objectives

The objectives of consultation, during the preparation of the EA, were to:

- *Ensure an open, accountable and transparent community involvement process for the development of a proposed landfill facility for the Armidale region;*
- *Ensure that accurate information was disseminated to the community, aligning with the development stages for the proposed landfill facility;*
- *Ensure all potentially affected property owners and interested stakeholders were provided with sufficient information about the project and the likely impacts so that they could provide informed input;*
- *Enable the identification of issues that are relevant to the community at all development stages of the proposal; and*
- *Manage community expectations by clearly outlining the decision making process and how their inputs would be used.*

7.1.2 Stakeholder Groups

Several stakeholder groups were identified and are shown in **Table 17**. It should be noted that some individuals overlapped across different stakeholder groups.

Table 17: Stakeholder Groups

Stakeholder Group	Composition of the Group
Group 1: Primary Stakeholders	Including landowners nearest to the proposed landfill site as well as residents along the required transport route (i.e. for the movement of waste from the WTS at the Armidale Waste Management Centre to the proposed landfill facility).
Group 2: The Wider Community	Interested individual persons within nearby areas, including all of the Armidale-Dumaresq, Guyra, Uralla Shire and Kempsey Council areas.
Group 3: Special Interest Groups	Community, environmental interest groups, non-government organisations, political groups or elected members.
Group 4: Government Agencies	All relevant local, State and Commonwealth government agencies.
Group 5: Local media	Representatives of the media who may have an interest in the project, focussing on potentially controversial aspects, and who could contribute to community awareness and development of perceptions about the project.

7.1.3 Key Messages

Council required that the focus of any messages delivered to stakeholders should be of an informative and advisory nature and should relate directly to the issues and impacts associated only with the development of the proposed landfill. Council stipulated that all consultation activities conducted on its behalf should focus on the development of solutions that would address issues and alleviate impacts.

The following key messages were the focus of all communications with stakeholders throughout the development of the proposed landfill project:

- Provide accurate information about how fully engineered and lined landfills actually work.
- Include realistic details on what the impacts of the proposed landfill facility are likely to be.
- Communicate a clear message about the issues that are relevant to each stakeholder group and that facilitate a clear understanding.
- Inform each stakeholder group in appropriate detail about how the proposed design, operation and management of the landfill would alleviate the identified impacts and other potential issues.

7.1.4 Stakeholder Management

Correspondence from all staff involved in the development and planning of the proposed landfill was recorded and logged, including letters, emails and the results of relevant phone calls. This approach is considered essential to ensure that only consistent information and details are relayed to stakeholders and the wider community. Issues identified via this process have been considered in this EA and addressed within the concept designs for the construction and/or the various management plans for the operation of the proposed landfill facility. Appropriate records of all correspondence have also been maintained for both legal reasons and for quality assurance.

EA Systems were engaged to maintain a consultation database that logged incoming queries, stakeholder details, actions and all outgoing correspondence. The following information is recorded within that database:

- Contact details – incoming / outgoing, date, contact method and reference identification.
- Stakeholder group (refer **Table 7-1**).
- Inclusion on a mail out list. Mail outs were used to provide information to individual stakeholders who expressed their interest in being updated with respect to the ongoing progress of the landfill proposal;
- A summary of all major issues raised.
- Outgoing Correspondence Register. This Register records all actions relating to each logged item, including who responded and appropriate links to copies of all relevant correspondence.

All written correspondence received by either EA Systems or AECOM was forwarded to Council, marked to the attention of the General Manager, to also facilitate appropriate record keeping in accordance with Council's records management procedures. Similarly, copies of any relevant correspondence received directly by Council were forwarded to EA Systems for input to the consultation database.

7.2 Government Consultation

Consultation with NSW and Commonwealth government departments was carried out to obtain the requirements for the EA and identify potential issues that should be addressed. A summary of the issues raised and how they have been addressed is presented in **Table 7-4**.

7.2.1 Initial Planning Focus Meeting (2005)

As discussed in **Section 6.2** a PFM was held on 9 June 2005. The purpose of the PFM was to enable a clear and open discussion with NSW government departments to identify the key issues of the proposal and how to address them. The PFM was chaired by a representative from the former NSW DIPNR.

The PFM was attended by representatives from the following departments, agencies and councils:

- Armidale-Dumaresq Council.
- Maunsell AECOM.
- DIPNR.

- DEC/EPA Armidale.
- Uralla Shire Council.
- Kempsey Shire Council.

Council's proposed landfill facility was discussed at that meeting, along with its intention to lodge a DA under Part 4 of the *EP&A Act* for the proposal. The intention to prepare and lodge a DA under Part 4 was not subsequently implemented.

7.2.2 Second Planning Focus Meeting (2008)

Following the submission of a PEA to support a request for the issue of updated DGRs, a further PFM was held at Armidale Waste Management Centre on 22 October 2008. The PFM followed an inspection of the Project Site for all PFM participants. DoP subsequently issued updated DGRs under Part 3A of the *EP&A Act* on 20 November 2008. The updated DGRs considered and included the requirements of all other relevant NSW state government agencies, as well as requirements of DEWHA. The new DGRs have formed the basis for preparation of this EA document and are included as **Appendix A**.

Representatives from the following departments, organisations and councils attended the second PFM:

- DoP.
- DECC.
- DWE
- DEWHA.
- Armidale-Dumaresq Council.
- AECOM.

Issues raised by the different parties during the PFM included:

- AWT – Council's aim is to remove all putrescible wastes prior to disposal in the landfill.
- Ground water – management, impacts, licensing, monitoring and interception.
- Leachate management.
- Heritage values – indigenous and non-indigenous.
- Surface water management, impacts and monitoring.
- Noise.
- Odour.
- Soils and Geology.
- Biodiversity offsets and management.
- Visual impacts.
- Landuse changes.
- GHG emissions.
- Harvestable rights.
- Design and control for culverts and stream crossings.
- Whether further extension of the existing landfill is feasible.

7.2.3 Government Departments

Other government departments were also consulted in order to clearly identify any issues that should be addressed during the preparation of the EA. This consultation requirement is noted in the DGRs (**Appendix A**).

A letter and the preliminary concept design drawings were provided to government departments in May 2006 and November 2008. The following departments were contacted in 2006:

- DEC.
- DNR.
- Border Rivers - Gwydir Catchment Management Authority.
- Northern Rivers Catchment Management Authority.
- DPI (Fisheries and Agriculture).

- Uralla Shire Council.
- Guyra Shire Council.
- RLPB.

The following departments were contacted in 2008:

- DECC.
- DPI.
- DWE.

A summary of the outcome of consultations with the government departments is detailed in **Table 7-4**. Copies of correspondence received from the above noted government departments are included in **Appendix A**.

7.2.4 Additional Consultation with Government Departments

Consultation with the RLPB and the environmental division of the Department of Lands (Armidale office) was undertaken with the intention of establishing whether items of non-indigenous heritage significance existed in the study area. The results of the consultations are contained in **Section 7.0**.

Consultation with the DEWHA was carried out and a referral was submitted. Details are provided in **Section 7.5**. DEWHA assessment requirements were provided to the DoP for inclusion in the DGRs (2008).

7.3 Indigenous Heritage Consultation

Archaeological Surveys & Reports Pty Ltd (ASR) was commissioned to undertake an archaeological assessment for the Project Site in 2006, including consultation with the local Aboriginal community. At the time of ASR's investigation in 2006, attempts were made to contact the Armidale Local Aboriginal Land Council (LALC), however it was not operational and the past-Chairperson of the Armidale LALC could not be contacted. The Anaiwan Aboriginal Traditional Owners group was consulted and took part in a field investigation undertaken by ASR in May 2006.

Further advertising in the local print media and consultation with interested Aboriginal stakeholders was undertaken by ASR in 2009 in accordance with the requirements of DECCW's *Guidelines For Aboriginal Cultural Heritage Impact Assessment and Community Consultation*. Two responses to these advertisement were received, one from Nyakka Aboriginal Culture Heritage Corporation Archaeological & Cultural Heritage Consultants (current name of the group formerly known as Anaiwan Aboriginal Traditional Owners) and another from an individual respondent. The Nyakka group and the individual respondent have both been formerly registered as stakeholders of this project. In February 2009, ASR contacted both respondents to enquire whether either party wished to participate in a stakeholder meeting to discuss the project further. Both parties advised ASR that the information already provided was satisfactory and that a formal meeting of stakeholders would not be required.

In February 2010, a representative on the Board of the reappointed Armidale LALC was contacted and informed of the proposal, consultation and site investigations that have taken place (refer **Section 8.10)**.

Ongoing consultation with Aboriginal stakeholder groups would be undertaken during detailed design, to ensure that appropriate mitigation and management measures are documented in an Indigenous Heritage Management Plan and implemented during construction and operation of the proposed landfill facility.

7.4 Community Consultation

Community consultation was strategically planned and aimed to target stakeholder groups 1 to 3 (refer **Table 17**). The development stages for the proposed landfill facility were defined as:

- Detailed investigation.
- Preferred site selection.
- Concept design.
- EA exhibition period.
- Detailed Design.
- Construction.

Consultation was undertaken during the detailed investigation, site selection and concept design stages of the project to ensure continued stakeholder involvement. Various communication mediums were used to address stakeholder and community information needs as detailed in **Table 18.** Further opportunities for input to the project would be provided during exhibition of the EA.

Table 18: Communication Undertaken at Project Stages

Project Stage	Communication Strategy Components
Detailed Investigation	Website Update
	Newsletter No. 1
	Media Releases
	Contact with neighbouring properties and direct contact if necessary
Confirmed Site	Website Update
	Newsletter No. 2
	Confirmed Site Display
	Media Releases (newsletter and public display)
	Contact with neighbouring properties and direct contact if necessary
Concept Design	Website Update
	Newsletter No. 3
	Concept Design Display
	Media Releases (newsletter and public display)
	Contact with neighbouring properties and direct contact if necessary*
EA exhibition period	To be conducted in early 2010

7.4.1 Community Meetings

An introductory meeting was held on the 10 March 2005 with the Council Waste Management Committee and interested members of the public. The purpose of the meeting was to provide interested stakeholders with information on the process to be undertaken to gain regulatory approval and to develop the proposed landfill facility.

7.4.2 Newsletters

Newsletters were prepared to coincide with the key project stages. The newsletters were prepared as detailed in Table 19. All newsletters reiterated the importance Council places on consultation and feedback from the community in order for issues to be accurately identified and addressed in the EA. A website was established as a key resource for the community and full contact details were provided to enable feedback and direct contact with project staff.

Table 19: Community Information Prepared: Newsletters

Project Stage	Date Newsletter Released	Purpose of the Newsletter and Key Message
Newsletter No. 1 – Detailed Investigation	October 2005	• Information on the project background, including the site selection studies. • Investigations currently taking place. • Explanation of the EIS process. • The importance of community consultation and details of how to be involved in the consultation process. • Location map showing the proposed landfill in relation to the Gara River and Oxley Wild Rivers National Park. • Site Plan.
Newsletter No. 2 – Confirmed Site	April 2006	• Site investigations that were undertaken (surface and underground investigations). • Details on the understanding of the site's suitability for use as a landfill. • How to be involved in the consultation process. • The next steps required for the development of a proposed landfill facility. • Aerial photo detailing the proposed landfill footprint and study boundaries.
Newsletter No. 3 – Concept Design	October 2006	• Proposed concept design including waste management measures to prevent water pollution, which is a key environmental goal for the proposed landfill facility. • Staged development and the construction of cells over a period of approximately 50 years. • Construction details and the work involved to initially construct the proposed landfill. • Proposed operational details including the handling of waste on site. • Proposed landfill closure and rehabilitation details.
Newsletter No. 4	August 2007	• Details of the EA's progression. • Additional hydrogeological studies undertaken (predominantly groundwater sampling) to be included in the EA. • Map and details of the biodiversity offset plan. • Referral submitted to DEWR. • Revised project program
Newsletter No. 5	April 2008	• Update on changes to *EP&A Act* (Part 3A) and request for preparation of a PEA in order for the 2005 DGR's to be revised. • The determination of the referral submitted to DEWR, now known as DEWHA. On 1 October 2007, DEWHA determined the proposed landfill requires approval under the *EPBC Act* and declared the proposed project as a "Controlled Action". • Details of AWT initiatives.
Newsletter No. 6	November 2008	• Details of PFM Number 2 and site inspection. • Justification of the Controlled Action Declaration. • Details of the information contained in the PEA and the areas identified as needing further investigation.

7.4.3 Website

The Council website[1] enabled community access to accurate and up to date information. Information on the proposed landfill facility was first uploaded onto the Council website in October 2005. The website was intended to be comprehensive and provide downloadable access to all information that was made publicly available at the time.

The website was divided into the following weblinks in the Environmental Services section of the Council website:

- New Landfill Facility Background Information.
- New Landfill Facility Planning and Development.
- New Landfill Facility Community Involvement.

The following provides details of the information that was contained in each of the above noted weblinks. A copy of the downloadable information that was on the website is provided in **Appendix J**.

New Landfill Facility Background Information

The following was contained in this weblink:

- Details on the project background, which focussed on the project need in relation to declining landfill capacity at the existing Armidale landfill.
- Landfill siting studies – a link was provided to every landfill siting study that had been completed. The community were able to download copies of the consultant's reports relating to the location of the proposed landfill facility.
- A message from the Mayor, which re-emphasised to the community that

  Council's focus is to protect our environment, with its unique ecosystems and World Heritage areas for the enjoyment of future generations.

New Landfill Facility Planning and Development

The following was contained in this weblink:

- Landfill Project Schedule – a downloadable copy of the project programme. This programme was updated at various stages throughout the project, to reflect the current progress of the project.
- Concept Design – a description of concept design measures that are proposed to be implemented in the design of the proposed landfill facility to prevent and minimise damage to the environment. Of particular note was the protection of the water environment (both surface water and groundwater) which was identified at the initial stages of the project as a key community concern. A downloadable copy of the concept design was available.
- About the Proposed New Landfill – general details on the operational aspects of the proposed landfill facility, such as capacity, waste acceptance criteria, life of landfill and development area. General details on AWT were also presented.
- Development of the Landfill - details the work stages which will comprise major milestones in the development of the proposed landfill facility, i.e. preliminary site investigations; proposed site details; concept design; the EA; and landfill construction.
- What Is Currently Happening – an important weblink for the community to identify what studies were currently happening. This related mainly to on-site investigations, such as geotechnical drilling and flora and fauna studies.
- Map – a downloadable map which identified the Project Site in relation to surrounding key landmarks, including Waterfall Way, Gara River and Oxley Wild Rivers National Park.
- Approvals Process - details on the approvals process and requirements for assessment, including the approving authority (DoP) and the environmental legislation.
- Environmental Assessment – details on the EA being prepared, including the range of EAs (and investigations) being undertaken.

[1] http://www.armidale.nsw.gov.au/environment.html

New Landfill Facility Community Involvement

This weblink contained information on:

- The importance of community involvement, to ensure that a sustainable solution is achieved for the development of the proposed landfill facility through the mitigation of potential environmental impacts.
- Direct contact details.
- Downloadable copies of all newsletters.
- Downloadable copy of the feedback form for the community to provide comments on the proposed landfill.

7.4.4 Media Releases

Media releases were issued through the Council page in both the *Armidale Independent* and *Armidale Express* local newspapers.

7.4.5 Direct Contact

Various avenues for direct contact were made available to the community to ensure that all members of the community could provide feedback on the proposed landfill facility for use in the EA. Face-to-face contact carried out by EA Systems was facilitated through public displays.

Community Liaison Manager

To ensure consistency and ease of communications with the community, a Community Liaison Manager was appointed by EA Systems as the only point of contact throughout the scope of the proposed landfill development. Any unplanned meeting with the community out of work hours or impromptu visits by the members of the public were directed to contact the Community Liaison Manager, so that all community comments could be consistently handled by the project team.

Free Phone Number and Email

A free phone number was established in February 2006. A dedicated community email address was established in October 2005. The details were:

- Free phone number: 1800 103885
- Email: newlandfill@easystems.biz

The free phone number and email were manned by EA Systems. Any calls or emails received were logged in the consultation database. It is proposed to continue the operation of the free phone number and email during construction of the proposed landfill facility.

Feedback Form

A standardised feedback form was developed to enable collection of appropriate information from the community.

The feedback form enabled the collection of contact details and documentation of any issues or concerns. Responses from the feedback forms were logged in the consultation database. Feedback forms were downloadable from the Council website, available at Council reception and were provided at all public display meetings.

To put into perspective community concerns, the feedback form also requested very general information on the locality of the community member, that is, if they were adjacent to or near the Project Site; a resident in Armidale-Dumaresq LGA or surrounding areas, from a Special Interest Group (environmental interest groups, non-government organisations, elected members or other interested parties) or from elsewhere. An option was also available on the feedback form to allow the community member to be included on the mail out list.

Consultation Letters

Direct contact was made by EA Systems with all potentially affected/affected residents or property owners in the immediate vicinity of the site. The purpose was to advise the neighbouring community of hydro-geotechnical investigations that were going to be conducted on the Project Site which would require the use of a drilling rig.

Consultation letters were also posted to those interested members of the community who requested to be included on the mail out list, as identified in the consultation database.

7.4.6 Public Information Displays

EA Systems represented the project team at the public displays which were designed to inform and advise of progress to date in line with specific key project development stages. The feedback forms and newsletters were also available for collection by the community at the public information displays. The public displays were not intended to act as a forum or meeting.

The following public information displays were held:

- A display at the Armidale Australia Day celebrations, 26 January 2006 at the Armidale Racecourse.
- A display at the Wool Expo, 12-14 May 2006. The purpose of this display was to inform the rural community, outside of Armidale, of the proposed development.
- A display at Council reception area, manned between peak 'rush' times of 12 pm and 1 pm on 5 May 2006.
- A display was set up at the Sunday Markets in the Mall on Sunday 26 November 2006 . Newsletters 1, 2 and 3 and the Feedback forms were available to the public. In addition, A3 sized laminated maps and aerial photos (as published in the three newsletters) were provided to help with answering questions. The display here was intended to capture the 'wider' community, i.e. those that would simply wander past the stall and register an interest in the project. A head count over a five minute period was used to estimate daily attendance numbers and approximately 5,000 people were in attendance at the Sunday Markets in the Mall. A total of 41 people stopped and talked to EA Systems about the proposed landfill facility.

7.5 Key Issues Raised

A key requirement, as specified in both DGRs, was that the EA must clearly indicate issues raised by stakeholders during consultation and how those matters have been addressed in the EA. Based on consultations undertaken with government departments and the community, as detailed in the sections above, the following sections outline key issues identified. For each issue, cross reference to the relevant section in the EA has been provided.

7.5.1 Government Departments

The following table summarises correspondence received by Government departments. The key issues outlined here relate to the assessment requirements NSW Government departments require to be addressed in the EA. Copies of all government correspondence received are contained in **Appendix A**.

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Table 20: Summary of Criteria Raised by NSW Government Departments

Key Criteria	Raised by NSW Government Department	Assessment Requirement	Relevant Section of Environmental Assessment
EA Format	DoP, 20.11.08	Executive Summary.	See Executive Summary
		Detailed description of the project.	**Section 5**
		Risk Assessment of the potential environmental impacts of the project, identifying key issues for further assessment.	**Section 10**
		Detailed assessment of the key issues and any other significant issues identified in the risk assessment.	**Section 8**
		A SoC, outlining all the proposed environmental management and monitoring measures.	**Section 9**
		A conclusion justifying the project on economic, social and environmental grounds, taking into consideration whether the project is consistent with the objects of the *EP&A Act 1979*.	**Section 11** and **12**
		A signed statement from the author of the EA certifying that the information contained in the report is neither false nor misleading.	At front of EA
	DEWHA, 2008	Title of the action.	Project Application
		Full name and postal address of designated proponent.	Project Application
		Clear outline of the objective of the action.	**Section 1.3**
		Location of the action.	**Section 1.4**
		Background to the development of the action.	**Section 2**
		How the action relates to any other actions that have been, or are being, taken or that have been approved in the region affected by the action.	**Section 8.18**
		The current status of the action.	**Section 1.2**
		The consequences of not proceeding with the action.	**Section 4.1.2**

Key Criteria	Raised by NSW Government Department	Assessment Requirement	Relevant Section of Environmental Assessment
	DoP, 20.11.08	Details of waste strategy for the region, and the need for the project within this broader strategic context.	**Section 2.1**
		Details of alternatives considered, including not proceeding and expansion of existing landfill.	**Section 4**
		Plans of the proposed landfill, leachate management systems and associated infrastructure.	**Section 5**
		Proposed rehabilitation of the landfill.	**Section 5**
	DEWHA, 2008	Description of all components of the action.	**Section 5**
		Precise location of any works to be undertaken, structures to be built or elements of the action that may have relevant impacts.	**Section 5**
		How the works are to be undertaken and design parameters for those aspects of the structures or elements of the action that may have relevant impacts.	**Section 5**
		Description of any feasible alternatives to the controlled action that have been identified through the assessment and their likely impact.	**Section 4**
Environmental Impact Assessment	DoP, 20.11.08	A description of the existing environment, using sufficient baseline data.	**Section 8**
		An assessment of the potential impacts of all stages of the project, including any cumulative impacts, taking into account any relevant policies, guidelines, plans and statutory provisions, including the *Environmental Protection and Biodiversity Conservation Act 1999* and associated regulations.	**Section 8**
		A description of the measures that would be implemented to avoid, minimise, mitigate, rehabilitate/remediate, monitor and/or offset the potential impacts of the project, including detailed contingency plans for managing any potential significant risks to the environment.	**Section 8**
	DEWHA, 2008	Description of relevant impacts of the action on matters of national environmental significance.	**Section 6.1.1**
		Detailed assessment of the nature and extent of likely short and long term impacts.	**Section 8**

Key Criteria	Raised by NSW Government Department	Assessment Requirement	Relevant Section of Environmental Assessment
		Whether any relevant impacts are likely to be unknown, unpredictable, or irreversible.	**Section 8**
		Analysis of the significance of the relevant impacts.	**Section 8**
		Any technical data and other information used or needed to make a detailed assessment of the relevant impacts.	**Section 8** and Appendices
Waste Management	DoP, 20.11.08	Cell and landfill design and integrity.	**Section 5.2**
		Source, quantity and type of waste.	**Section 2.2, 2.3, 2.4**
		Waste management, classification, receival, separation and stockpiling.	**Section 2.2**
		Input rates into landfill.	**Section 2.4**
		Litter and feral animal control.	**Section 8.8**
	Department of Primary Industries, 29.10.08	The planning and provision for a Drum Muster Depot for collection of chemical drums will support agricultural industries and the environment through responsible collection and recycling of chemical drums.	**Section 2**
	Department of Environment and Climate Change, 4.10.08	Landfill must be assessed against environmental and Benchmark Techniques in the document *Environmental Guidelines: Solid Waste Landfills* (NSW EPA 1996).	**Section 5** and LEMP **(Appendix B)**
		Litter and feral animal control.	**Section 8.8**
Surface Water	DoP, 20.11.08	Water balance for site detailing water sources and quantity, water consumption and recycling, and estimated quantity of leachate and stormwater.	LEMP (**Appendix B)**
		Surface water impacts including potential impacts on the Gara River and Oxley Wild Rivers National Park.	**Section 8.3** and **8.12**
		Proposed leachate management measures including pond management and remediation measures, and potential risks on the Gara River and the Oxley Wild Rivers National Park.	**Section 8.12**, LEMP (**Appendix B)** and **Appendix I**

Key Criteria	Raised by NSW Government Department	Assessment Requirement	Relevant Section of Environmental Assessment
		Proposed erosion and sediment controls and stormwater management systems.	**Section 8.1.3, 8.3.3** and LEMP (**Appendix B)**
		Surface water monitoring program.	LEMP (**Appendix B)**
		Water access and harvestable rights.	**Section 6.2.11**
		Flooding impacts.	**Section 8.3**
	Department of Primary Industries, 29.10.08	Appropriate containment of refuse, rubbish, etc. to ensure no net impact on receiving waters.	**Section 8**
		Appropriate erosion and sedimentation controls along drainage lines in place to control sediment entering waterways after the construction phase is completed, and until the site has been fully stabilised to ensure that there is no net increase in runoff and no reduction in water quality of receiving waters.	**Section 8.1.3, 8.3.3** and LEMP (**Appendix B)**
		Provision of a vegetated buffer zone around the disturbed area and re-instatement of riparian vegetation where possible along water courses and drainage lines to ensure protection of water quality.	**Section 8.8** and LEMP (**Appendix B)**
	Department of Environment and Climate Change, 4.10.08	Conceptual design and calculations for stormwater management that is consistent with the requirements of Landcom's Managing Urban Stormwater: Soils and Construction (2004).	**Section 5** and LEMP (**Appendix B)**
		Any proposed discharge should be considered in terms of NSW Water quality and river flow objectives and utilising the Australian and New Zealand *Guidelines for Fresh and Marine Water Quality* (2000).	**Section 8.4**
	DEWHA, 2008	Detailed monitoring program for surface water quality on the site at key areas adjacent to the perimeter of the site and at appropriate locations downstream on the Gara River to: establish baseline data; detect water quality changes over time; identify critical water quality values; identify remedial actions; and identify a period of review and evaluation of effectiveness.	LEMP (**Appendix B)**

Key Criteria	Raised by NSW Government Department	Assessment Requirement	Relevant Section of Environmental Assessment
	Department of Water and Energy, 4.10.08	Sources of surface water.	**Section 8.3**
		Details of stream order (Strahler System).	**Section 8.3**
		Proposed surface water extraction – purpose, location of dams, pumps, diversions, cuttings, levees.	No surface water extraction – **Section 5**
		Proposed development or diversion works.	**Section 5**
		Evaluation of proposed method of excavation, construction and material placement.	**Section 5**
		Potential impacts in terms of vegetation, sediment movement, water quality and hydraulic regime.	**Section 8.3, 8.4** and **8.8**
		Design features and measures incorporated to guard against long term disturbances to natural hydraulic regime and sediment movement patterns and identification of riparian buffers.	**Section 5** and **8.3**
		Impact on water quality and remedial measures proposed.	**Section 8.3** and **8.4**
		Details of any existing or proposed water management structures or dams.	**Section 5** and **8.3**
		Provision of a sustainable water supply for the proposed project.	**Section 5.4.1**
Groundwater	DoP, 20.11.08	Groundwater impacts including potential impacts on the Gara River and Oxley Wild Rivers National Park.	**Section 8.4.4** and **8.12**
		Proposed leachate management measures including pond management and remediation measures, and potential risks on the Gara River and the Oxley Wild Rivers National Park.	**Section 8.4.4**
		Groundwater monitoring program.	**Section 8.4** and LEMP (**Appendix B)**
		Water access and harvestable rights.	**Section 6.2.11**
		Flooding impacts.	**Section 8.3**

Key Criteria	Raised by NSW Government Department	Assessment Requirement	Relevant Section of Environmental Assessment
	DEWHA, 2008	Detailed monitoring program for groundwater quality on the site at key areas adjacent to the perimeter of the site and at appropriate locations downstream on the Gara River to: establish baseline data; detect water quality changes over time; identify critical water quality values; identify remedial actions; and identify a period of review and evaluation of effectiveness.	**Section 8.4** and LEMP (**Appendix B)**
	Department of Water and Energy, 4.10.08	Predicted highest groundwater table at the development site.	**Section 8.4**
		Works likely to intercept, connect with or infiltrate groundwater sources.	**Section 8.4**
		Any proposed groundwater extraction – purpose, location and construction details.	**Section 8.4**
		Flow direction and rates and physical and chemical characteristics.	**Section 8.4**
		Predicted impacts of any final landform on groundwater regime.	**Section 8.4**
		Existing groundwater users in the area and potential impacts on users.	**Section 8.4**
		Assessment of quality of groundwater for local groundwater catchment.	**Section 8.4**
		Details of how proposal will not potentially diminish current groundwater quality.	**Section 8.4**
		Details on preventing groundwater pollution so remediation is not required.	**Section 8.4**
		Details on impacts to and protective measures for groundwater dependent ecosystems.	**Section 8.4** and **8.8**
		Details of proposed methods for the disposal of waste water and approval from relevant authorities.	LEMP (**Appendix B)**
		Assessment of potential saline intrusion of the groundwater.	**Section 8.4**
		Details of results of any models and predictive tools.	**Section 8.4** and LEMP (**Appendix B)**
		Details of proposed monitoring programs, including water levels and quality data.	**Section 8.4** and LEMP (**Appendix B)**
		Reporting procedures for any monitoring program including mechanisms for transfer of information.	LEMP (**Appendix B)**

Key Criteria	Raised by NSW Government Department	Assessment Requirement	Relevant Section of Environmental Assessment
		An assessment of any groundwater source/aquifer that may be sterilised as a consequence of the proposal.	**Section 8.4**
		Identification of nominal thresholds.	**Section 8.4**
		Remedial measure and contingency plans.	**Section 8.4** and LEMP (**Appendix B)**
		Any funding assurances covering the anticipated post development maintenance cost.	N/A
		All proposed groundwater works, including bores must be identified in the proposal and an approval obtained from DWE prior to their installation.	**Section 8.4**
Leachate Management	Department of Environment and Climate Change, 4.10.08	Details of design, construction and operation of the leachate management system. System must provide for the level of leachate within the cell to be maintained less than 300 mm above the surface of the engineered barrier.	**Section 5**
		Details on the capacity and location of the leachate storage dam/s and a management regime for those dams.	**Section 5.2** and LEMP **(Appendix B)**
	DEWHA, 2008	Demonstrate the efficacy of the proposed landfill lining in preventing leachate entering groundwater.	**Section 8.4.4** and **Appendix I**
		Remediation of the sediment and dry basins on site should the leachate pond overflow into either of these structures.	**Section 5** and **8.4**
Soil Management	DoP, 20.11.08	Details of soil structure and potential impacts.	**Section 8.1**
	Department of Water and Energy, 4.10.08	Assessment of need for an Acid Sulfate Management Plan (prepared in accordance with ASSMAC guidelines).	**Section 8.1.2**
Air quality	DoP, 20.11.08	Odour impacts from all operational sources at the nearest sensitive receivers.	**Section 8.5**
		Odour control measures.	**Section 8.5**
		Dust generation.	**Section 8.5**
	Department of Environment and	Maintain existing rural air quality and protect sensitive receivers from adverse impacts of dust and odour.	**Section 8.5**

Key Criteria	Raised by NSW Government Department	Assessment Requirement	Relevant Section of Environmental Assessment
	Climate Change, 4.10.08	An air impact assessment in accordance with the DEC document "Approved Methods and Guidance for the Modelling and Assessment of Air Pollutants in NSW, 2005".	**Section 8.5** and **Appendix O**
Noise and vibration	DoP, 20.11.08	Construction, operation and traffic noise.	**Section 8.7** and **Appendix Q**
	Department of Environment and Climate Change, 4.10.08	Design and operate landfill and associated activities to comply with the NSW Government's Industrial Noise Policy (INP).	**Section 8.7** and **Appendix Q**
		Access road should be evaluated as a noise source under the INP.	**Section 8.7** and **Appendix Q**
		Noise impacts associated with road haulage will need to be assessed against DECC's guidance document 'NSW Environmental Criteria for Road Traffic Noise (ECRTN) (EPA, 1999)'.	**Section 8.7** and **Appendix Q**
		Vibration impacts should be assessed against DECC guideline "Assessing Vibration: A Technical Guideline DEC 2006".	No vibration impact anticipated
		Construction impacts need to be fully evaluated with reference to the Environmental Noise Control Manual Chapter 171 – Construction Site Noise.	**Section 8.7** and **Appendix Q**
Traffic and transport	DoP, 20.11.08	Traffic volumes likely to be generated during construction and operation, and an assessment of the predicted impacts of this traffic on the safety and capacity of the surrounding road network.	**Section 8.14**
Regulatory Authority Consultation	DoP, 20.11.08	Relevant local, State and Commonwealth government authorities and service providers. The following groups must be consulted with: DEWHA; DECC; DWE; DPI; NSW RTA; and Uralla, Walcha and Guyra Councils.	**Section 7**
	DEWHA, 2008	Details of any consultation about the action.	**Section 7**
Community consultation	DoP, 20.11.08	Consult with community groups and affected landowners.	**Section 7**
		Describe consultation process and issues raised.	**Section 7**
	DEWHA, 2008	Details of any consultation about the action.	**Section 7**

Key Criteria	Raised by NSW Government Department	Assessment Requirement	Relevant Section of Environmental Assessment
Flora and fauna / Biodiversity	DoP, 20.11.08	Impacts of threatened species, populations or ecological communities and their habitats.	**Section 8.8**
		Impacts on aquatic habitats and groundwater dependent ecosystems.	**Section 8.8**
		Proposed biodiversity offsets and management.	**Section 8.8.17** and **Appendix H**
		Weed management, including potential risks to the Oxley Wild Rivers National Park.	**Section 8.8**
	Department of Primary Industries, 29.10.08	Attraction of feral animals and their access to food waste. Prevention of feral animal access is imperative to control the risk of endemic and exotic disease. Avoiding the attraction of pests helps avoid the increased damage they cause to primary production such as fox predation on lambs, bird damage to orchids, etc.	**Section 8.8**
		Weeds spreading off site as a result of incomplete composting and dumping of green waste. Green waste needs to be composted according to Australian Standards. If green waste compost is to be transported throughout the State, the Landfill will need to consider composting in accordance with a compliance agreement accredited through NSW DPI.	**Section 8.8**
	Department of Environment and Climate Change, 4.10.08	Conduct a field survey of the site.	**Section 8.8** and **Appendix E**
		Assess likely impacts on threatened species and their habitat.	**Section 8.8.15**
		Actions that will be taken to avoid or mitigate impacts or compensate to prevent unavoidable impacts. Assessment of the effectiveness and reliability of the measures and any residual impacts after these measures are implemented.	**Section 8.8.16**
		Offset strategies need to be considered where avoidance or mitigation is not possible. Particularly in relation to four environmental values: water quality, soils, salinity and biodiversity.	**Section 8.8.17** and **Appendix H**
		The EA needs to clearly state whether it meets each of the key thresholds set out in Step 5 of the *'Draft Guidelines for Threatened Species Assessment'*.	**Section 8.8** and **Appendix E**
		Hectares of native vegetation that will be cleared.	**Section 8.8** and **Appendix E**

Key Criteria	Raised by NSW Government Department	Assessment Requirement	Relevant Section of Environmental Assessment
		Floristic and botanical communities of native vegetation that will be cleared.	**Section 8.8** and **Appendix E**
		The extent of vegetation on site that may be remnant vegetation, protected regrowth or non-protected regrowth as defined by the *Native Vegetation Act 2003*.	**Section 8.8** and **Appendix E**
	DEWHA, 2008	Threatened ecological communities and threatened species potentially present and listed under section 18 and 18A of the *EPBC Act.*	**Section 8.8** and **Appendix E**
		Migratory species listed under the *EPBC Act.*	**Section 8.8** and **Appendix E**
		Ramsar Wetlands.	**Section 8.8**
Heritage	DoP, 20.11.08	Impacts on the heritage values of the Oxley Wild Rivers National Park as part of the Gondwana Rainforests of Australia World Heritage Area.	**Section 8.8**, **8.12**
		Impacts on other Aboriginal and non-Aboriginal heritage.	**Section 8.10** and **8.11**
	Department of Environment and Climate Change, 4.10.08	Address and document information requirements set out in the draft *Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation*.	**Section 8.10** and **Appendix R**
		Identify nature and extent of impacts of the project on Aboriginal cultural heritage values and consider any impact in a regional context.	**Section 8.10** and **Appendix R**
		Actions that will be taken to mitigate impacts or compensate to prevent unavoidable impacts. Assessment of effectiveness and reliability of these measures.	**Section 8.10.3** and **Appendix R**
		Clearly demonstrate that effective community consultation with Aboriginal Communities has been undertaken.	**Section 7.3, 8.10.1** and **Appendix R**
	DEWHA, 2008	Places listed on the National Heritage register.	**Section 8.11** and **8.12**
		World Heritage areas.	**Section 8.8**

Key Criteria	Raised by NSW Government Department	Assessment Requirement	Relevant Section of Environmental Assessment
		A Management Plan that identifies the potential impacts on the heritage values of the downstream GRAWHA, including: identification of values; water quality monitoring; control of weed invasion; identification of thresholds; detailed contingency plans; and a period of review and evaluation of its effectiveness.	**Section 8** and LEMP (**Appendix B**)
Planning	DEWHA, 2008	Details of local or state government planning scheme/plan/policy under any local or state government planning system detailing what EA is being carried out and how the scheme provides for the prevention, minimisation and management of any relevant impacts.	**Section 6**
		Description of and approval that has been obtained from a state, territory or commonwealth agency or authority.	**Section 6**
		Statement identifying any additional approval required.	**Section 6**
		Description of monitoring, enforcement and review procedures that apply or are proposed to apply.	**Section 8** and LEMP (**Appendix B**)
Greenhouse Gas	DoP, 20.11.08	Quantitative assessment of the potential scope 1, 2 and 3 emissions of the project, and qualitative assessment of the potential impacts of these emissions on the environment.	**Section 8.6**
		Detailed description of the measures that would be implemented to ensure that the project is energy efficient.	**Section 8.6**
	Department of Environment and Climate Change, 4.10.08	Comprehensive assessment and report on the project's predicted GHG emissions. This should include direct emissions, indirect emissions and any significant upstream and/or downstream emissions associated with the project.	**Section 8.6** and **Appendix P**
		Emissions should be estimated using an appropriate methodology such as DoP's *Draft Guidelines: Energy and Greenhouse* in EIA (2002) or the Australian Greenhouse Office's (AGO) *Factors and Methods Workbook* (2006).	**Section 8.6** and **Appendix P**
		Annual emissions should be compared against 'best practice' and total annual NSW emissions.	**Section 8.6**
		Additional measures to reduce GHG emissions, including offsets.	**Section 8.6.4**
Visual	DoP, 20.11.08	Impact on surrounding residences and Waterfall Way.	**Section 8.16**

Key Criteria	Raised by NSW Government Department	Assessment Requirement	Relevant Section of Environmental Assessment
Hazards	DoP, 20.11.08	Fire management.	**Section 8.15**
Socio-Economic	DoP, 20.11.08	Any impacts on the surrounding agricultural activities.	**Section 8.13**
	Department of Primary Industries, 29.10.08	Plastic bags blown off site can be ingested by inquisitive livestock causing digestive problems leading to sever weight loss and even death. Strategies should be put in place to protect neighbouring property owners and stock route against plastic bag contamination	**Section 8.8** and **8.9**
		Harbouring of pest animals such as mice and cats is a concern as these can serve as a source of infestation for neighbouring landholders.	**Section 8.8**
Mitigation Measures	DEWHA, 2008	Description and assessment of expected or predicted effectiveness.	**Section 8**
		Any statutory or policy basis for mitigation measures.	**Section 8**
		Cost of measures.	N/A
		Outline of environmental management plan that sets out framework for continuing management, mitigation and monitoring programs for relevant impacts, provisions for independent auditing.	LEMP (**Appendix B**)
		Name of agency responsible for endorsing/approving each mitigation measure/monitoring program.	LEMP (**Appendix B**)
		Consolidated list of mitigation measures.	SoC in **Section 9** consolidates mitigation measures of EA
Environmental record of person proposing to take the action	DEWHA, 2008	Details of any proceedings under a commonwealth, state or territory law for the protection of the environment or the conservation and sustainable use of natural resources against: the person proposing to take the action; and for an action for which a person has applied for a permit.	N/A
		If the person proposing to take the action is a corporation – details of the corporation's environmental policy and planning framework.	N/A

7.5.2 Community

Community consultation is a fundamental component of the EA process. The aim of managing and maintaining a detailed and accurate list of issues is to inform the EA and guide the development of appropriate mitigation measures to address these issues.

From the outset of the project, a comprehensive database has been compiled and maintained to ensure that an accurate record of community issues is obtained. Community issues were recorded by the Community Liaison Manager in the consultation database. The continual identification and update of issues ensured that the impact assessment process was relevant and addressed key concerns of stakeholder groups.

Table 21 summarises the key issues that have been identified through phone calls, emails and written submissions (including feedback forms) received by the Community Liaison Manager. The issues were raised by:

- Action groups against the proposed landfill - namely the Gara Valley Environment Preservation Association (GVEPA).
- Government departments (not involved in identifying EA requirements).
- The wider community.
- Neighbouring properties.

7.6 Ongoing Community Consultation

Community consultation activities relating to waste management after construction of the proposed landfill facility are considered outside the scope of this EA. It should be noted however that ongoing community consultation is considered necessary to ensure:

- The continual appropriate use of waste facilities.
- That the community are educated and informed on relevant waste management issues.
- To foster positive attitudes and to build an on-going relationship between Council, its contractors, and stakeholders in order to gain long term support for the proposed landfill facility.

The Council Waste Management Committee fosters a “Whole of Community” approach to the management of solid waste, which acknowledges the interests and needs of the main stakeholder groups in the Armidale Dumaresq area and the impact of solid waste on the environment. It is therefore envisaged, at this stage, that the Waste Management Committee would be the most appropriate means by which to continue community engagement efforts relating to the operation and management of the proposed landfill facility.

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Table 21: List of Key Issues Raised by the Community

Key Issue	Specific Issues Identified	Relevant Section of Environmental Assessment
Site Selection	Justification that the site location is suitable when the new site is located on the eastern edge of town, meaning that all traffic will have to travel through the town.	**Section 8.14**
	Information on which other councils will utilise the Regional landfill and potential for increased impacts associated with increased number of users.	**Section 2.1** and **Section 2.4**
	Information on soil properties and soil suitability for landfill construction.	**Section 8.1**
Landfill Design and Operation	Information on the class of waste to go to the proposed landfill.	**Sections 2.3** and **5.5** LEMP (**Appendix B**)
	Information on infrastructure to be established on the proposed landfill including on-site manager's residence. Details on the types of buildings to be constructed and their function.	**Section 5.3** and **5.5.6**
	Information on what constitutes 'state of the art' in terms of landfill design and operation.	**Section 5**
	Information on the type of Alternative Waste Technologies that will be incorporated with the landfill management at the transfer station.	**Section 2.2** and **2.4**
	Information and images of the exact location of the property boundary, the proposed landfill area and buffer zones.	**Section 1.3** and **Figure 2**
	Can the integrity of waste sorting at the transfer station be guaranteed?	**Section 2.2, 2.4** and **5**
	Operating procedures for waste contractors/Council operators which provide protocols on waste management to be included in the Environmental Assessment.	**Section 5** and LEMP (**Appendix B**)
	Confirmation that roadside collection will be sorted at existing facility and not taken directly to the new site.	**Section 2.2** and **Section 5**
	What procedures will be in place for waste, such as those delivered in 'skips' to be sorted at the transfer station (e.g. a five litre container of chemical or putrescible wastes in amongst a 10 tonne industrial waste skip)?	**Section 5.5** and LEMP (**Appendix B**)
	Concern that proposed landfill will accept clinical waste.	**Section 5.5.6**

Key Issue	Specific Issues Identified	Relevant Section of Environmental Assessment
Litter and Indiscriminate Dumping	Information on how litter will be controlled on the proposed landfill site including how rubbish will be prevented from blowing into the air and onto adjoining properties.	**Section 5** and LEMP (**Appendix B**)
	What actions are available to the public if litter drifts onto adjacent private land?	LEMP (**Appendix B**)
	Information on methods of transport of the waste from the transfer station and insurance that all waste will be covered, including skip bins.	**Section 5**
	Actions to prevent indiscriminate dumping of rubbish near the proposed landfill.	**Section 5** and LEMP (**Appendix B**)
	Measures to be put in place to stop illegal dumping of wastes near the site.	**Section 5**, **8.8.16** and LEMP (**Appendix B**)
Transport and Traffic	Description and explanation of the options available for the access route into the site and insurance of a safe intersection with Waterfall Way.	**Section 5.4.1**
	Information on the provision of overtaking lanes to improve driver safety on the road due to slow moving vehicles at the Waterfall Way intersection.	**Section 8.14** – Provision of right had turning lane
	Number of traffic movements per day from transfer station to and from the proposed landfill.	**Section 8.14**
	Justification of why the site access route cannot be located further east so that it may require one not two watercourse crossings. Moving the access road further east may improve visual amenity and reduce truck noise reverberation off the hill. It may also increase the road buffer zone to reduce impacts on adjoining landholder.	**Section 5.4** and **Section 8**
EPA Licensing Conditions	Information on the process of changing DECCW-EPA licensing conditions. Is it possible that significant changes such as operating hours, number of deliveries and type of waste received can be changed by a change of licensing conditions without the need for community consultation? What guarantee is there that in ten years time, the number of trucks, hours of operation or other potentially impacting aspects of the proposed landfill operation will not be changed.	LEMP (**Appendix B**) Project objectives for proposed landfill not expected to change, **Section 2** and **Section 3**
	Information on the frequency of DECCW-EPA inspections for compliance for the Regional landfill and Long Swamp Road landfill.	LEMP (**Appendix B**)
Air quality	What procedures and methodology will be used for the odour impact assessment?	**Section 8.5** and **Appendix O**
	Will the access route be tarred to reduce dust impacts?	**Section 5.4.1**
	Discussion of the effectiveness of EPA guidelines on odour. How can the community be assured that any odour emanating from the proposed landfill, albeit if they were within EPA guidelines, would not be intolerable.	**Section 8.5**

Key Issue	Specific Issues Identified	Relevant Section of Environmental Assessment
Noise	Acceleration, deceleration and airbrakes may disturb existing residences. Provide mitigation measures for noise disturbances.	**Section 8.7.4**
	Concerns over machination and high pitched reversing horns on site. Is the same equipment that is used at current site proposed for the new one? What mitigation measures will be in place to control noise?	**Section 8.7.4**
Surface water, Groundwater and Hydrogeology	Justification on the number of deep and shallow test bores that were used to gain information on the depth of the water table and the presence or movement of aquifers for the site.	**Section 8.1**
	Information on the effectiveness of clay liners in mitigating leachate. Indication of the most likely direction of movement of the leachate in case of failure of the liner or after decades of operation.	**Section 5, Section 8.3.3**, LEMP (**Appendix B**) and **Appendix I**
	Information on the potential fault line that is shown to traverse the proposed landfill site.	**Section 8.2.1**
	Detailed information on management of surface water flows including response and management of a 100 mm or more rainfall event.	**Section 8.3**
	Information on how the redesign of the landform and the site access road will affect surface water runoff into adjacent properties.	**Section 5.4.1** and **Section 8.3**
	Concerns that un-controlled surface runoff will flow into World Heritage Area.	**Sections 8.3**, **8.8** and **8.12**
	Potential effects and mitigation measures in relation to contaminated groundwater polluting nearby bores used for livestock.	**Section 8.4**
	Requesting that the map included in the EA shows current drainage lines and location of waterways on the site, adjacent to the site, and include the Gara River.	**Figure 2** and **Section 8.3**
Ecology, Flora and Fauna	Information on the degree of threat to the waterways, habitat and World Heritage Areas from contamination of waters.	**Sections 8.3**, **8.8** and **8.12**
	How will pollution of the Macleay River be prevented?	**Section 5** and **Section 8**
	Information on threatened flora and fauna and justification of the survey effort time. Map showing location and extent of surveys.	**Section 8.8** and **Appendix E**
	Disturbance and weed invasion will not be able to be prevented.	**Section 8.8**
	Concerns that a variety of threatened plant and animal species may be located on and adjacent to the proposed landfill site.	**Sections 8.8** and **Appendix E**
	Feral cats, dogs or foxes attracted to the proposed landfill may interfere with native wildlife.	**Section 8.8** and **Appendix E**
	Increased potential for fuel spill on Waterfall Way that may contaminate land or water.	**Section 8.15**

Key Issue	Specific Issues Identified	Relevant Section of Environmental Assessment
Community consultation	There is a lack of time to gain access to accurate data and prepare reports during the 30 day period of public review. Can the public consultation period be extended to allow for independent professional examination of data and reports that will be presented in the EA?	Council and the DoP have extended the EA exhibition period to 60 days.
	Once Council has purchased the land, will access to the land be permitted for independent consultants to carry out studies?	Purchase of the land by Armidale Dumaresq Council would occur subject to planning approval for the proposed landfill development. Discussions relating to site access would be undertaken only after land acquisition.
Visual Impact Assessment	Provision of a visual impact assessment that shows the finalised impression of the development.	**Section 8.16**
	Will the final result look like a filled valley or a third hill? How high above the skyline and above the existing landform will the final height be?	**Section 8.16**
	Include a view from the north showing completed mound height at site closure, including the existing hills east and west for reference and total dump height above existing ground level.	**Section 8.16**
Tourism	Concerns that the proposed landfill may impact on Armidale's tourism (site is located just off a National Tourist Drive, linking Coffs Harbour to the New England area).	Considered that this relates to a visual amenity and land use impact issue. Refer to **Sections 8.13** and **8.16**
Cultural Heritage	Concerns regarding the cultural heritage significance of the site.	**Section 8.10** and **8.11**
Land Use	Concerns regarding impact on local agricultural land practices.	**Section 8.13**
	Possible impact to adjacent agriculture and horticulture resulting from the spread and/or introduction of disease, vermin, insects and weeds.	**Sections 8.8** and **8.13**

8.0 Environmental Impact Assessment

This section identifies the potential environmental impacts associated with the construction and operation of the proposed landfill facility. The impact determination process is based on the project description, community and stakeholder consultation and AECOM's past experience. Measures proposed to manage the potential impacts on the environment are also described here and are set out within a SoC provided as part of this EA (refer **Section 9.0**).

8.1 Landform and Soils

EA Systems was commissioned to undertake the following investigations relating to soils and their management:

- Contaminated site investigation (Preliminary Contaminated Site Investigations, EA Systems, 2006) (**Appendix K**).
- Review of soils on site (Hydro-Geological Assessment, EA Systems, September 2006) (**Appendix D**).
- Presence of salinity on site (Salinity Assessment, EA Systems, November 2005) (**Appendix L**).

The scope of the assessments was to:

- Undertake a site history review to identify potential Areas of Environmental Concern (AEC) and Chemicals of Concern (CoCs).
- Provide an assessment of site contamination based on the site history review and site visit.
- Identify the soil landscape of the site and any limitations of the soils in regard to the proposed development.
- Identify the potential salinity related impacts that the proposed landfill facility may have on localised soil and groundwater conditions.

The following is a summary and discussion of the contents and the main findings of the investigations and assessment.

8.1.1 Topography

Regional Topography

Regional topography has been reviewed at a surveyed scale of 50 metre contours. The region includes terrain that is characteristic of a flat, plateau-like landscape. The elevation of this area varies between 900 to 1100 metres (AHD) and is representative of the area between Armidale (approximately 12 kilometres west of the site) and the Wollomombi River located 24 kilometres east of the site.

Ten kilometres south-east of the site the plateau tapers off into a sharp descent where the landscape changes to a terrain of cliff faces running along a 20 kilometre ridge line. The total relief, from the tops of the ridge line (920 metres AHD) down to the valley floor, varies by more than 400 metres, occurring over a very short horizontal distance resulting in very steep slopes. The area has been formally defined as the boundaries of the Oxley Wild Rivers National Park.

Local Topography

Local topography has been reviewed at a surveyed scale of 10 metre contours. The local landscape is representative of cleared, pastoral land and consequently much of the local terrain's slope profile ranges between 0 – 5 degrees (refer **Figure 11**). There is however, a sporadic arrangement of gently rolling, irregularly shaped hills and valleys which are commonly little more than 50 metres high.

Located approximately one kilometre west of the site and progressing in a south-easterly direction (eventually turning sharply to the east and to the south of the proposed landfill footprint), lies a ridge with a moderate slope profile ranging between 0 - 5 degrees (**Figure 11**). The ridge gives rise to several small plateaux along its peaks and also forms the eastern tier of Burying Ground Creek.

The ridge ends to the south-east of the Project Site, descending abruptly in an easterly direction from 1010 metres (AHD) to 945 metres (AHD) over 700 metres distance. The slope here is relatively prominent with a gradient of 17.7 degrees at its steepest descent, gradually flattening out to a gentle slope ranging from 0 – 5 degrees. The terrain continues to decline gradually and eventually meets the banks of the Gara River, located 1 kilometre east of the Project Site.

Further east of the Project Site (and on the eastern side of the Gara River), the terrain rises rapidly into a series of sharp ridges and tiers that flanks the Gara River below. The ridges have a peak height of approximately 1020 metres AHD and extend further north delineating the Gara River below.

Site Topography

The slope of the area within the Project Site is predominately flat with most of the area having a gradient of 0 - 5 degrees (**Figure 11**). Areas that are above this gradient are mostly located at the southern half of the proposed site where slope is mostly between 5 – 10 degrees combined with a sporadic arrangement of moderately steep slope ranging between 10 and 15 degrees.

The mid-southern half of the Project Site is distinguished by an abrupt change in slope and elevation of up to about 3 metres, forming the edge of the ridge previously described above. Ground slope at this location ranges between 15 and 22 degrees. At the northern part of the Project Site the terrain becomes relatively flat at 974 metres AHD, for a distance of about 40 metres, before beginning to steadily rise again to the west on a gradient between 5 and 10 degrees, for a distance of about 370 metres and reaching an elevation of 1015 metres (AHD). A similar rise occurs to the east and to a lesser extent to the south, forming a landscape similar to a natural amphitheatre.

From south to north the site progressively declines, more noticeably at the southern end of the site and less toward the northern end, however only a moderate overall decline of 20 metres in height exists over the 375 metres distance from the ridge.

8.1.2 Soils

Site Investigations

EA Systems also conducted an electro-magnetic (EM) survey of the Project Site, including both an “EM31” and an “EM38” survey. An EM31 survey has a maximum recording depth of 6 metres, with the greatest zone of influence for measurement being between 2 and 4 metres. An EM38 survey has a maximum depth of 1.5 metres, with the greatest zone of influence between 0.2 and 1 metre.

EM surveying measures a soil’s apparent electrical conductivity (ECe). Conductivity in soil is influenced by a number of factors including soil porosity and moisture content, concentration of dissolved electrolytes and the amount and type of clays that are present. Maps compiled from the results of the survey were used to identify soil characteristics and trends across the Project Site and to target particular locations where variability may be more pronounced.

A separate soil investigation was also conducted, including the drilling of 22 bore holes and the excavation of 9 test pits. The locations of the bore holes and test pits are shown on **Figure 12**. The test pits were excavated using a backhoe to a depth of approximately 1.5 metres. The majority of the bore holes were drilled to a depth of approximately 4 metres, or less wherever “refusal” of the drilling operation was reached (refer **Figure 12**). Several deeper pilot bore holes were also drilled to a depth of 5.5 metres.

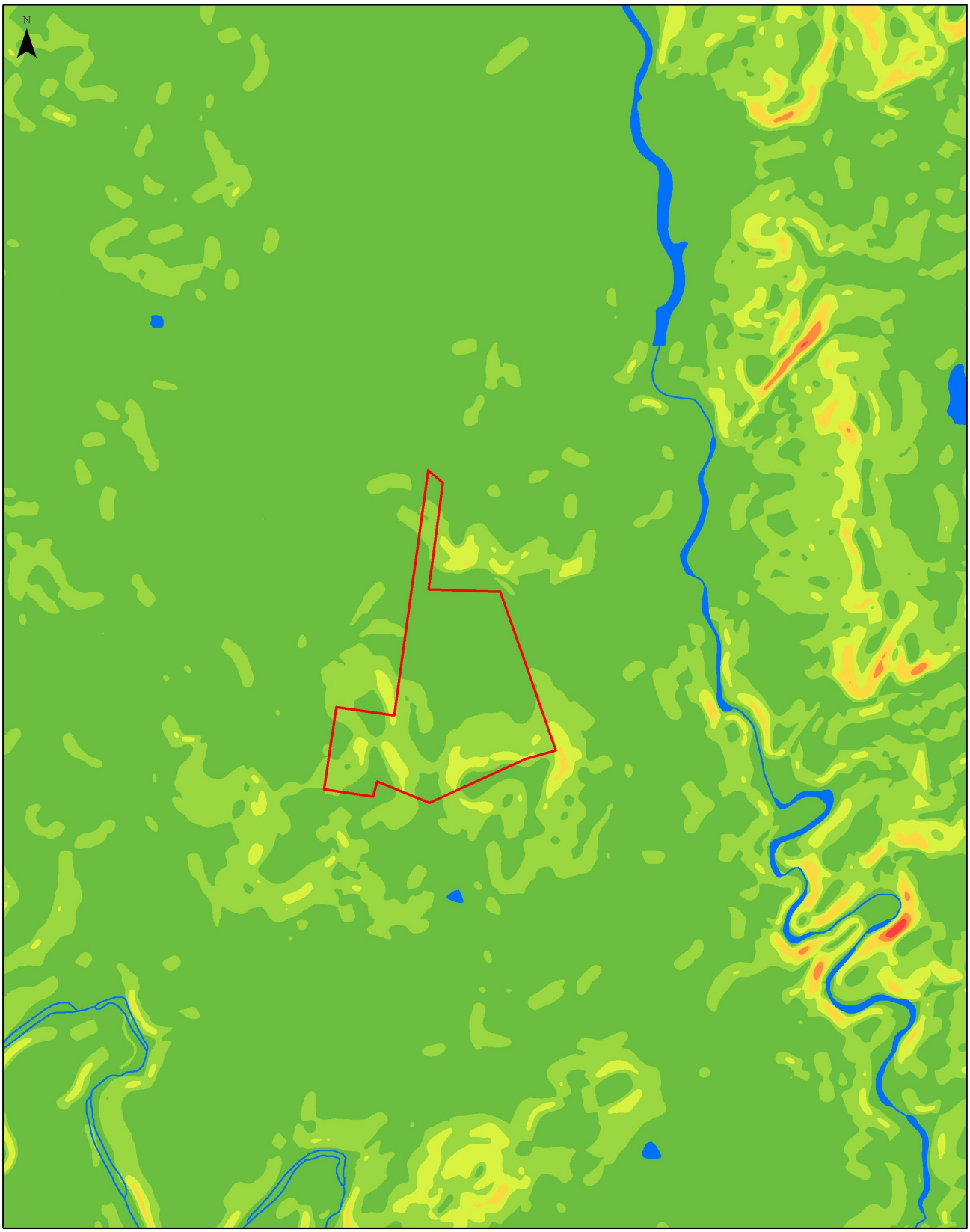
Soil Profiles

Based on the site investigation, it can be considered that the Project Site comprises the following four distinct areas (refer **Figure 12**):

- The “flats” running out to the creek line.
- The toe of the slope.
- The wooded mid-slope.
- The rocky crests of the hill.

Typical profiles of soil types observed across each of these four broad areas are described in **Table 22**. These are typical profiles only, including the range of each soil horizon and it should be noted that variation does occur between individual bore holes and test pits.

AECOM



Project site

Slope (degrees)

0 - 5
6 - 10
11 - 15
16 - 20
21 - 25
26 - 31

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LOCAL AREA SLOPE PROFILE

Source: EA Systems (2007), AECOM (2007), Map Data (2008)

0 250 500 1000 m

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Fig **11**

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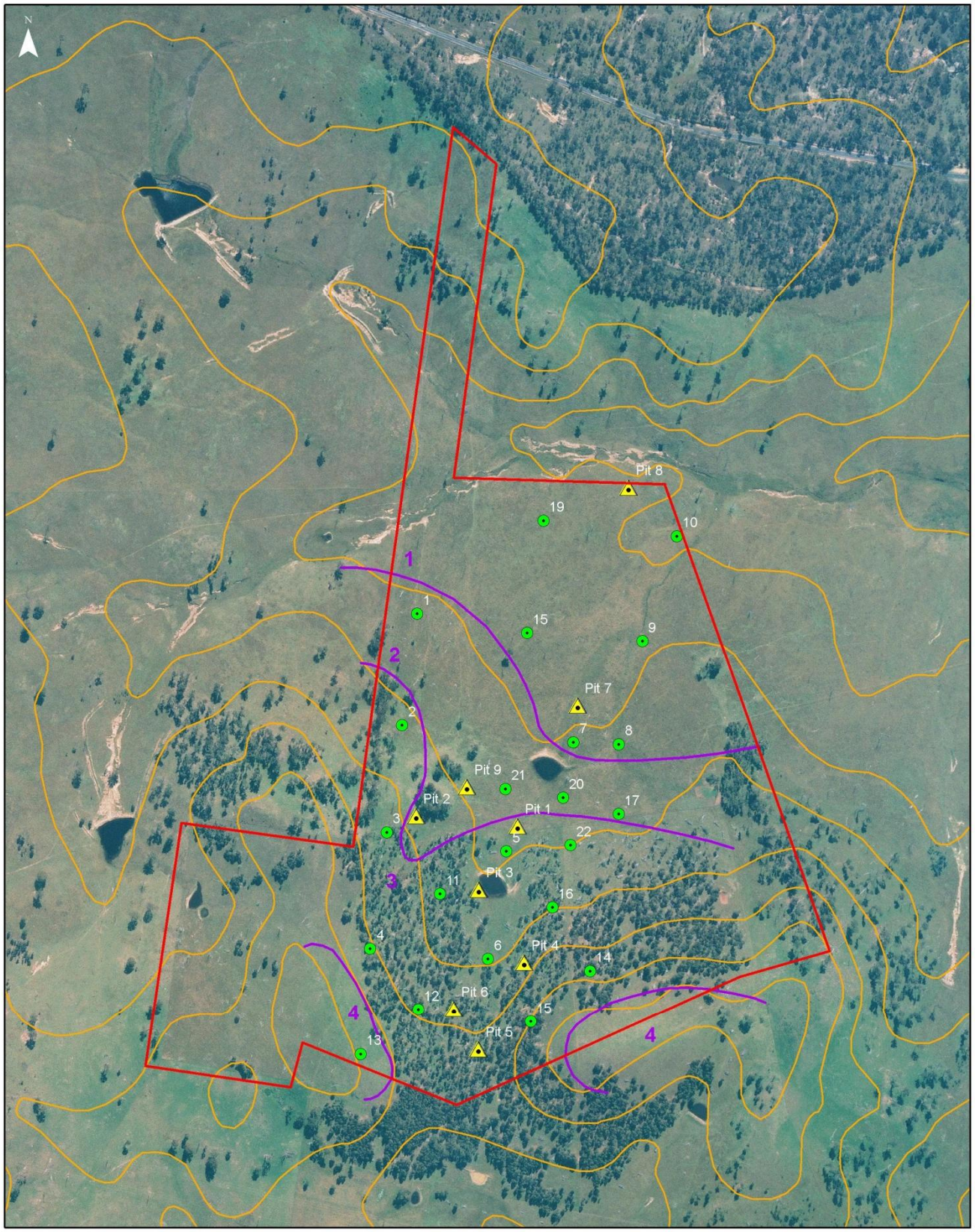
AECOM



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BOREHOLE AND TEST LOCATIONS

Source: EA Systems (2007), AECOM (2007), Map Data (2008)

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Fig. **12**

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Table 22: Typical Soil Profiles

	Creek Flats		**Slope Toe**		**Midslope**		**Hill Crest**	
Bore holes	7, 8, 9, 10, 18, 19		1, 17, 20, 21		2, 3, 4, 5, 6, 11, 12, 14, 15, 16, 22		13	
Test pits	7, 8		2, 9		1, 3, 4, 5, 6			
Ranges of typical horizontal depths	0 – 0.3	Brown clay loam (SC – CI)	0 – 0.15	Brown clay loam (SC – CI)	0 – 0.15	Brown-grey clay loam (SC – CI) with some surface gravel	0 – 0.3	Brown rocky loam
	0.15 – 0.75	Grey-brown clay with sand (SC – CI) and some gravel	0.15 – 0.45	Grey-white sandy loam (CI – CL, SM – SC) with some gravel	0.15 – 0.3	BH2, 4, 5, 11 & TP1 – grey-white clay loam (CI – CL) that may indicate transient flow	0.3 – 0.4	Brown gravel
	0.3 – 3.3	Orange-yellow medium to heavy clay with fine sand (CL – CH) and gravel occurring in horizons 0.1 – 1.0 thick	0.25 – 1.5	Orange-red silty medium to heavy clay (CL – CH) with gravel	0.15 – 1.6	Orange heavy clay with some sand and gravel (GC, SC, CI – CH)	0.4 – 0.8	Yellow silty gravel
	1.5 – 4.3	Yellow sandy clayey silt (ML) material likely to be extremely weathered mudstone-agrillite	1.2 – 5.5	Yellow sandy clayey silt (ML) material likely to be extremely weathered mudstone-agrillite	1.2 – 5.5	Yellow sandy clayey silt (ML) material likely to be extremely weathered mudstone-agrillite	0.8 – 1.0	Orange silty gravel
	0.3 – 2.8	Bore holes 18 – 19, medium clay with fine sand (SC – CL)					1. – 2.0	Yellow silty gravel
							2.0 – 2.5	Orange gravelly clay
Termination and refusal details	2.0 – 3.8	Bore hole refusal* (except BH7 – termination)	3.0 – 5.5	Borehole termination*	1.7 – 4.2	Bore hole refusal in 4, 5, 6, 12, 14, 22	2.5	Refusal
					4.0 – 5.5	Bore hole termination* in 2, 3, 11, 15, 16		
	1.2 – 1.35	Backhoe refusal on decomposed mudstone-agrillite	1.2 – 1.3	Backhoe refusal on decomposed mudstone-agrillite	1.2 – 1.7	Back hoe refusal on decomposed mudstone-agrillite		

* Note that augers used on the light drill rig are able to penetrate hard materials and therefore grindings brought to the surface may present as fines.

Source: EA Systems, September 2006

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Soil Landscapes

A soil survey of the area undertaken by the (former) DNR (now DWE) indicates that the Project Site occurs predominantly within the two soil landscape groups 'Argyle' and 'Middle Earth'. A small section of the site, located along the drainage gullies, is classified as 'Commissioners Waters'. A description of these soil landscapes is presented in the **Table 23**.

The distribution of these landscapes across the site is shown in **Figure 13**.

Table 23: Soil Landscapes

Soils Landscape Group	Landscape Description	Soil Description
Argyle	Rolling low hills and occasional hills on greywacke/chert and related sediments. Local relief 30 - 80 metres, slopes mostly 10 - 30%, elevation 910 – 1170 metres. Minor rock outcrops (<10%) and partially cleared *Eucalyptus caliginosa* (New England stringybark) open woodland.	Very shallow to shallow (<50 cm), well drained Basic Lithic Leptic Rudosols (Lithosols) and other shallow soils on crests, ridges and upper slopes. Shallow to moderately deep (40- 80 cm), moderately well drained Haplic eutrophic Yellow Kandosols/Tenosols (Yellow Earths) on mid-slopes and occasionally extending onto crests. Shallow to moderately deep (<80 cm), moderately well drained Yellow/Red and Grey Chromosols (Yellow and Red Podzolic Soils) on mid-slopes, footslopes and drainage lines. Mottled-Subnatric, eutrophic Brown and Yellow Sodosols (Soloths) occur along some drainage depressions.
Commissioners Waters	Narrow streams, swamps and occasional small floodplains/terraces on Quaternary alluvium. Includes Commissioners Waters and the Gara River. Local relief 0-10 metres, slopes 0 – 3%, elevation 900 –1070 metres. Extensively cleared open woodland.	Variable soils due to the source rocks from which they are derived. Shallow to moderately deep (40 – 100 cm), well drained Alluvial Sands and Alluvial Loams (Yellow / Brown and Grey Earths) occur in areas derived from coarse grained parent materials. Moderately deep to deep (>80 cm), moderately well drained Mottled eutrophic Grey Chromosols / Grey Sodosols (Gleyed Podzolic Soils / Grey Brown Podzolic Soils / Lateritic Podzolic Soils) are fairly common. Some Haplic Eutrophic Brown Dermosols/ Kandosols (Prairie Soils) are encountered along parts of Burying Ground Creek.
Middle Earth	Undulating plains, rises and footslopes on Sandon Beds. Local relief 0-30 metres, slopes 0-10%, elevation 910 - 1120 metres. Extensively cleared open woodland to partially cleared.	Moderately deep to deep (>70 cm), moderately well drained Bleached-Mottled Haplic eutrophic Yellow Kurosols and Chromosols (Yellow Podzolic Soils) are widespread. Deep (>100 cm), poorly drained Yellow Chromosols and Mottled-Mesonatric and Mottled-Subnatric eutrophic Yellow Sodosols (Soloths) and Bleached-Manganic and Bleached-Ferric Eutrophic Yellow Chromosols (Lateritic Podzolic Soils / Grey Brown Podzolic Soils) occupy drainage depressions and poorly drained areas. Occasional shallow (<40 cm), well drained Bleached eutrophic Yellow Kandosols (Yellow Earths) on slopes with bedrock close to the surface.

Source: EA Systems, 2006 – extracted from Soil Landscapes of Armidale 1:100,000 Sheet, DNR

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AECOM

Project site
Argyle (ar)
Commissioners Waters (cm)
Middle Earth (me)

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DISTRIBUTION OF SOIL LANDSCAPES OVER THE SITE

0 100 200 400 m

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Fig. **13**

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Scope of Laboratory Analysis

Laboratory analysis was conducted for 15 samples taken from four profiles from the test pits, as shown in **Figure 12**. The soils were analysed for:

- pH (1:5 soil / 0.01M $CaCl_2$).
- ECe (1:5 soil / water suspension).
- Sodium (Na).
- Potassium (K).
- Calcium (Ca).
- Magnesium (Mg).
- Cation Exchange Capacity (CEC).
- Slaking and Dispersion (EAT).

Calculations were made to determine the following:

- Exchangeable Sodium Percentage (ESP).
- Calcium/Magnesium Ratio.

Results of Laboratory Analysis

The major salinity-related factors are ECe, sodium, potassium and ESP. Chemical analysis showed the soils have a mean ECe of 0.4 dS/m (ranging from 0.1 to 1.1dS/m), mean Na levels of 255.2 mg/kg (ranging from 12.0 to 931.5 mg/kg) and a mean ESP of 8.2% (ranging from 1.3 to 24.1%) (refer **Table 24**).

Table 24: Summary of Soil Salinity Results

		Sampling Depth (mm)						
		Overall			**A1 0-200**	**A2 200-320**	**B 320-700**	**B2 700-1200**
		min	**mean**	**max**	**mean**	**mean**	**mean**	**mean**
N*		15	15	15	4	4	4	2
pH (CaCl)	scale	3.8	5.0	6.5	4.5	4.7	5.0	6.02
ECe	dS/m	0.1	0.4	1.1	0.30	0.02	0.05	0.65
Na	mg/kg	12.0	255.2	931.5	17.6	55.5	357.8	685.9
K	mg/kg	9.2	44.7	96.6	41.8	19.8	59.6	62.9
Ca	mg/kg	28.3	668.0	2422.0	406.0	296.8	769.7	1671.7
Mg	mg/kg	75.4	601.0	1365.0	97.8	212.2	974.9	1296.5
ESP	%	1.3	8.2	24.1	2.0	6.4	10.7	14.3
CEC	mg/kg	2.4	11.4	26.6	4.0	5.0	17.8	22.8
Ca/Mg	ratio	0.0	1.3	3.2	2.6	1.2	0.5	0.8

* N = number of samples. Source: EA Systems, 2005

Detailed results are presented in the Appendices of the Salinity Assessment report (EA Systems 2005) (refer **Appendix L**) and are also discussed below.

Soil pH

In general, the soils at the site range from strongly acidic to slightly acidic, i.e. soil pH ranges from 3.8 to 6.5. A pH range of 4.5 to 6.5 is considered optimal for the growth of most plant species. The majority of the samples analysed are within this optimal range.

Emerson Aggregate Test

The Emerson Aggregate Test (EAT) is a measure of a soil's structural stability in water. The degree of soil aggregate stability increases from Class 1 through to Class 8. Aggregates in Emerson Classes 1 and 2 are generally regarded as being unstable, while those in Classes 4 to 8 are considered to be stable. Results of the EAT on soils from the Project Site are presented in **Table 25**.

Table 25: Summary of Emersion Class Test Results on Soils

Sample Number	Depth (mm)	Emerson Class	Description
Pit 1	0-200	8	No swelling
Pit 1	200-350	3	Dispersion
Pit 1	350-550	6	Complete flocculation
Pit 1	550-850	2	Some dispersion
Pit 1	850-1200	1	Complete dispersion
Pit 6	0-300	7	Swelling
Pit 6	300-1100	6	Complete flocculation
Pit 6	1100-1400	6	Complete flocculation
Pit 7	0-100	8	No swelling
Pit 7	100-300	3	Dispersion
Pit 7	300-800	2	Some dispersion
Pit 8	0-150	7	Swelling
Pit 8	150-320	6	Complete flocculation
Pit 8	320-700	6	Complete flocculation
Pit 8	700-1200	6	Complete flocculation

Source: EA Systems, 2005

Soils from the A1 horizons were classified as being Emerson Classes 7 and 8 and are considered stable. Any swelling that may have occurred is considered to be the result of organic matter in the soil. Flocculation, where clay particles that separate in water have long-range attractive forces between the particles that bring them together again, generally occurred in the B1 or lower horizons. Soil of the A2 horizon in Pit 1 is dispersive in nature and may be unstable when wet.

Soils classified here as being Emerson Class 1 or 2 were reported by the laboratory as being mostly weathered and decaying sandstone fragments.

Soil Salinity

Soil salinity occurs when dissolved salts naturally found in soil landscapes and groundwater are mobilised, allowing capillary action and evaporation to concentrate crystalline salt at the ground surface. These movements are caused by changes in the natural water cycle which are often caused by changes in land use practices, especially changes in vegetation cover.

The principal effects of salinity (in relation to the Project Site) may include damage to vegetation due to salt scalding on the land surface and/or damage to road pavements, including cracking and potholing.

Soil salinity is measured as electrical conductivity (ECe), which is a measure of the presence of water soluble salts, mainly sodium, calcium and magnesium within a soil solution. Soil samples taken from the Project Site have a mean ECe of 0.4 dS/m (within the range of 0.1 to 1.1dS/m). These low ECe results indicate that there are no salinity issues in the soils, as all samples were below the salinity threshold for ECe of <4dS/m.

Soil Sodicity

"Sodic" soils are sodium rich soils that readily lose their structure upon becoming wet, resulting in structural collapse and the closure of soil pores. This leads to restricted air and water movement through the soil and reduces hydraulic conductivity. As conditions dry out, these soils form a hard crust, effectively sealing the surface layer and reducing water infiltration. A soil is "sodic" if its ESP is in the range of 6% to 14%, within the top metre of a soil profile.

On average the soils on the Project Site are considered to be non-sodic within the surface A1 horizon and subsurface A2 horizon, but become sodic (ESP>6%) deeper through the top metre of the soil profile. Specifically the soils in Pit 1 start becoming sodic (ESP 9.9%) in the B1 horizon, between 350 to 550 mm deep. Sodicity increases (ESP 17.9%) within the B2 horizon, from 550 to 850 mm and then becomes very sodic (ESP 21.4%) within the B3 horizon, at depths >850 mm. Pit 7 displays a similar pattern of sodicity increasing with depth, i.e., its B2 horizon between 400 to 800 mm has an ESP 24.1%. Results for other pits are summarised below:

- None of the soils in pit 6 were above the sodicity threshold for ESP>6%.
- Pit 8 displayed a slightly high ESP result of 7.2% in its B3 horizon, from 200 to 700 mm.

Acid Sulfate Soils

Acid Sulphate Soils are typically associated with low-lying coastal areas. The location and elevation of the Project Site are such that the risk of encountering any PASS or AASS is considered negligible.

Contamination Potential

Site Inspection

The following observations were made during a site inspection conducted by EA Systems on 8 September 2005:

- The primary use of the subject land has been for livestock grazing.
- A small quarry was in operation within Lot 2 DP 253346, used for extracting gravel.
- Sheep yards were located within Lot 1 DP 253346.
- Two empty 200 litre (44 gallon) drums and discarded empty vaccination packs were observed on the ground beside the sheep yards. The tops of the drums were intact, indicating that the drums had not been used for mixing of chemicals.
- There is no evidence of earth or other fill material that may have been acquired from another site.

Interviews and Records Search

Sherraloy was acquired by its current owners in 1986. The owner was interviewed by EA Systems by telephone on 10th April 2006 in order to gain information about the historical land uses on the property. The owner confirmed that there were no old stock dips or previous waste landfilling activities (domestic or other rubbish tipping) sites present on the property, that there had been no storage of dangerous goods or explosives on the property and there had been no storage of pesticides or herbicides. Furthermore, it should be noted that Sherraloy is an accredited "CattleCare" property. CattleCare properties are managed in accordance with international quality assurance principles to prevent, amongst other things, the accumulation of unacceptable chemical residues in grass fed cattle. CattleCare accreditation requires an assessment of the risk of soil contamination on grazing properties from the previous use of any persistent agricultural chemicals, such as from sheep dipping or drenching activities.

Edington was acquired by its current owners in 1974. The owner was interviewed by EA Systems by telephone on 5th May 2006. The owner confirmed that there had been no storage of dangerous goods or explosives on Edington, there were no old stock dips or previous waste landfilling sites and that there had been no storage of pesticides or herbicides. The owner confirmed that the empty 44 gallon drums located near the sheep yards had not been used for mixing of chemicals, they had been used as tables to hold tools for lamb marking.

A search of the New South Wales EPA's records was conducted on the 30 January 2006. No contaminated land records were found for the Project Site.

Potential Contaminants

Based on the site history, potential AEC and associated CoC were identified. These are summarised in **Table 26**.

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Table 26: Potential Areas of Contaminants on Site

Potential Areas of Environmental Concern	Description of Potentially Contaminating Activity	Chemicals of Concern *	Likelihood of Contamination (Based on Site History Review)* A	Comments
Waste Oil	Waste oil from the maintenance of heavy vehicles may have been disposed of on-site	• TPH • PAHs • Lead • Phenol • Additives	Low	The maintenance of heavy vehicles would have resulted in the generation of waste oil. The site history review cannot rule out with certainty whether waste oil was disposed off-site. This concern may be limited to the quarry site.
Sheep Yards	Spraying Drenches	• DDT, Arsenic and lead based pesticides • OCPs • OPPs	Low	Usually low level and diffuse. Contamination, if present, is likely to be limited to the near subsurface.
Sewage Management	Potential bacterial contamination	• Bacterial contamination	Low	Residence is located outside the area of interest by approximately 300 metres across a ridge from the Project Site boundary.
Project Site	Contaminated fill material may have been imported to the Project Site	• Metals • PAHs • TPH • OCPs • Asbestos • PCBs	Low	Site observations suggest that significant fill material is unlikely to be present at the Project Site
Project Site	Pesticides may have been applied within the property boundaries for weed or pest management.	• OCPs • OPPs • Metals • TPs • SPs	Low	Contamination, if present, may be limited to the near subsurface.

*** Legend**

A	Qualitative assessment of the probability of occurrence of contamination	TPH	Total Petroleum Hydrocarbon
BTEX	Benzene, Toluene, Ethyl Benzenes and Total Xylenes	MTBE	Methyl Tertiary Butyl Ether
PAHs	Polynuclear Aromatic Hydrocarbons	OCPs	Organochlorine Pesticides
PCBs	Polychlorinated Biphenyls	OPPs	Organophosphorus Pesticides
TPs	Triazine Pesticides	SPs	Synthetic Pyrethroids

Source: EA Systems, 2006

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Potential Soil Impacts

Soil Erosion

There is the potential for erosion of soils during construction, particularly upon removal of top soil and during the excavation works that will be required for the preparation of the proposed landfill footprint for cell construction, as well as for the construction of the access road into the site. Any impacts would potentially be accentuated via the movement of construction machinery, vehicles and personnel and would also be further exacerbated by any heavy rain. There is also the potential for aeolian (wind) erosion to occur from any unsecured stockpiles of materials or spoil, as well as any exposed ground along the working width of the access road during its construction, and/or during operation of the proposed landfill facility.

Some soils on site were identified as being dispersive clays that would be more prone to erosion when exposed during the construction process. Soil erosion impacts would be exacerbated when exposed to running water, such as rainfall and runoff, however excavations for the proposed landfill footprint are expected to be relatively shallow and always above the local groundwater level.

Soil Stability

There is some potential for the existing slopes to become destabilised during vegetation clearance and construction. Slopes of up to 15% occur on the site. Due to the dispersive nature of the existing soils on the site, there is the potential for slope instability. Appropriate controls will therefore need to be in place to retain soils on site.

Sodicity

The high sodicity levels within the site's sub-soils may cause a breakdown in soil structure during wet conditions. This may cause sealing in these layers and a subsequent reduction in future water infiltration.

Contamination

Based on the site history review and site inspection, the overall potential for the exposure of contaminated soils is considered to be low. This conclusion is based on the following:

- There is no evidence of oil spills or stains from the use of heavy vehicles within the quarry area.
- No dangerous goods or explosives were used in the quarry.
- No chemicals of concern have been used for gravel extraction.
- There is no evidence of either contaminated or clean fill material (acquired from another site) being present on the site.
- There is no evidence of previous rubbish disposal on the site.
- The onsite sewage management system connected in 1991 for the residence on Lot 2 DP 253346 is outside the Project Site (approximately 300 metres down slope, on the other side of a ridge) and is therefore unlikely to be a source of potential contamination for the proposed development site.
- There may be areas in and around the sheep yards that have been exposed to chemicals associated with routine sheep drenching, jetting and vaccination. However, there is no permanent infrastructure present that would have used for either dipping or fixed hose jetting, therefore any resultant contamination would be low and limited to localised surface stains, if present.

8.1.3 Mitigation Measures

In order to mitigate against potential erosion impacts, suitable erosion and sediment control measures would be installed during the initial construction period of the access road and for each cell footprint. Appropriate ongoing control measures would also need to be implemented and fully maintained during the progressive development of each subsequent landfill cell.

The shape of the final landform will also be compatible with the existing local topography.

Construction

Prior to any construction commencing an appropriate Construction Environmental Management Plan (CEMP) would be prepared and would form part of the LEMP. The CEMP would contain a range of appropriate erosion and sediment control measures that would be contractually required for implementation during the construction of all relevant components of the proposed development, in order to minimise the impact of the proposal on receiving waters. All appropriate measures would be required to be installed either prior to, or in conjunction with, the commencement of any construction activities on the site, including all initial site preparatory works.

Erosion control measures would be documented in the final LEMP as part of an ESCP. Sediment management principles, which would be comprehensively documented and implemented through the ESCP, include the following:

- Delay disturbance of the existing topsoil and vegetation until immediately before earthworks occur and minimise the area of disturbance, wherever feasible.
- Vegetation clearance and soil disturbance would be confined to those areas required for the construction of the landfill, carpark, access road and amenity facilities. Vegetation clearance would be limited to the minimum required for the purpose of construction.
- All access points onto the site would be stabilised and a hard wearing base course (bitumen/asphalt) laid as soon as possible in order to minimise soil disturbance during construction.
- During the initial construction period, suitable erosion and sediment control measures including silt fences and straw bale filters would be installed for the access road and for each cell footprint. Silt fences and straw bale filters would be installed perpendicular to the direction of surface water runoff flow and will be appropriately maintained in order to ensure optimal sediment trapping/removal at all times. Appropriate ongoing measures would also be applied during the progressive development and ultimate closure of each new landfill cell.
- Appropriate landscaping measures would be provided adjacent to the new access road, including the planting of turf or grass during construction, in order to stabilise all embankments created.

Operation

Erosion and sediment control measures that would be applied during operation of the proposed landfill facility include the following:

- Progressively strip only those areas that would be worked on immediately, to minimise erosion and sedimentation. This is of particular importance as the proposed landfill facility would be a staged development over a 50 year life span. Existing vegetation on site would be retained as long as possible and only cleared when actually required for cell construction or ancillary infrastructure.
- Wheel wash facilities would be provided at site egress points, to prevent the tracking of mud or loose sediment off site.
- Provide progressive revegetation of capped landfill areas to minimise disturbance of soils on capped cells.
- Design and clearly identify haul routes around the proposed landfill to minimise surface and vegetation disturbance.
- Apply appropriate slope stabilisation techniques. This would include installation of sub-soil drains, where appropriate, along the proposed access road to alleviate soil pore water pressure.
- Maintain the landscaped area around the proposed landfill ensuring that areas are revegetated and maintained with a consistent grass cover, where required. At all times, exposure of surfaces would be minimised to ensure that soils are bonded on site via vegetative cover.
- Appropriate maintenance of access roads would ensure that there are no potholes and that road surface edges do not progressively degrade over time.
- In the (unlikely) event of discovery of previously unidentified area(s) of potentially contaminated material, the following procedures would be implemented / adopted to mitigate potential impacts on the environment, employees and to the public:
    - If required, DECCW will be promptly notified of any suspected potentially contaminated ground that is exposed during construction activities;
    - Advice will be immediately sought from a suitably qualified and experienced contaminated site consultant;

- Any suspected contaminated materials excavated during site works would be stockpiled on a sealed surface or on plastic sheeting. The stockpile will also be covered to prevent wind or rain removing any of the material. The stockpile will not be placed in the vicinity of sensitive environmental receivers such as vegetated areas. A spoon drain will be excavated on the down gradient side of the stockpile and any run-off will be appropriately treated prior to release;
- Stockpiles will be adequately secured to prevent unauthorised access;
- Stockpiled material will be sampled for testing. Reuse or disposal options will be based on the results of laboratory analysis in accordance with relevant legislation;
- All confirmed contaminated material will be excavated and disposed of off-site in a suitably licensed facility in accordance with DECCW regulations;
- Any workers who come in contact with suspected contaminated material will report the exposure and take appropriate precautions in terms of the project's adopted OH&S;
- Any contaminated waste identified or generated during the works would only be disposed of in accordance with DECCW guidelines.
- If necessary, a Remedial Action Plan would be prepared and implemented in accordance with DECCW requirements.

While sodicity in the soils at the Project Site is evident, it is considered that this should pose no restrictions to the development of the proposed landfill. Clay material located within the B1 horizon (300 to 550 mm) is suitable to be used for a lining/capping material. Soils from this horizon were generally only slightly sodic. This would indicate that after compaction these soils would form a lining with low permeability as would be most desirable for the proposed landfill.

8.2 Geology

Associate Professor Paul Ashley was commissioned to investigate the geological faults believed to be present within the proposed landfill site as detailed in the *Geological Report on the Proposed Armidale Dumaresq Council Landfill Site* (Ashley, 2006) (**Appendix M**). Particular emphasis was placed on whether a geological fault exists in the vicinity of the site, as such a fault is indicated on previously published maps that apparently passes through the area of the Project Site.

A geological assessment of a 26 metre vertical borehole drilled on the Project Site was also carried out identifying rock type, structures that might have geotechnical implications (e.g. groundwater migration, site stability) and weathering effects. A copy of the *Report on Geological Logging of Diamond Drill Core from the Proposed Armidale Landfill Site* (Ashley, 2005) is contained in **Appendix N**.

8.2.1 Existing Environment

Geological Setting

According to the 1:250 000 Dorrigo-Coffs Harbour geological map (1992), the Project Site is underlain by Late Palaeozoic deep marine sedimentary rocks of the Girrakool Beds, lying close to the contact with the nearby Sandon Beds.

Geophysical data indicates that the rocks underlying the Project Site are most likely part of the late Palaeozoic Sandon Beds (Brown, 2003). Mapping carried out by A/Professor Ashley supported Brown's (2003) interpretation.

The Sandon Beds are largely deep marine sedimentary in character and of a similar age to the Girrakool Beds. Both of these rock units are composed largely of low grade metamorphosed and folded greywacke, siltstone, mudstone-argillite and chert. As a consequence of folding, it is common for the rock sequence to be steeply dipping.

The Project Site is in an undulating landscape on the New England Plateau and weathering has affected all rocks types. It is common to have weathering effects manifest to depths of metres, to tens of metres on the plateau.

Local Geology

Field mapping of the site (Ashley, 2006) indicated that the dominant underlying substrate rocks within the Project Site include greywacke, siltstone, mudstone-argillite and chert. Tertiary age sedimentary rocks, basalt and regolith were found on the southern side of the Project Site. A small Tertiary basalt mass approximately 0.5 kilometres deep is located south of the proposed landfill footprint. The dominant rock type surrounding the site is Sandon Beds greywacke.

Potential Fault Line

The published 1:250 000 Dorrigo-Coffs Harbour geological map includes a linear fault trace marked as "position accurate", striking about 50° across the southern portion of the Project Site (see **Figure 14**). However, it has been stated that the fault line shown is only in its approximate position (**Appendix M** refer NSW DPI-Mineral Resources, pers comm., 16 September 2005).

A geological mapping programme was conducted to ascertain if the mapped fault could be identified within the area of the Project Site (**Appendix M**). The mapping programme made observations on rock types and structures and attempted to identify any characteristics that might confirm the presence of a fault and/or any geologically recent tectonic activity.

If an underlying fault was likely, or a zone of faulting, one or more of the following criteria would be anticipated to occur and might be recognisable, assuming that there is a sufficient surface outcrop:

- Evidence of shearing, fracturing, brecciation or stronger cleavage development in the rocks, particularly those having a north east-trending strike (consistent with the strike of the potential fault line).
- Evidence of hydrothermal alteration focussed along a fault (i.e. that might change the texture, mineralogy, colour or competency of the rock).
- Abrupt changes in rock type, or in structural style, for example bedding or cleavage orientation.
- Topographic evidence, for example the presence of a linear scarp or depression (valley). Topographic indications might be expected if there had been relatively recent motion on a fault (geologically recent, i.e. within about the last 10 to 30 million years, for example).

Field observations seeking to identify evidence of any of the above criteria did not support the occurrence of a fault at the Project Site.

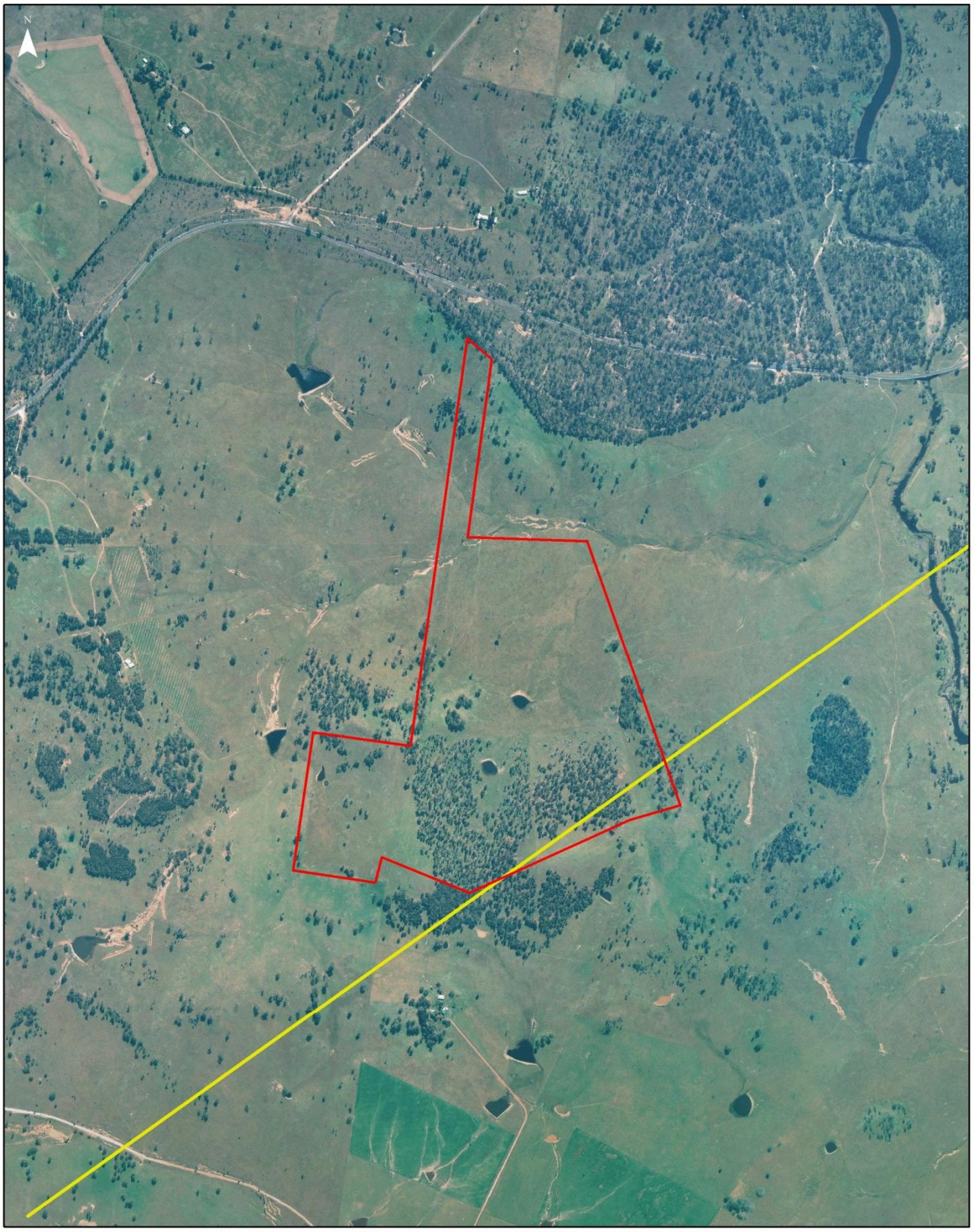
A hydrogeological investigation undertaken in 2007 (**Appendix F**) reported the abandonment of two bores during drilling near the southern boundary of the Project Site. It was reported that confining pressure was lost due to a subsurface void or possibly a fault in the rock structure. However, the report could not verify the existence of such a fault and recommended that additional geotechnical and hydrogeological investigation be undertaken in the vicinity of the anomaly, should further assessment be required. It is important to note that these bores were located outside the operational landfill footprint.

From the detailed field observations and structural measurements and the examination of remote sensing data and maps, it is considered that there is no well-defined fault within the vicinity of the Project Site. According to the findings of these investigations it is considered that there is no factual evidence for the fault shown on the 1:250 000 geological maps, at least within the region immediately surrounding the Project Site.

It is not clear why the geological map shows such a fault. It has possibly been inferred from long range photography conducted to the north-east or south-west of the Project Site. It has since been separately reiterated by A/Professor Ashley that the fault line shown on the published geological map has no basis in fact, within the Project Site and for at least one to two kilometres along the strike to the northeast and southwest of the site. Ashley has since confirmed that there should be no "*significant bedrock geological reason mitigating against the siting of the proposed landfill (e.g. earthquake risk, groundwater leakage along a fault)*."

Detailed field observations, structural measurements and the examination of all available, relevant data do not support the existence of any significant geological fault within the vicinity of the Project Site.

AECOM



Project site

Mapped fault line

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POTENTIAL GEOLOGICAL FAULT

Source: AECOM (2007)

0 125 250 500 m

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Fig. **14**

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8.2.2 Potential Geological Impacts

If the fault exists and displays any evidence of activity (e.g. earthquakes), zones of increased porosity and/or permeability would create concern with respect to the siting of the proposed landfill facility at this location. In that instance there would be possible issues of landfill stability, as well as potential for groundwater contamination as a result of potential fault line activity. However, given the approximate position of the fault and lack of evidence supporting its location, it is likely that even if the fault exists that it is not active (no movement since the Holocene period) and is unlikely to be active throughout the life of the proposed landfill facility. Potential impacts resulting from seismic movements are therefore unlikely.

8.2.3 Mitigation Measures

No mitigation measures are required, however observations would be made and recorded during and/or on completion of excavation works in the vicinity of the potential geological fault. Further detailed assessment, including additional geotechnical and hydrogeological investigation in the vicinity of the feature, would be undertaken should evidence of a geological fault be encountered during earthworks. This approach, as recommended by DECCW, has been agreed with DoP (December, 2009).

8.3 Surface Water

8.3.1 Existing Environment

Gara River

The Gara River originates about 45 kilometres north of the Project Site, traverses to the bottom of the valley of the Oxley Wild Rivers National Park and eventually runs into the Macleay River. The Macleay then runs into the Pacific Ocean near South West Rocks in northern NSW. The mid and lower reaches of the Gara and Macleay Rivers are characterised by deep and extensive gorge systems that form part of the Oxley Wild Rivers National Park and the GRAWHA. The Gara River descends into a gorge approximately 4.3 kilometres south-south-east of the Project Site, within the Oxley Wild Rivers National Park. The riverbed distance between the closest point to the Project Site and the National Park is 8.8 kilometres. The minimum or straight line distance between the Gara River and the proposed landfill site is 1 kilometre. The Gara River flows from north to south, forming the eastern boundary of the Edington property over a distance of about 2.5 kilometres.

The Southern New England Tablelands Region State of the Environment Report (2004) and Supplementary report (2004/05) identifies the Gara River as a “stressed sub-catchment”, exhibiting signs of poor water quality. It also shows signs of “high hydrologic and environmental stress”, including:

- Eutrophication (due to high nutrient content).
- Poor river structure (stream bank erosion and poor riparian habitat).

The Stressed Rivers Assessment Report 1998, produced by the former Department of Land and Water Conservation (DLWC), gave the Gara River the highest overall stress classification, indicating that water extraction within the region contributes to the river’s environmental stress. Flows within the river are impacted both by the Guyra Shire Council Dams and the Malpas Dam, all of which are close to Guyra.

Commissioners Waters

Commissioners Waters is a water course located approximately 1.6 kilometres south of the Project Site. Commissioners Waters flows eastwards and into the Gara River upstream of the Oxley Wild Rivers National Park. Runoff from the Project Site does not flow to Commissioners Waters.

Minor Drainage Lines

Two intermittent unnamed creeks flow onto the Edington property from the neighbouring Strathaven property to the west. Both creeks are seasonal and only flow during wet weather. The flow regime of the creeks has been modified by farm dams located upstream in an adjacent property. These drainage lines flow onto the Project Site from the westerly and south westerly directions for approximately 200 metres before they merge to form a single gully (with intermittent flows), which extends a further 1300 metres east across the Edington property, before joining the Gara River at the north-western corner of the site.

Seven small farm dams are scattered across the Sherraloy property and two small farm dams are present on the Edington property. Two of these dams are within the proposed boundaries of the landfill footprint and its associated buffers.

Catchment Areas

The Project Site is situated within the Gara River sub-catchment, which covers an area of 41,486 hectares. Runoff from the site runs to the two intermittent drainage lines described previously. These have a combined catchment area of 370 hectares. The Gara River feeds into the Macleay River catchment and is managed by the Northern Rivers Catchment Management Authority (CMA).

The land uses within the region are generally agricultural. Some residential, commercial and industrial areas are concentrated around the major urban centres of Guyra and Armidale (refer to **Section 8.13**). Any water-borne pollution within the catchment would come from a combination of urban, rural and industrial sources.

Flooding

Runoff from the Project Site flows northwards to the intermittent creek, which is a tributary of the Gara River. The Project Site is located within the upper reaches of the catchment. No flood studies have been conducted in this area, instead, calculations using Manning's equation were used to estimate the 100 year Average Recurrence Interval (ARI) flow and the 100 year flood level in these creeks. The results of these calculations indicate that the proposed landfill site is well outside the extent of the 100 year floodplain.

The design for the landfill and stormwater ponds (dry basin) incorporates adequate freeboard to contain 100 year ARI flows on site.

8.3.2 Potential Surface Water Impacts

Construction

The construction of the proposed landfill facility would require the disturbance and movement of soils. The disturbance and exposure of soils represents a risk to the water quality of local waters. The generation of sediment-laden runoff from exposed areas could potentially occur during periods of heavy rainfall. Spillage or uncontrolled releases of pollutants such as fuel and oils could provide a source of pollutants. Runoff containing sediments and other pollutants could enter downstream watercourses, adversely impacting on both water quality and the aquatic flora and fauna within these systems.

Potential impacts on the unnamed creeks (which intermittently flow to the Gara River) during construction could include:

- Disturbance of the stream bed of the unnamed creek during construction of the culvert.
- Temporary alteration to the channel flow regime of the creek.
- Increased suspended sediment load to the creek and the Gara River.
- Temporary alteration of overland flow paths, possibly concentrating and redirecting overland surface water flows.

Operation

The proposed landfill facility has the potential to impact on water quality and flows in downstream watercourses. Potential impacts resulting from the operation of the proposed landfill facility could include:

- Impact on water quality resulting from the mobilisation of sediment and other stormwater borne pollutants and potential discharge of leachate from the proposed landfill.
- Increases in runoff volume or velocity entering the unnamed creek.

Potential Impacts on Water Quality

Leachate would be generated by the landfill and, if released to the environment, could impact on water quality through:

- Input of nutrients at elevated levels.
- Rapid growth of weeds, supported by the high nutrient levels.
- Death of aquatic organisms within the creek such as fish and macro-invertebrates.
- Lower dissolved oxygen levels in the creek.
- Odour emissions from the river, mainly during periods of low flow.

- Other pollutants of concern that may potentially be contained in surface water runoff from the Project Site include weed propagules (i.e. seeds or other plant matter), bacteria, other organic matter, oil and grease from operational plant and machinery, heavy metals and other toxins.

However, the landfill would be designed to ensure that no operational water (i.e. leachate or dirty stormwater) is released to the environment, therefore it is unlikely that the proposed landfill would impact on water quality of the unnamed intermittent creek or Gara River.

Potential Impact on Runoff Volumes and Velocities

A culvert would be constructed where the access road crosses the unnamed intermittent creek. Construction of the culvert could impact on the natural flow of the creek and, by increasing the velocity of the water in the creek, could increase the potential for erosion and scour and result in impacts to water quality by mobilising sediments.

An increase in the impermeable surface area or runoff characteristics of the catchment can increase runoff flows when compared with undeveloped catchments. Generally, runoff could enter the downstream waterways in a shorter period of time as a result of the proposal contributing to peak flows. Modification of the flow regime in the intermittent creek could subsequently influence bed and bank stability, downstream flood levels and biological components of the creek. The detailed design of the drainage system for the Project Site would incorporate measures and controls to mitigate these impacts.

8.3.3 Mitigation Measures

Construction

The proposed mitigation measures for the construction phase of the proposed landfill facility are provided within the WLMP (refer Draft LEMP in **Appendix B**), which would form part of the final LEMP. The WLMP would be implemented during construction to address the potential impacts on water quality and flows by reducing erosion hazard and preventing any off-site sediment movement.

The WLMP was prepared in accordance with *Managing Urban Stormwater: Soils and Construction* (Landcom, 2004) and includes:

- An assessment of the key site constraints.
- A list of actions to minimise site disturbance.
- A description of erosion and pollution control measures to be used during construction and a plan showing locations of such controls.
- A staging programme for the erosion and sediment control measures.
- A site inspection and maintenance plan.

The WLMP requires a series of soil and water controls to be installed both up and down gradient of the working width of the site to contain surface water on site and/or to divert clean surface waters away from the construction areas.

The main principles during site construction for water and soil management, specifically erosion and sediment control are:

- To appropriately stockpile and reuse all topsoil and ensure that temporary topsoil stockpiles are protected from erosion.
- Ensure that stockpiles are not placed in the flow path of upslope runoff.
- Divert clean runoff water from the upstream drainage system around the site.
- Monitor and maintain all sediment and erosion control measures.
- Minimise additional soil disturbance activities during wet weather.
- Stabilise rehabilitated surfaces at the earliest possible time.
- Provide adequately designed sediment fences, barrier fences, and other required structures.
- Restrict vehicular access to stabilised entry and exit points with controls to reduce export of soil that is attached to excavators and truck tyres exiting the site.
- Restrict access to areas that do not require land disturbance.

- Operation

The proposed water management for the Project Site is shown in **Figure 8**. The proposed landfill facility would be graded to ensure that stormwater is diverted appropriately and managed on site. In order to manage surface water during operation of the landfill, surface water has been categorised as clean stormwater, dirty stormwater and leachate as discussed in **Section 5.2.6**.

- Clean Stormwater

Clean stormwater would not be in contact with any areas where waste, organic material or compost has been handled or stored. Clean stormwater would be conveyed via the site's clean water diversion drains to the unnamed creek to the north of the Project Site. Clean stormwater would not require treatment, however appropriate erosion controls would be provided along diversion routes and at the discharge (e.g. energy dissipator).

- Dirty Stormwater

All dirty stormwater comprising runoff from disturbed (i.e. cleared, non-vegetated or construction) areas (but outside exposed/uncapped active waste cell area/s) would be controlled and managed within the Project Site. Dirty stormwater is potentially contaminated with gross pollutants, sediments or oils / grease etc, but not with leachate waters, and therefore would require treatment for those contaminants prior to discharge or reuse on site for dust suppression or irrigation.

The methods proposed for control and management of dirty stormwater are set out within the draft LEMP (refer **Appendix B**) and include the following:

- Construction of a perimeter bund around the entire active landfill area to prevent surface water from entering the landfill area from run-off or localised flooding;
- The total area of exposed and/or uncapped active waste cell areas would be kept to a minimum and bunded (diversion drains) to prevent run-off entering these areas. Progressively filled areas would be covered with daily cover (150 millimetres minimum) to minimise contact between surface waters and waste, and therefore minimise the generation of leachate. Water collected within these exposed/uncapped active waste cell areas would be designated as "leachate";
- Construction of a diversion drain around the entire landfill area to collect all runoff from disturbed areas (but outside exposed/uncapped active waste cell area(s)) which would drain to the sedimentation basin to the north east of the landfill footprint.
- Construction of a dry basin downstream of the sedimentation basin and leachate pond that would capture any overflow from the sediment and/or leachate pond.

Water Sensitive Urban Drainage (WSUD) principles would be adopted in the design criteria for the control and treatment of drainage runoff and include:

- Construction of a permanent sedimentation basin located outside the landfill footprint to collect and treat sediment laden water prior to release. The permanent sedimentation basin would be sized in accordance with Managing Urban Stormwater: Soils and Construction (2004) guidelines and would be sized to treat runoff from the disturbed areas of the landfill (refer **Appendix I**). Once an area has been fully capped and revegetated the surface runoff would be diverted to the clean water diversion drains.
- Drainage channels would run parallel to the proposed access road. The drainage channels would be in the form of table drains. Table drains would be grassed to form grass swales. The grass swales would act as a form of surface water treatment by impeding surface water flow and facilitating surface water infiltration rather than runoff.

Leachate

In order to appropriately manage leachate water, the proposal would include the construction of a permanent leachate pond where all leachate would be collected, stored and treated. This would also include all waters that are potentially contaminated due to their contact with waste or with any areas of land that have been contaminated with waste.

The volume of all leachate water produced would be regulated and would be required to undergo regular monitoring in accordance with the site EPL under the *POEO Act*. In the unlikely or "emergency" case that the leachate pond overflows, all overflow waters would be transferred to the permanent sedimentation basin for emergency storage and appropriate treatment.

The leachate pond has been sized to capture the 1 in 25 year, 24hr storm event from direct rainfall over the pond surface as well as runoff generated from the daily and intermediate covers. The catchment area used to calculate the required storage is the area of Cells 4 and 5, which is the maximum area that will contribute to the pond throughout the life of the landfill. The water balance model used to size the leachate pond adopted 10 years of average daily rainfall data for Armidale between 1982 to 1991 as it represented overall average annual rainfall and included a range of wet year, dry year and the 10% Annual Exceedance Probability (AEP) wet year. This 10 year period was used to assess the water balance for each stage of the landfill development. The pond was initially assumed to be empty. The size of the pond was altered until there was no overflow from the pond (by regulating the pond size) for 50 years of landfill operation. The leachate pond was sized to approximately 12 ML.

The effects of climate change were also taken into consideration for the sizing of the leachate pond. The rainfall data used in the modelling was amended to reflect the projected worst case rainfall changes resulting from climate change, i.e. maximum wetting, based on the data in **Section 8.17.2**, as follows:

- Autumn (from March to May): 10% increase in daily rainfall.
- Winter (from June to August): 20% decrease in daily rainfall.
- Spring (from September to November); 10% increase in daily rainfall.
- Summer (from December to February): 20% increase in daily rainfall.

As quantitative assessment of future evaporation couldn't be predicted, it is assumed that the effect of climate change on evaporation is negligible (i.e. worst case). The water balance model was rerun taking account of the above revised rainfall values and assuming that evaporation rates remain the same, and concluded that the leachate pond with 12ML capacity would be sufficient to manage the leachate that would be generated during operation of the proposed landfill.

Lining of Leachate Pond

The leachate pond would be lined in accordance with EPA Benchmark Technique Number 2 – Leachate Collection System (refer to **Appendix B** for details).

Emergency Containment

A dry basin, in the form of a bund downstream of the landfill is proposed as an emergency containment system, in the event that the sedimentation basin and/or leachate pond overflow during a major storm event. The main components of the design of the basin are listed below:

- The basin has been designed with sufficient capacity to contain all runoff from the landfill area for the 1 in 100 year ARI storm event (six hour duration). The contributing area is 32.2 hectares and the required volume is 19,000 m^3. This volume will be further refined during detailed design.
- The basin has been designed as a three metre high bund located downstream of the disturbed landfill area and the leachate and sedimentation basin.
- All emergency overflow from the sedimentation basin and leachate pond is to be directed to the dry basin through the use of bunds and diversion drains. Clean runoff is to be diverted around all ponds and basins offsite.

Overflow from the sedimentation basin and other runoff from the site that would be diverted to the dry basin, would be treated in the same way that discharge from the sedimentation basin would be treated, as described in the WLMP. In the event that the leachate pond exceeds capacity, options for management include:

- Allowing the leachate to evaporate (from the Sedimentation and/or dry basins).
- Pumping leachate back into the landfill or leachate pond once there is sufficient storage available.
- Transport offsite to a licensed facility such as the Council's Sewage Treatment Plant (STP).

There would be no discharge of contaminated water to the downstream environment. In the event that the volume of the dry basin is exceeded, actions contained in the Water Contamination Remediation Plan in the LEMP would be followed (refer **Appendix B**).

Runoff Volumes

New impervious areas at the proposed landfill facility would be limited to the access road, perimeter road, and the roof of the staff amenities building. The increase in runoff would be minimal as these areas are small in relation to the entire catchment.

Dirty water and leachate runoff from the landfill would be directed to the sedimentation basin and leachate pond, and to the dry basin should any overflow occur from either the sedimentation basin or leachate pond. Adequate detention storage would be provided on site, meaning that peak flows from the catchment would be reduced and would not increase from the current levels. An analysis using the RAFTS hydrology model was undertaken to examine the pre- and post development flows from the site. The analysis confirmed that peak flows in the 100 year ARI storm event would not increase as a result of the operation of the proposed landfill facility.

A culvert would be provided where the access road crosses the unnamed creek. The culvert would be sized to ensure that there is no increase in upstream water levels. The road would be sealed but would not be designed to cater for all storm events and therefore may be overtopped during major storm events.

Water Quality Monitoring

Monitoring of surface water and leachate is to be carried out at the Project Site as detailed in the Surface Water Monitoring Programme (refer to **Appendix B**) and the Leachate Monitoring Programme (refer to **Appendix B**). Monitoring would help to ensure there are no measurable effects on surface water resulting from the landfilling activities.

8.4 Groundwater

Hydro-geological investigations were conducted by EA Systems (2005-2006) (**Appendix D**), RCA (2006-2007) (**Appendix F**) and AECOM (2010) (**Appendix I**) to:

- Establish the hydro-geological conditions across the site.
- Determine the potential impact on groundwater from the project.

8.4.1 Assessment Criteria for Groundwater Quality

At present there are no formally endorsed groundwater guidelines for Australian conditions. For the purposes of this assessment, the guidelines used were those developed for the protection of receiving waters. The NSW *Groundwater Quality Protection Policy* (DLWC, 1998) requires protection of groundwater quality for the purposes of sustaining ecosystem health and also to protect groundwater as a potential source of drinking water. The Australia and New Zealand Environment and Conservation Council (ANZECC) *Guidelines for Fresh and Marine Water Quality (ANZECC/ARMCANZ, 2001)* for the protection of aquatic ecosystems are considered to be the most appropriate guidance available, however it should also be noted that, due to the distance of the Project Site from the Gara River, as well as the relatively small area of the Project Site when compared to its overall catchment, results of site groundwater analysis do not necessarily represent the final concentration of contaminants in the river, i.e. results of groundwater analysis may be considered to be conservative (refer **Section 8.4.4**) .

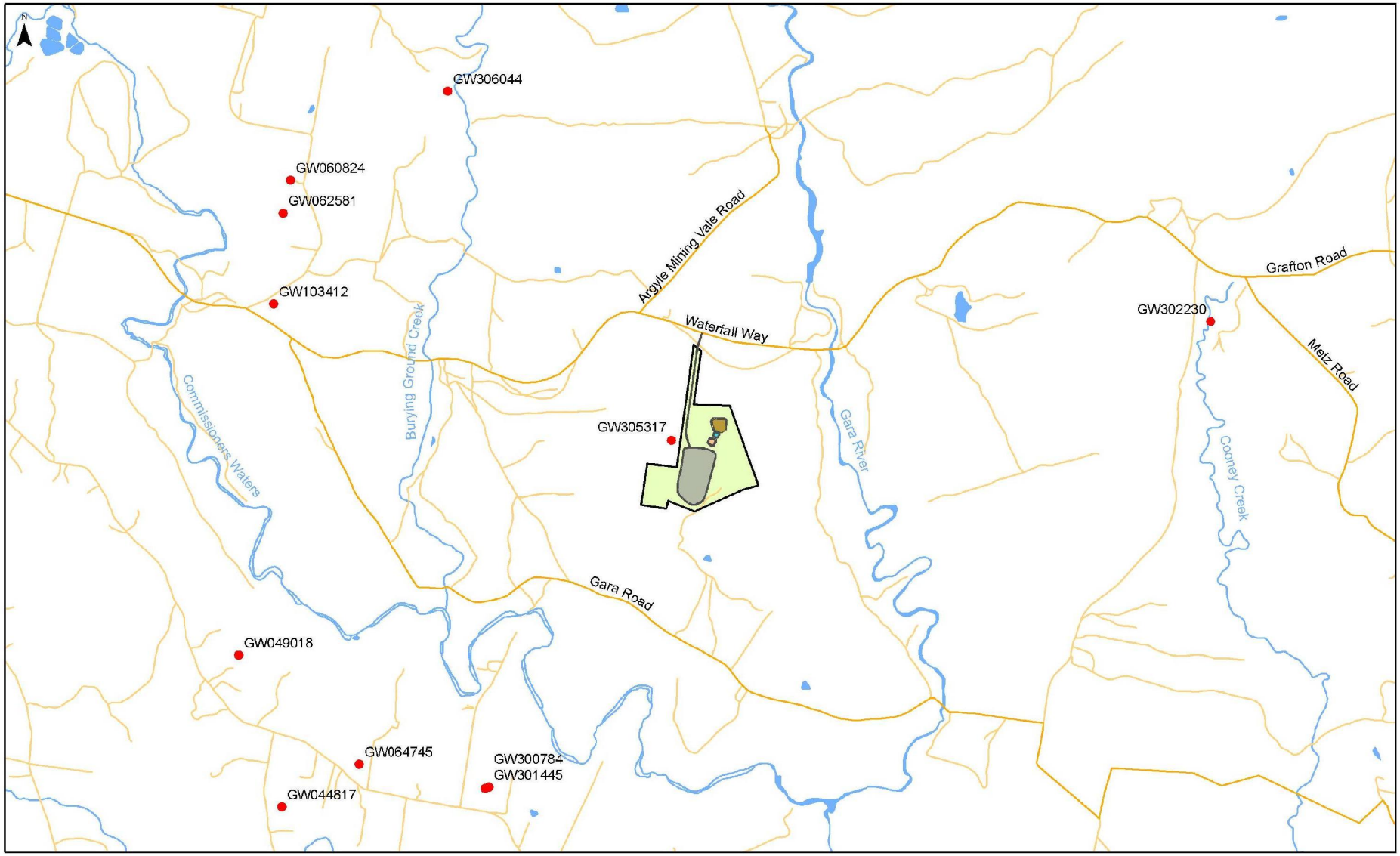
The receiving water in this instance is considered to be the Gara River, which is a fresh water environment. This river is considered a moderately modified waterway. While a 90% protection level may be appropriate, it is proposed that a 95% protection level should be used from the boundary of the Project Site as any tributary that flows into the Gara River system should contribute to an improvement of water quality. The 95% protection level was therefore considered during the development of mitigation measures (refer **Section 8.4.5**).

8.4.2 Existing Hydro-geological Conditions

Registered Groundwater Bores

A search of registered bores in the vicinity of the Project Site was undertaken using the Natural Resources Atlas on 9th September 2009. The search identified eleven registered bores within a distance of approximately 6 kilometres from the Project Site (see **Figure 15**). Registered users consistently include domestic and stock uses, with two bore owners also reporting intended use for irrigation and one reporting intended use for farming.

Ten of the eleven bores are located more than 3.5 kilometres from the Project Site. The bore located on the Strathaven property, GW305317, is located approximately 100m from the Project Site.



Groundwater bore
Biodiversity Offset Area
Landfill footprint
Leachate pond
Sedimentation basin
Dry basin

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REGISTERED GROUNDWATER BORE LOCATIONS

Source: ASR (2006), Map Data (2008), Natural Resources Atlas NSW (2009)

0 0.5 1 2 km

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Fig. **15**

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Table 27 provides a summary of all bores reported in the registered bore search including their distance from site, installation depth and indicative salinity.

Table 27: Registered bores in proximity to site

Registered Bore #	Registered Use	Distance from Site (approx km)	SWL	Total Depth (m)	Salinity (ppm)
GW044817	Domestic, Stock	5.5	NR*S	61.0	NR
GW049018	Domestic, Stock	5.2	NR	32.0	NR
GW060824	Domestic, Stock	5.3	NR*B	54.9	501-1000
GW062581	Domestic, Stock	5.0	24.5*G	47.5	1001-3000
GW064745	Domestic, Stock	4.5	NR*B	53.0	NR
GW103412	Domestic, Stock	4.8	NR	60.0	NR
GW301445	Domestic, Stock	3.5	28*B	62.0	NR
GW302230	Domestic, Stock	5.8	6.0*G	42.0	120
GW300784	Domestic, Stock	3.5	28.0*B	62.0	NR
GW305317	Domestic, Stock	0.1	31.4*B	38.7	NR
GW306044	Domestic, Stock	4.2	NR	85.0	NR

NR = not reported * = water bearing formation indicated B = basalt G = granite S = slate

Groundwater Survey

EA Systems drilled and logged five bore holes, into which five piezometers were installed to monitor groundwater movement (**Table 27**). Four of these piezometers were installed on 13th October 2005 and one was installed on 17th November 2005, at the locations shown in **Table 28** and on **Figure 16**. Groundwater monitoring was then carried out from November through to December 2005. While no standing groundwater was detected during the shallow soil drilling investigation, the soil profile had evidence of transient sub-surface flow within the shallower soils. No groundwater was detected in any of the bore holes during the piezometer monitoring period.

Table 28: EA Systems Piezometer Locations (MGA94 Zone 56) and Water Entry Screen Depths

Piezometer	Easting	Northing	Water Entry from (m)	Water Entry to (m)
P1	383261.98	6618683.49	0.35	1.85
P2	383490.08	6619462.43	0.5	2.0
P3	383412.89	6619775.29	0.45	1.95
P4	384608.59	6619877.89	1.1	2.6
P5	383471.27	6619105.1	5.1	9.6

Subsequent to the above investigation, RCA conducted hydro-geological studies (refer **Appendix F**) in the study area, during October 2006, which included the following:

- Drilling of 10 bores to depths ranging 1.0m (BH1) to 18.0m (BH4) (**Table 29**).
- Groundwater monitoring wells were installed in 5 bores (BH4 & BH5 in rock; BH4a, BH5a and BH7 in soil).
- Permeability tests were conducted in a number of bores (BH4, BH4a, BH5a and BH7).
- Groundwater samples were collected from BH4 and BH5 as well as from an existing groundwater bore on a neighbouring property to the west of the landfill site (no survey was done of this bore and no registration was found for the bore on the DNR database searched on 30 October 2003). No standing groundwater was encountered in any of the bores in soil.

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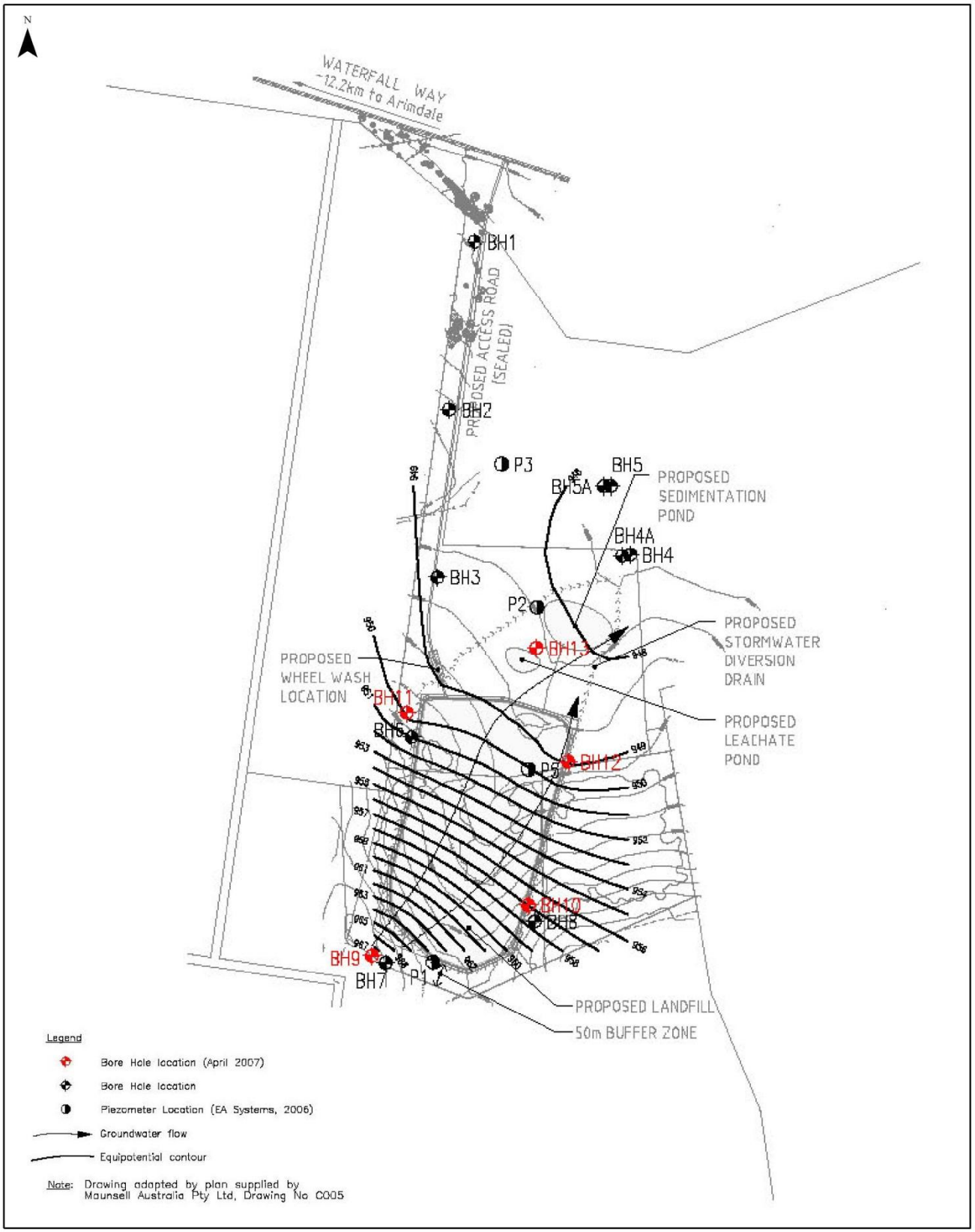

ARMIDALE DUMARESQ COUNCIL - ARMIDALE REGIONAL LANDFILL FACILITY

DIRECTION OF GROUNDWATER FLOW AT PROJECT SITE

Source: RCA (2007)

0 125 250 500 m

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Fig. **16**

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Table 29: RCA Bore Hole Locations (MGA94 Zone 56)

Bore Hole	Easting	Northing	RL (m, AHD)	Bore Depth (m)
BH1	383353.47	6620262.81	980.48	1.3
BH2	383297.43	6619894.91	958.14	
BH3	383271.88	6619528.24	962.85	
BH4	383691.47	6619577.55	954.11	18.0
BH4a	383693.19	6619577.72	953.96	
BH5	383650.96	6619727.59	953.13	
BH5a	383649.85	6619727.47	953.05	
BH6	383215.21	6619176.42	981.14	
BH7	383158.60	6618681.95	1010.58	
BH8	383484.77	6618773.13	999.37	

RL = Relative Level AHD = Australian Height Datum

During March 2007, RCA conducted further groundwater investigation on the Project Site (**Appendix F**). Groundwater monitoring wells were installed into the bedrock aquifer in seven bores during the investigation (including bores BH4 and BH5 which were drilled during the earlier RCA investigation). A summary of the details of the monitoring wells is presented in **Table 30**.

Table 30: Piezometer Summary

Bore No.	Easting	Northing	RL (m, AHD)	Screen Depth (m)
4	383691.47	6619577.55	954.11	6.0-18.0
5	383650.96	6619727.59	953.13	3.6-9.6
9	383128.77	6618697.86	1014.03	53.5-59.5
10	383470.84	6618809.06	993.78	41.0-47.0
11	383204.64	6619230.01	977.58	30.0-36.0
12	383558.08	6619122.94	969.79	34.0-40.0
13	383488.09	6619373.36	961.70	16.0-22.0

RL = Relative Level AHD = Australian Height Datum

Standing groundwater was encountered in all bores at varying depths (3.6 to 59.5 metres below ground level) from 953 to 1014 metres AHD during the further groundwater investigation conducted by RCA in March 2007 and the results are presented in **Table 31**.

Table 31: Gauged Groundwater Depths

Bore No.	RL (m AHD)	Stickup (m)	GW Depth from top of pipe (m)	Screen Depth (m) Below ground level	GW RL (m, AHD)
BH4	954.11	0.74	6.35	6.0-18.0	947.76
BH 5	953.13	0.75	5.27	3.6-9.5	947.86
BH 9	1014.03	0.95	46.7	53.5-59.5	967.33
BH 10	993.78	0.67	37.0	41.0-47.0	956.78
BH 11	977.58	0.72	28.0	30.0-36.0	949.58
BH 12	969.79	0.62	21.3	34.0-40.0	948.49
BH 13	961.70	0.60	13.3	16.0-22.0	948.40

Survey data from Hawkins Hook & Co site survey report May 2007.

RL = Relative Level AHD = Australian Height Datum

RCA concluded that the groundwater flow in the upper or southern section of the Project Site is generally assumed to be toward the north-north east, whereas in the lower or northern section of the Project Site flow is assumed to be more directly north-east.

Hydraulic Conductivity

Tests for hydraulic conductivity (permeability) were undertaken at two bore locations. Hydraulic conductivity test results are summarised in **Table 32**.

Table 32: Hydraulic Conductivity/Permeability Test Result Summary

Bore Number	Test Method	Permeability (m/s)
BH1*	Falling Head Piezometer Test (Hvorslev method)	3.8×10^{-6}
BH5 *	Rising Head Test (Hvorslev method)	4.4×10^{-8}

* The falling head test was conducted over a relatively short period and has required extrapolation to interpret the permeability

The results indicate that the permeability of the sandstone bedrock tested in the vicinity of monitoring well, BH11 is in the order of 3.8×10^{-6} m/s. The permeability of the argillite bedrock in the vicinity of well BH5 was in the order of 4.4×10^{-8} m/s. Given the limitations associated with the permeability data collected during the investigation, it is recommended that the above permeability results be used as indicative values only. A more rigorous testing schedule for permeability should be adopted for more accurate data for detailed design purposes.

Groundwater is assessed as likely to be leaving the site in a predominantly north easterly flow direction, towards the Gara River, close to the location of BH4. The direction of the groundwater flow is shown in **Figure 16**.

Aquifer Characterisation

A summary of the groundwater geochemistry on the site is presented in **Table 33**.

Table 33: Groundwater Geochemistry

Bore No.	Water Type	Classification
BH 4	Bicarbonate	Ca + Mg, Na + K HCO_3, Cl + SO_4
BH 5	Sulphate	Ca + Mg, Na + K Cl + SO4, HCO_3
BH 9	Chloride	Ca + Mg, Na + K Cl + SO_4, HCO_3
BH 10	Calcium/Chloride	Ca + Mg, Na + K Cl + SO_4, HCO_3
BH 11	Bicarbonate	Ca + Mg, Na + K Cl + SO_4, HCO_3
BH 12	Bicarbonate	Ca + Mg, Na + K HCO_3, Cl + SO_4
BH 13	Bicarbonate	Ca + Mg, Na + K HCO_3, Cl + SO_4

Table 33 indicates that the aquifer in the southern section of the Project Site which is contained within the ridgeline, is predominantly a chloride water type. In the northern section, the water is more likely to be influenced by influx of other water types from up gradient or from the south-west of the site. All groundwater sampled in this section of the Project Site was predominantly a bicarbonate water type, except for the water in well BH5 which was a sulphate water type. Well BH5 is screened in the argillite bedrock, whereas well BH11 higher up the Project Site to the south-west, is screened in sandstone. Other wells screening the argillite had significantly higher recovery rates than BH5. A possible reason for the lower recovery observed in BH5 is the layer of mudstone, which was identified in BH5 immediately above the level of the argillite, but was not identified in the other bores.

It is considered likely that the water sampled from BH5 is representative of, or is being impacted by a separate aquifer to that of the majority of the site, flowing from the north back toward the low point of the Project Site in the vicinity of BH4. Based on the limited number of wells in this section of the Project Site, groundwater flow direction could not be accurately interpolated. However, the estimation of groundwater flow direction, based on the available data and the observed topography, is considered to give a valid representation of the flow direction in the northern section of the site.

Groundwater passing through the argillite bedrock is expected to have higher dissolved solids than water discharging from the sandstone or highly weathered argillite layers.

A summary of the ion concentrations used to characterise the groundwater types encountered on the site, and several other chemical groundwater quality parameters, is provided below:

- The ammonia concentration in BH5 was slightly greater (<109%) than the National Health and Nutrition Research Council (NHNRC) and National Resource Management Ministerial Council (NRMMC) 2004 drinking water guidelines. The overall concentration of ammonia across the aquifers encountered could be considered as low, given the high potential for solubility.
- The relatively high concentration of both ions detected in groundwater on the site is considered likely to be as a result of the long residence time of the groundwater within the predominantly argillite bedrock, and the solubility of the chemical constituents of the rock.
- Chloroform was detected in very low concentrations in wells BH9 and BH11. The wells are on opposite sides of the site and do not have the same geochemical characterisation. Despite the potential source of the chloroform being unknown, the chloroform detected is not considered significant given the low concentrations.
- Phenols have been detected in BH5. However, the concentrations detected do not exceed the site guidelines and are falling. No likely source of phenols was observed in the vicinity of BH5. Contamination of the well due to drilling is not considered to be a likely source as the phenols were detected over several months and the bore has been subjected to repeated rigorous development.
- The Total Organic Carbon concentrations detected in all wells is considered relatively low except for BH5. The TOC concentration in BH5 has risen markedly (740%) since measured in October, 2006. No apparent reason for this rise was observed, however variation in TOC is not unusual especially where groundwater recharge is intermittent and standing water levels fluctuate.

8.4.3 Geology and Soils

The geology of the region and site are described in **Sections 8.1** and **8.2**.

In general, the clay loam topsoils which have been observed to a maximum depth of 0.45 metres, are underlain by silty clays and subsequently by clayey silts at depths of between 1.2 to 5.5 metres below surface level. The clayey silts represent extremely weathered mudstone-argillite which includes sands or gravels in some locations throughout the Project Site. This layer is underlain by the parent rock at varying depths, which are typically in the range 0.75 -1.5 metres below surface.

The area of elevated topography at the southern part of the Project Site is expected to act as a local groundwater recharge location with infiltrating waters forming spatially and temporally transient perched groundwater at the shallower depths. Additionally, deeper percolation of groundwater is expected to recharge the deeper aquifers observed on site in the fractured mudstone. Review of regional bore data indicates that this is likely to be underlain at greater depths by a fractured granite formation which also acts as a regional groundwater body. The main expression of groundwater at the Project Site is anticipated to be both in the areas of higher permeability, that is, where sands and gravels have been identified, as well as at depths within the fractured mudstone of the Sandon Beds.

8.4.4 Potential Groundwater Impacts

Landfill Liner Defects

As described in **Section 5.0**, it is proposed to install a liner compromising of a clay layer in combination with a HDPE artificial liner, in conjunction with a leachate collection system to prevent transmission of any leachate from the landfill into the underlying groundwater or aquifer(s).

There is potential, albeit limited, for defects to occur during the construction of the landfill liner, resulting in potential leaks to the groundwater. During operation, a well-designed and installed liner may be expected to experience some degradation or aging with time that would eventually lead to localised failure. Degradation mechanisms include swelling, ultraviolet degradation, temperature, environmental stress cracking and biological and oxidative degradation (refer **Appendix I**).

A review of available literature on the efficiency of different landfill linings was undertaken. It included a review of typical liner life and performance, to establish the foreseeable life and performance of the proposed landfill liner (refer **Appendix I**). The review also considered leachate generation and quality over time.

The main findings of the literature review are as follows:

- Composite liner systems must be used appropriately and in accordance with site specific design and in strict adherence to construction specifications including Construction Quality Assurance or Construction Quality Control (CQC/CQA) programmes, and appropriate protection of the geosynthetics after construction. In particular, geosynthetic clay liners (if required) should be selected based on the required engineering properties.
- The available laboratory and field evidence, combined with modelling, indicates that primary Leachate Collection and Conveyance Systems in municipal solid waste landfills have a finite service life, which could range from less than 70 years to more than a century depending on the design, waste characteristics, material and exposure conditions and mode of operation. A typical HDPE liner should have an operational life of approximately 200 years if appropriately maintained.
- Leachate quality and quantities would be dictated by the type of waste received, the design of the landfill and how the landfill is constructed and operated. In the literature there is acceptance that leachate chemistry and naturally occurring processes within the landfill would act to degrade pollutants over time and eventually result in leachate that has a low level of pollution.

An appropriate WLMP has also been developed to ensure that both surface water and leachate are properly and effectively controlled and managed during the operational life of the landfill (refer **Section 8.3.3** and **Appendix B**). The WLMP considers all aspects of surface water and leachate storage at the proposed landfill facility, including design of a permanent leachate pond, sedimentation basin and dry basin.

Leachate Infiltration

Potential impacts to underlying groundwaters may arise from leachate infiltration through a landfill's liner material, primarily where the liner has not been installed appropriately, or has since become compromised in some manner.

A Hydrogeological (Leachate) Assessment was undertaken by AECOM (2010) to examine the potential risk of leachate infiltration through the liner and subsequent worse case impacts if a leak were to occur. The assessment results indicated that if a leak occurred, it would take approximately 300 years for the leachate to reach the site boundary and approximately 700 to 800 years to reach the Gara River. In considering the potential impacts on the Gara River, the assessment indicated that concentrations at the Gara River would peak at approximately 0.1% of the source concentration after 10,000 years.

As an example, an indicative concentration of ammonical nitrogen in the leachate in the landfill would be 12.4 mg/L. If the leak occurred, the model calculated that the concentration of ammonical nitrogen is unlikely to be greater than 0.013mg/L when it enters the Gara River (after 10,000 years), well below the ANZECC (2000) ammonical nitrogen trigger value of 0.9 mg/L for freshwater at 95% level of protection of species.

The hydrogeological assessment presented the worst case scenario with the following notable assumptions:

- The assessment assumed that defects would be present and leaking from day one of operation. While defects may be present in the constructed liner, CQA has improved significantly since 1994 (when Girroud's research was published). While it would be fair to say that standards have improved across the industry during this time, standards can be improved again by implementing a conservative construction quality plan. This would act to decrease if not eliminate the number of defects which may occur during construction, increasing the length of time before a leak would allow infiltration of leachate.
- The assessment assumed that leachate migration through the clay would occur directly at the defect in the HDPE liner or that the clay liner is saturated. While the migration of leachate through the clay liner would occur, it is unlikely that path of infiltration would occur directly adjacent to a defect. If the clay liner became saturated with leachate, then the defect may present a path of least resistance for leachate, but it would require a significant amount of time and pressure for leachate to fully displace the water held within the re-compacted clay liner.
- The assessment assumed 300 millimetres of leachate would be present above the liner. However, given the following, there is a negligible probability of there being a sustained 300 millimetres of leachate present above the liner:
    - the design of the leachate barrier incorporates 300 millimetres of drainage medium which would act to transport leachate to the sump which would in turn reduce the effective head of liquid present on the liner;
    - the landfill would be subject to a relatively low filling rate ; and
    - waste being deposited is likely to be relatively inert given the removal of a significant proportion of recyclable material.
- The assessment assumed that the leachate would migrate through the clay taking the shortest path. Clay liners are typically constructed using multiple layers of re-compacted clay. This ensures consistent compaction across the clay liner, decreasing the permeability of the clay liner and increasing its load bearing capacity. It also has the benefit of creating a laminar pattern within the clay layer. The laminar pattern in the clay acts to move migrating leachate horizontally between layers of clay, rather than allow it to move in a straight vertical line towards the HDPE liner. This would serve to increase the time required for the landfill to leak.
- The assessment assumed that the leak would occur at the point in the landfill closest to the site boundary and the Gara River. If the leak occurred on the western edge of the landfill, the length of time for any contaminants to reach the boundary and subsequently the Gara River would increase.
- The assessment assumed that the entire landfill would contribute to the leakage. While this may be correct during the latter stages of operation, initially there would be a single cell, and this cell would be operating on the reduced footprint for the first 10 years, and the landfill would not have a complete footprint covered in waste until 40 years into the operation of the landfill.
- The attenuation and dilution factors used for modelling the transport of leakage to groundwater and then for the migration of the impacted groundwater to the site boundary and Gara River are all worse case scenarios, assuming straight line travel, and cannot account for the additional externalities that would act to further reduce leachate concentration.

Given these assumptions and the conclusions of the literature review, the estimated time for leakage to escape the landfill (approximately 17 years) is highly conservative. Similarly, the time required for the leachate to reach the site boundary and the Gara River is highly conservative. Given the timeframe estimated for leachate analytes to reach the site boundary (300 years) and the Gara River (700 to 800 years) and considering that concentrations at the Gara River would peak at approximately 0.1% of the source leachate concentration after 10,000 years, it is concluded that the landfill, even under worse case conditions would have negligible impacts on the Gara River.

Additionally, comprehensive management systems and strategies would be implemented to manage the rate and volume of leachate generated from the landfill mass, as well as the manner in which the leachate would be stored, treated and ultimately disposed. These management systems / strategies would be described in detail in the LEMP (**Appendix B**).

The finally agreed management systems would ensure that the proposed landfill facility does not impact on underlying groundwater. Although considered to be highly improbable, potential impacts are examined below, in order to appropriately assess potential consequences.

Groundwater-Surface Water Interaction

It is expected that groundwater generated from shallow penetration of the substrata at the Project Site may contribute to "perched" water flows within a few meters of the surface. As discussed previously, these may be expected to occur in the sands and gravels found in some bore locations throughout the site. Observations of site bores (RCA, 2007) failed to identify the presence of perched groundwater, however.

Any perched water flows would be expected to move northward in concert with the falling topography of the site. The ground generally slopes to the east towards the Gara River at a slope of about 3%. The Gara River is located approximately 1 kilometre to the east of the site at its closest point. Whilst shallow groundwater flows within the upper soils would have the potential to eventually discharge into the Gara River, it is considered that this outcome is highly improbable, as highly permeable zones were not consistently identified to be present during the on-site and borelog investigations conducted (RCA, 2007).

The elevation of site groundwater exhibited in Bores 4 and 5 (at approximately 947 metres AHD) within the fractured mudstone is approximately 10 metres higher than the elevation of the nearby Gara River, estimated from satellite data to be approximately 938 metres AHD (Europa Technologies, 2007; Google Earth, 2010). Whilst the deeper percolating groundwater may be expected to provide a source of recharge to the regional flows within the mudstone, it is considered that groundwater generated at the site would likely discharge into the Gara River, albeit over long time periods as described in the Hydrogeological (leachate) Assessment. Upon examination of the registered bore locations, it should be noted that all bores are located in different catchments to that of the proposed landfill facility. All of these bores are also separated from the site by waterways (rivers or streams). It is therefore expected that groundwater from the Project Site would not impact on nearby registered groundwater bores.

Considering the low potential for groundwater to become impacted by site operations, it is noted that the travel distance of approximately one kilometre from the site to the Gara River would be substantially longer once the tortuous nature of the actual flow paths through the fractured rock is taken into account. Considering the low permeability (4.8×10^{-9} m/s) of the rock observed in BH4 and the expected capacity of the clays and silts to naturally attenuate any fugitive contaminants, any significant impacts to potential receivers would be extremely unlikely.

As discussed previously, the *Southern New England Tablelands Region State of the Environment Report 2004* identifies the Gara River as a "stressed sub-catchment". As such management processes have been built into the design, construction and operation of the facility to ensure that no further stresses are placed upon waterways.

8.4.5 Mitigation Measures

A number of design features and management measures will be used to mitigate the potential for leachate generated by the waste in the proposed landfill to impact upon groundwater and surface waters, including the Gara River (either directly by overland flow or indirectly by transmission through groundwater). Appropriate mitigation measures are outlined below.

Construction

During the construction phase, mitigation measures described in **Section 8.3.3** will be employed addressing overland flows of sediment and management of potential impacts on surface waters. Groundwater would not be affected during the construction phase and therefore no mitigation measures have been proposed.

Operation

During the operational phase of the proposed landfill, a number of engineering measures and management strategies would be used to mitigate impacts to groundwater. These are outlined below.

Leachate Barrier System

The leachate barrier system would limit the quantity of leachate being generated by minimising the inflow of groundwater into the landfill and maximising the diversion of groundwater around the area. The leachate barrier system would also be designed to appropriately contain all leachate within the landfill and/or within the designated leachate collection / storage infrastructure, all of which would be designed, constructed and operated in accordance with the relevant *Landfill Guidelines Benchmark Techniques*.

The detailed design of the leachate barrier system would be fully detailed in the LEMP.

Leachate Collection System

The leachate collection system would be designed to ensure collection of all leachate generated from the waste and would thus prevent transmission of leachate to the external environment, including to the underlying groundwater. The leachate collection system would also prevent the pooling of leachate at the base of the landfill and would facilitate the diversion of leachate to nominated storage and treatment systems. These systems are a component of the integrated landfill management system and would also be designed, constructed and operated in accordance with the relevant *Landfill Guidelines Benchmark Techniques*.

The detailed design of the leachate collection system would be contained in the LEMP.

Leachate Pond

The leachate pond has been sized to ensure that sufficient holding capacity would be provided for the safe storage of all collected leachate, thus assisting to prevent transmission of leachate to the environment and underlying groundwater.

The detailed design of leachate pond system would be contained in the LEMP.

Groundwater Monitoring

A network of groundwater bores would be used to monitoring groundwater quality and trends at the Project Site. This would include a regular programme of groundwater sampling and assessment as detailed in the LEMP, which would provide a secondary means of gauging the on-going effectiveness of the leachate management system.

The leachate management system would be monitored in accordance with measures described in the LEMP, including direct monitoring for the purposes of system integrity, leachate quantity and quality. In combination with the proposed groundwater monitoring, it would also provide a further check of the system's overall integrity.

Post-Closure

The management of groundwater impacts in the post-closure phase would continue in the same manner for the leachate management system as used during the operational period (described above). The exact nature of this measure would be developed during the operational phase and would address the ongoing need to monitor leachate containment and the potential for impacts to groundwater.

Management strategies, as outlined in the LEMP, include:

- Leachate monitoring programme.
- Groundwater monitoring network.
- Groundwater monitoring programme.
- Groundwater assessment programme.

8.5 Air Quality

Holmes Air Sciences (Holmes) was commissioned to undertake an air quality assessment for the proposed landfill facility and prepared a report entitled *Air Quality Assessment Report Proposed Armidale Landfill* (Holmes Air Sciences, November 2006) (**Appendix O**). The assessment examined the impact of dust and odour emissions from the proposed landfill and presented the results of computer-based dispersion modelling for the proposed landfill facility.

The impacts of emissions have been assessed by comparing predicted dust and odour levels with relevant air quality criteria. Modelling was undertaken in accordance with the Approved Methods for the Modelling and Assessment of Air Pollutants in NSW (DEC, 2005) using AUSPLUME version 6.0.

8.5.1 Assessment Criteria

Dust Emissions

DECCW's dust assessment procedures are set out within its *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* document (DEC, 2005). These procedures include DECCW's methods for the use of models and also set out the relevant air quality criteria for particulate matter (PM_{10}), Total Suspended Particulates (TSP) and dust deposition that are to be used in modelling assessments.

Table 34 sets out the air quality assessment criteria that are relevant to this project. The air quality goals relate to the total dust burden in the air, not just the dust from the proposed development.

Table 34: NSW DECCW Criteria for Particulate Matter Concentrations

Pollutant	Standard / Goal	Averaging Period	Agency
Total suspended particulate matter (TSP)	90 μg/m^3	Annual mean	National Health & Medical Research Council
Particulate matter < 10 μm (PM10)	50 μg/m^3	24-hour maximum	DECCW
	30 μg/m^3	Annual mean	DECCW long-term reporting goal
	50 μg/m^3	(24-hour average, 5 exceedances permitted per year)	National Environment Protection Council

Source: Holmes Air Sciences, 2006 – as extracted from Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales (DEC, 2005).

In addition to health impacts, airborne dust also has the potential to cause nuisance impacts by depositing on surfaces. **Table 35** shows the maximum acceptable increase in dust deposition over the existing dust levels.

Table 35: NSW DECC Criteria for Dust Fallout

Pollutant	Averaging period	Maximum Increase in Deposited Dust Level	Maximum Total Deposited Dust Level
Deposited dust	Annual	2 g/m^2/month	4 g/m^2/month

Source: Holmes Air Sciences, 2006 – as extracted from Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales (DEC, 2005).

Odour Emissions

The DECCW draft policy entitled *Assessment and Management of Odour from Stationary Sources in NSW* (EPA, 2001) includes some recommendations for odour criteria. These have been refined by DECCW to take account of population density in the area. **Table 36** lists the odour certainty thresholds for different population densities. These are not to be exceeded for more than 1% of the time (DEC, 2005). Standard odour measurement procedures define that the "odour certainty threshold" is the minimum concentration at which an odour panellist is certain that they can detect the odour.

Table 36: Odour Performance Criteria for the Assessment of Odour

Population of Affected Community	Odour Performance Criteria (nose response odour certainty units at the 99th %ile)
Single residence (≤ ~ 2)	7
~ 10	6
~ 30	5
~ 125	4
~ 500	3
Urban (~ 2000)	2

Source: Holmes Air Sciences, 2006

The odour performance criteria outlined above takes account of the human nose response time of one-second. It should be noted that the difference between odour goals is based on considerations of risk of odour impact rather than differences in odour acceptability between urban and rural areas. For example, in a densely populated area there would be a greater risk that some individuals would find an odour unacceptable over a sparsely populated area. Further description of the odour performance criteria is described in the Air Quality Assessment Report (**Appendix O**).

Although it is possible to derive formulae for assessing odour annoyance within a community, the response of any individual to an odour is still quite unpredictable. Whether or not an individual considers an odour to be a nuisance would depend on the FIDOL factors which include:

- The Frequency of the exposure.
- The Intensity of the odour.
- The Duration of the odour episodes.
- The Offensiveness of the odour.
- The Location of the source.

Dispersion Modelling

Potential dust impacts have been simulated for assessment using appropriate mathematical models including US EPA ISCST3 model. Potential odour impacts of the proposed facility on the surrounding receivers have been assessed using AUSPLUME v6.0. The dispersion modelling took account of the local meteorology and terrain information and used emission estimates to predict off-site air quality impacts. The location of the proposed excavation area, tipping face, daily and intermediate cover areas within the active landfill cell would progressively change throughout each 10 year period and then progressively again within each subsequent 10 year period. Appropriate, representative scenarios were chosen to simulate activities that would be occurring at a point in time within Stages 0 - 10 years, 10 - 20 years and 40 - 50 years of the landfill operation. The following three scenarios were modelled to predict the maximum emissions from the landfill (refer **Appendix O**):

- 0 - 10 years:
  - Tipping face in Cell 1, part b.
  - Daily cover in Cell 1, parts a and b.
  - Excavation in Cell 1, parts c and d.
  - Stockpile in western section of Cell 2.
- 10 - 20 years:
  - Tipping face in Cell 2, part b.
  - Daily cover in Cell 2, parts a and b.
  - Excavation in Cell 2, parts c and d.
  - Stockpile in western section of Cell 3.
  - Intermediate cover over Cell 1.
- 40 - 50 years:
  - Tipping face in Cell 5, part c.
  - Daily cover in Cell 5, parts c and d.
  - No excavation.
  - Stockpile to the north of the landfill.
  - Intermediate cover over Cell 5 parts a and b, and Cell 4.
  - Final cover over Cells 1, 2 and 3.

8.5.2 Existing Environment

Meteorology

The rate at which pollutants are dispersed is dependent on meteorological conditions including wind speed, wind direction, atmospheric stability class and mixed-layer height. Meteorological data was sourced from the Bureau of Meteorology at Armidale Airport using an automatic weather station and cloud cover data was sourced from Glenn Innes, approximately 85 kilometres north of Armidale.

The winds in the area of the Project Site are predominantly from the east, west and east-north-east (when considered on an annual basis). Easterly winds are the most common in summer and autumn, while westerly winds dominate during winter. In spring, the winds are often strongest from the west, however easterly and east-north-easterly winds are also common.

In dispersion modelling, stability class is used to categorise the rate at which a plume will disperse. Stability is usually assigned according to six classes, A to F. Class A relates to unstable conditions, such as might be found on a sunny day with light winds. In such conditions, plumes will spread rapidly. Class F relates to stable conditions, such as those that occur when the sky is clear, the winds are light and an inversion layer is present. In such conditions plumes will spread slowly. The intermediate Classes B, C, D and E relate to intermediate dispersion conditions. The frequency of occurrence of each stability category expected in the Armidale area is shown in **Table 37**.

Table 37: Frequency of Occurrence of Stability Classes at Armidale

Stability class	% frequency of occurrence
A	1.9
B	8.2
C	14.1
D	48.8
E	11.4
F	15.6
Total	100.0

Source: Holmes Air Sciences, November 2006

The high frequency of D class stabilities (48.8%) indicates that emissions will disperse quickly for a significant proportion of the time. A more detailed analysis of the joint wind speed, wind direction and stability class frequency is provided in the Air Quality Assessment Report (**Appendix O**).

Rainfall and Climate

Table 38 presents average temperature, humidity and rainfall data from Armidale Airport (Bureau of Meteorology, 2006).

The annual average maximum and minimum temperatures experienced at Armidale are 20°C and 7.1°C respectively. January is usually the hottest month, with an average maximum temperature of 27.1°C. July is usually is the coldest month, with average minimum temperature of 0.3°C.

The annual average humidity reading collected at 9am from the Armidale site is 68%. At 3pm the annual average is 47%. The month with the highest humidity on average is June with a 9am average of 80%, and the lowest is November with a 3pm average of 41%.

Rainfall data collected at Armidale shows that January is the wettest month, with an average rainfall of 104.5 mm over 10 days. The average annual rainfall is 790.1 mm with an average of 109 rain days.

Figure 17 shows that there is a strong seasonal pattern for both temperature and rainfall, with most rainfall occurring in the warmer summer months.

Table 38: Average Temperature, Humidity and Rainfall Data for Armidale Airport*

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
9 am Mean Dry-bulb and Wet-bulb Temperatures (°C) and Relative Humidity (%)													
Dry-bulb1	19.8	18.8	17.0	13.6	9.1	6.0	4.8	6.9	11.3	15.4	17.7	19.8	13.3
Wet-bulb2	15.9	15.6	14.0	11.0	7.3	4.6	3.2	4.8	7.9	11.1	13.3	15.1	10.3
Humidity	65	70	71	72	78	80	77	71	61	58	58	59	68
3 pm Mean Dry-bulb and Wet-bulb Temperatures (°C) and Relative Humidity (%)													
Dry-bulb	25.3	24.6	22.6	19.4	15.2	12.1	11.4	13.1	16.5	19.7	22.5	24.5	18.9
Wet-bulb	17.7	17.6	16.0	13.4	10.5	8.4	7.3	8.1	10.3	12.9	14.9	16.7	12.8
Humidity	45	48	48	48	53	58	53	47	42	43	41	43	47
Daily Maximum Temperature (°C)													
Mean	27.1	26.1	24.1	20.6	16.4	13.1	12.2	14.2	17.6	21.2	24.3	26.5	20.3
Daily Minimum Temperature (°C)													
Mean	13.4	13.3	11.3	7.5	3.9	1.6	0.3	1.1	3.7	7.0	9.8	12.2	7.1
Rainfall (mm)													
Mean	104.5	87.1	65.0	45.9	44.4	56.9	49.2	48.4	51.6	67.8	80.4	89.2	790.1
Median	91.6	72.3	53.9	39.4	35.2	48.3	43.3	42.0	47.0	62.2	75.0	80.2	767.7
Rain days (Number)													
Mean	10.3	9.7	9.5	7.9	8.3	9.9	8.9	8.5	7.7	9.0	9.3	10.0	108.9

Source: Holmes Air Sciences, November 2006 - Bureau of Meteorology (2006) (Station number 56002; Commenced: 1857, Last record: 1997; Latitude (deg S): -30.5167; Longitude (deg E): 151.6681)

Dry-bulb temperature is the temperature of air measured by a thermometer freely exposed to the air but shielded from radiation and moisture. Wet-bulb temperature is measured using a thermometer that has its bulb wrapped in cloth—called a sock—that is kept wet with water via wicking action, whilst an ambient air flow is directed over the bulb to induce evaporative cooling. Wet and dry bulb temperature readings are used to calculate the relative humidity of an air sample.

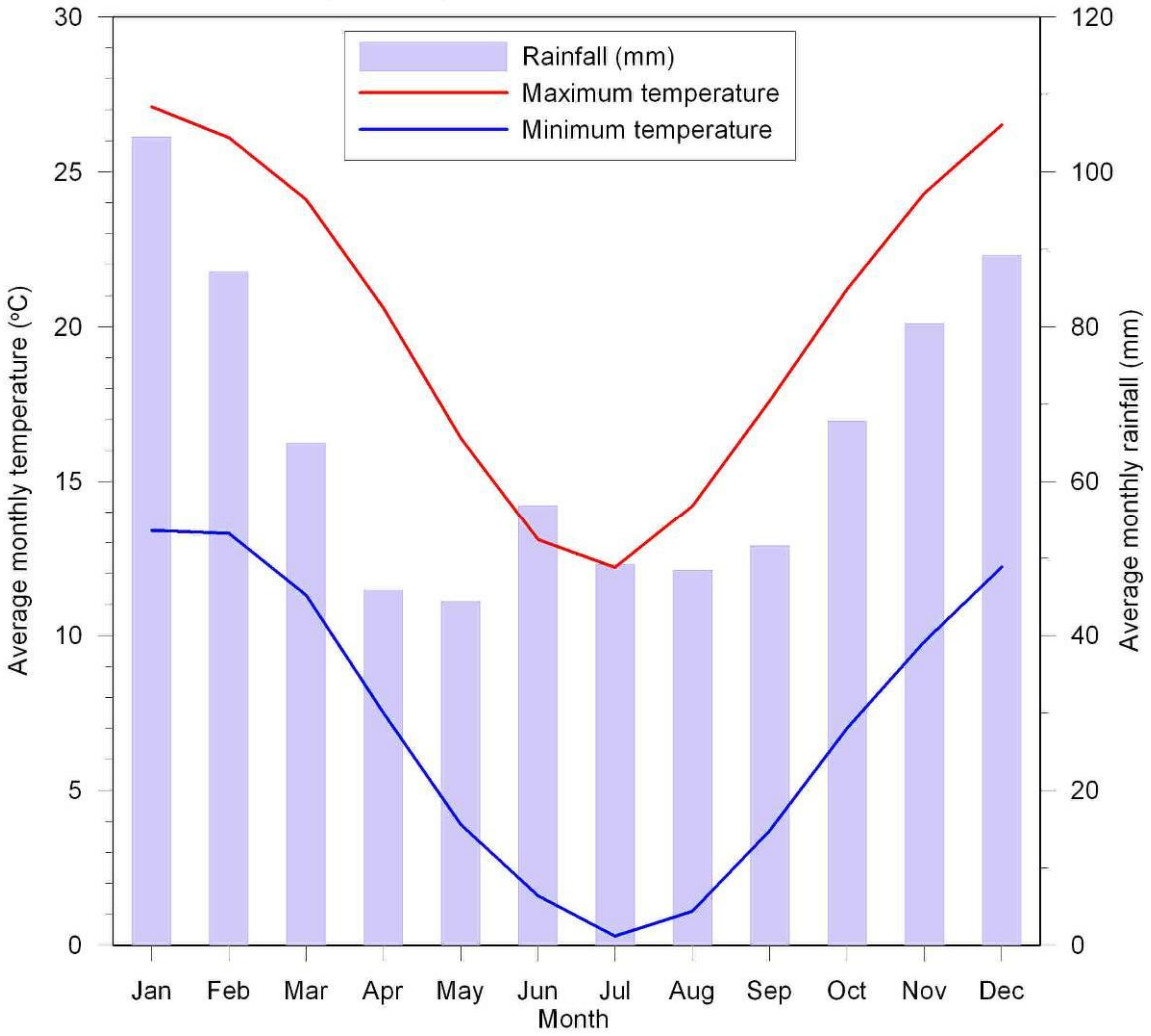

Figure 17: Average Monthly Temperature and Rainfall at Armidale Airport

Source: Holmes Air Sciences, November 2006

Local Air Quality

The proposed landfill site is located in a rural agricultural area where background levels of pollution are typically low. The concentration of airborne particulate matter is highly variable, as particulates may come from a multitude of local and other sources. The main source of particulate emissions would be from domestic wood fired heaters. Bushfires and wind-blown dust also have the potential to cause 24-hour average particulate (PM10) exceedances.

8.5.3 Potential Air Quality Impacts

Potential impacts relating to degradation of the local air quality are expected to arise primarily from dust and odour from the activities and operational aspects of the proposed landfill facility

Dust Emissions

Dust emissions may arise from various activities at the landfill, but would primarily be generated from vehicles travelling on unpaved surfaces, dumping of waste, shaping of the tipping face and as part of the effect of wind erosion. Total dust emissions due to the operations at the proposed landfill facility have been estimated by analysing the excavation and landfilling operations for three stages of the proposed landfill (refer **Section 8.5.1**). Rates of excavation and landfilling for each stage have been adjusted to assist in the determination of emission rates over a yearly basis.

Haul road distances and routes, landfill areas, activity operating hours, truck movements and other details are also factors that were taken into consideration when determining dust emission impacts.

Estimated dust emissions of TSP are presented in **Table 39**. Calculations are contained in the Appendices of the Air Quality Assessment Report (**Appendix O**).

Table 39: Dust Emission Estimates

Activity	TSP (kg/y)		
	Staging 0-10 years	**Staging 10-20 years**	**Staging 40-50 years**
Excavation			
Removing topsoil	1004	1004	-
Excavators in pit	3462	2935	-
Hauling material to stockpile	9233	7826	-
Dumping material at stockpile	371	314	-
Dozers shaping tipping face	23429	23429	-
Landfilling			
Dozers working in landfill (4h/d)	19600	19600	19600
Hauling waste on sealed road	121	121	121
Hauling waste on unsealed road	400	400	56
Dumping waste	3	2.8	3
Scraping and transporting cover material	118	118	128
Shaping covered area	23429	23429	23429
Wind erosion from exposed landfill excavation areas	3044	2840	2876
Wind erosion from stockpiles	1135	1135	1135

Source: Holmes Air Sciences, November 2006

The above estimates assume that 75% control of dust is achievable due to the watering of haul roads. These controls have been reiterated in the proposed mitigation measures (refer **Section 8.5.4**) and the SoC (refer **Section 9.0**).

Isopleths (in this case, lines joining predicted locations of equal dust concentration) showing the predicted concentration dispersion from the proposed landfill location toward surrounding local residential receivers are provided in the Appendices of the Air Quality Assessment Report (**Appendix O**). For each of the stages assessed (0 - 10 years, 10 - 20 years and 40 - 50 years) the isopleths show the following predictions based on the model:

- Maximum 24-hour average PM10 concentrations.
- Annual average PM10 concentrations.
- Annual average TSP concentrations.
- Annual average dust deposition.

The highest predicted concentrations at residential receivers for each stage are shown in **Table 40**. The highest dust impacts during each stage are concentrated around the section of the proposed landfill footprint where the dust generating activity would be occurring. Note that the predicted dust concentrations do not take account of background levels, however, the model predictions of dust generation are very low and it was concluded that the proposed activities would be unlikely to cause exceedances of the DECCW air quality criteria. Overall, dust concentrations and deposition levels at all residential receivers were very low and is was concluded that air quality impacts arising from dust emissions from the proposed landfill facility would be negligible.

Table 40: Predicted Dust Concentrations

Stage	Dust Prediction	Receiver*						Relevant Air Quality Goal
		1	2	3	4	5	6	
0-10 years	Maximum 24-hour PM10	3.71	8.91	1.27	0.70	0.79	1.61	50
	Annual PM10	0.25	0.60	0.10	0.03	0.04	0.03	30
	Annual TSP	0.36	0.98	0.13	0.05	0.05	0.03	90
	Annual dust deposition	0.08	0.10	0.03	0.01	0.01	0.00	4
10-20 years	Maximum 24-hour PM10	4.28	6.21	1.37	0.79	0.90	1.66	50
	Annual PM10	0.32	0.39	0.11	0.04	0.04	0.03	30
	Annual TSP	0.47	0.62	0.15	0.05	0.06	0.04	90
	Annual dust deposition	0.10	0.06	0.03	0.01	0.01	0.00	4
40-50 years	Maximum 24-hour PM10	2.85	1.55	0.85	0.69	0.70	1.37	50
	Annual PM10	0.30	0.09	0.08	0.03	0.03	0.03	30
	Annual TSP	0.43	0.14	0.11	0.04	0.05	0.03	90
	Annual dust deposition	0.09	0.01	0.02	0.01	0.01	0.00	4

Source: Holmes Air Sciences, June 2009. *Refer to **Table 1** and **Figure 5** for the location of these receivers.

Odour Emissions

It is proposed that the vast majority of collected green waste and other potentially recyclable materials would be separated and removed from the waste prior to landfilling. These would all be stockpiled for further processing and transported off site for recycling at the existing Armidale Waste Management Centre. Therefore, green waste and other potentially recyclable materials would not be directed to the proposed landfill facility. All other solid waste would continue to require landfilling, however, and for the purposes of this assessment it has been assumed that this solid waste would continue to contain putrescible (i.e. biodegradable) organic material.

The proposed landfill would contain some level of biodegradable organic matter including a range of putrescible, organic materials, including food waste, but may also include some paper, cardboard and/or wood/timber products, etc. When biodegradable material is deposited in a landfill site, landfill gas is produced, due to the microbial activity that facilitates the organic breakdown process. Landfill gas produced at the proposed landfill facility would consist mainly of carbon dioxide and methane. These are both odourless gases, however there would also be other trace gases produced, including organic sulphides and volatile fatty acids. Most of these other gases would have their own characteristic odour.

It is expected that odour from the proposed landfill facility would predominantly be emitted from the active tipping face, the leachate storage pond, various risers and other gas infrastructure, if included at detailed design stage, as well as from both the daily and intermediate covered landfill areas.

The active tipping face would be the main source of potential odour emissions. The tipping face has been calculated as being an area in the order of 32.5 square metres (5 metres wide by 6.5 metres long) for daily tipping, based on the assumption of a total of 15,000 tonnes per annum of waste material to be landfilled. Due to the ongoing requirements for daily and intermediate cover of all waste materials, the active tipping face would be the only area of exposed waste at any one time. Also, the tipping face would only ever be exposed during the normal operating hours of the landfill, as the active tipping face would be appropriately covered at the end of each working day. A new tipping face would not then be established until the beginning of the next working day's tipping (i.e. landfilling) operations.

Table 41 provides the quantitative information on odour emissions for the dispersion modelling.

Table 41: Estimated Near Field Odour Emissions for the Proposed Armidale Landfill

Staging	Source	Area (m^2)	Odour Emission Rate ($ou.m^3/s/m^2$)*	Peak Odour Emission Rate (Neutral) P/M = 2.5 ($ou.m^3/s/m^2$)	Peak Odour Emission Rate (Stable) P/M = 2.3 ($ou.m^3/s/m^2$)	Total Emissions ($ou.m^3/s$) Neutral	Total Emissions ($ou.m^3/s$) Stable
0-10 years	Leachate pond	2970	0.28	0.7	0.644	2079	1913
	Active tipping face	32	7.06	17.65	16.24	565	520
	1-day cover	15516	0.35	0.875	0.805	13576	12490
10-20 years	Leachate pond	2970	0.28	0.7	0.644	2079	1913
	Active tipping face	32	7.06	17.65	16.24	565	520
	1-day cover	15191	0.35	0.875	0.805	13292	12229
	Intermediate cover	34694	0.1	0.25	0.23	8674	7980
40-50 years	Leachate pond	2970	0.28	0.7	0.644	2079	1913
	Active tipping face	32	7.06	17.65	16.24	565	520
	1-day cover	15998	0.35	0.875	0.805	13998	12879
	Intermediate cover	50958	0.1	0.25	0.23	3811	3506
	Final capping	103403	0.05	0.125	0.115	8929	8214

Source: Holmes Air Sciences, November 2006

*A leachate pond odour emission rate of 0.28 $ou.m^3/s/m^2$ has been recorded by Holmes Air Sciences at another landfill in Sydney with a similar total leachate pond surface area to the proposed leachate pond. For the purpose of this study, it is considered that this represents the most conservative odour emission rate for this source and has therefore been used in this assessment.

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The population density in the area around the proposed landfill site is equivalent to a single residence. On this basis the odour criterion of seven odour units (ou) has been applied to the project.

The dispersion model results for odour levels at off-site receivers are presented in **Table 42**. The 99th percentile means that for 99% of the time, the values would be at or below the concentration as shown.

Table 42: Predicted 99th Percentile Odour Concentrations (ou)

Stage	Odour Concentration (ou) at Receivers*					
	1	2	3	4	5	6
0-10 years	0.15	1.48	0.16	0.04	0.04	0.02
10-20 years	0.27	2.09	0.26	0.06	0.06	0.03
40-50 years	0.63	1.08	0.38	0.09	0.09	0.04

Source: Holmes Air Sciences, November 2006 *Refer to **Table 1** and **Figure 5** for the location of these receivers.

Odour contours are presented in the Air Quality Assessment Report (**Appendix O**), which plot predicted maximum odour levels (corrected for nose response times) and odour levels at the 99th percentile. These odour levels were compared to DECC's odour goals, which for a single rural receiver is 7 ou at the 99th percentile. As shown in **Table 42** , the odour levels at the 99th percentile are well within the 7 ou odour goal for all three stages. It is therefore concluded that the off-site odour impacts from the landfill would be at acceptable levels.

8.5.4 Mitigation Measures

Dust Emissions

Given the dust emissions from the Project Site would be at acceptable levels, there are no specific mitigation measures necessary. Nonetheless, standard dust reduction measures such as watering of haul roads would be employed to ensure that dust related impacts are minimised. Similarly, daily cover material would be prevented from becoming a source of dust emissions through the frequent wetting of the area during dry periods.

All appropriate dust suppression measures would be included in the final LEMP.

Odour Emissions

As the odour emissions from the site are within acceptable levels at the nearest receiver, there are no specific odour mitigation measures proposed. Standard management strategies for landfill sites would be employed however, including the following:

- Sub surface gas monitoring devices.
- Sub surface gas monitoring programme.
- Surface gas emission monitoring.
- Covering of waste.

8.6 Greenhouse Gas Emissions

Greenhouse gases (GHG's) absorb and re-radiate heat from the sun. GHG's are emitted into the Earth's atmosphere as a result of natural processes (e.g. forest fires) and human activities (e.g. burning of fossil fuels to generate electricity). Since the industrial revolution there has been an increase in the amount of anthropogenic (human induced) GHG's emitted into the atmosphere which has increased the concentration of GHG emissions in the atmosphere. The increased concentration of GHG's in the Earth's atmosphere has led to an increase in the Earth's average temperature (surface temperature), this is known as the Greenhouse Effect (or enhanced greenhouse effect). The Greenhouse Effect has caused the phenomenon of Climate Change to occur. Climate Change (also known as global warming) refers to the change in climate patterns due to an increase in the average temperature of the Earth.

GHGs are reported for accounting purposes as tonnes of carbon dioxide equivalent (t CO_2-e). There are numerous GHGs which contribute to the Greenhouse Effect. These gases have varying Global Warming Potential (GWP). The higher GWP, the higher the intensity of effect each tonne of that gas has on the Enhanced Greenhouse Effect. GHGs are standardised by expressing them as carbon dioxide equivalent emissions (CO_2-e) where carbon dioxide has a GWP of 1. For example, the GHG methane has a GWP of 21, thus one tonne of methane has a Greenhouse Effect equivalent to 21 tonnes of carbon dioxide. The GWP of the six GHGs used in carbon accounting, commonly known as the Kyoto GHGs, are shown in **Table 43**.

Table 43: Global Warming Potential of GHGs

Greenhouse Gas	Global Warming Potential (GWP)
Carbon Dioxide (CO_2)	1
Methane (CH_4)	21
Nitrous Oxide (N_2O)	310
Sulphur Hexafluoride (SF_6)	23,900
Hydrofluorocarbons (HFCs)	HFC_5 – 1,300-11,700 (depending on the HFC)
Perfluorocarbons* (PFCs)	CF_4 – 6,500. C2F6 – 9,200

Note: *Varies depending on compound. Source: DCC, 2009, *National Greenhouse Accounts (NGA) Factors*.

GHG emissions are categorised into three different scopes (either scope 1, 2 or 3) in accordance with the Intergovernmental Panel on Climate Change (IPCC) and Australian Government GHG accounting/classification systems. The following provides a brief description of the three GHG emission scopes:

- Scope 1 emissions, also called “direct emissions” are emissions which are generated directly by the project, e.g. emissions generated by the use of diesel fuel by construction plant/equipment.
- Scope 2 emissions, also referred to as “indirect emissions” are emissions which are generated outside of the project’s boundaries to provide energy to the project, e.g. the use of purchased electricity from the grid.
- Scope 3 emissions, also referred to as “upstream, indirect emissions”, are upstream emissions due to third party supply chains that are in direct relation to the project, e.g. extraction, production and transport of purchased materials and waste disposal offsite.

8.6.1 Quantitative GHG Estimate Methodology

GHG emissions would be generated during the construction and operation of the proposed project. A Greenhouse Gas (GHG) Inventory (**Appendix P**) has been prepared to provide a quantitative estimate of the potential scope 1, 2 and 3 GHG emissions associated with the construction and operation of the proposed landfill.

The quantitative estimate of the potential scope 1, 2 and 3 GHG emissions associated with the construction and operation of the proposed landfill was undertaken in accordance with a methodology based on the general principles outlined in:

- *National Greenhouse Accounts (NGA) Factors, Australian Government Department of Climate Change* (DCC), June 2009.
- *The National Greenhouse and Energy Reporting System Measurement, Technical Guidelines for the estimation of greenhouse gas emissions by facilities in Australia*, DCC, June 2009.
- *Life Cycle Assessment Australian and New Zealand Standards* (ISO 14040 series).
- Australian Standard (AS ISO 14064.1 – 2006) *Greenhouse Gases Part 1: Specification with guidance at the organization level for quantification and reporting of greenhouse gas emissions and removals*.
- The *Greenhouse Gas Protocol, World Business Council for Sustainable Development (WBCSD) and World Resources Institute (WRI)*, 2004.

The emission sources which have been included in the GHG inventory are listed under each scope in **Table 44**.

Table 44: Emission Scopes

Scope 1 – Direct Emissions	Scope 2 – Indirect Emissions	Scope 3 – Upstream Indirect Emissions
• The onsite use of fuel by construction plant/equipment • The vegetation permanently cleared • Landfill gas (methane) emissions	• The onsite use of electricity purchased from the grid	• The onsite use of fuel by construction plant/equipment • The use of fuel for the transportation of construction materials and staff to/from the site • The onsite use of electricity purchased from the grid • The use of construction materials

The amount of landfill gas which would be generated would be dependent upon the fraction of putrescible materials within the waste stream. The proposed landfill would be classed as a General Solid Waste (putrescibles) landfill. It is Council's longer term objective, however, to begin operating the landfill, as soon as possible in the future (and then until final closure) as a General Solid Waste (non-putrescible) facility, when appropriate additional off-site sorting and/or treatment technologies are able to be procured and successfully employed. To account for this, the following waste stream scenarios have been modelled:

- Scenario 1: General Solid Waste (putrescibles) landfill operating for 50 years
- Scenario 2: General Solid Waste (putrescibles) landfill operating from years 1-10, General Solid Waste (non-putrescible) landfill operating from years 11-50

Scenario 2 assumes that from year 11 onwards the waste landfilled would be pre-treated at an alternative waste treatment facility and that this facility would successfully remove 85% of the following materials from the waste stream:

- Food
- Paper and paper board
- Garden and park
- Wood and wood waste
- Nappies

Construction and Operational GHG Emissions

The predominant source of GHG emissions associated with the proposed landfill would be the release of the landfill gas methane (generated as putrescible waste within the landfill decomposes in an anaerobic environment).

The construction and 50 year operation of the project would generate approximately 693,871 tCO_2-e if the putrescible materials and recyclables are not removed from the general waste prior to landfilling (i.e. for Scenario 1). The construction and 50 year operation of the project would generate approximately 279,381 tCO_2-e if the putrescible materials and recyclables are removed from the general waste prior to landfilling from year 11 onwards (i.e. for Scenario 2). The estimated total GHG emissions for the construction and 50 year operational life of the project are shown in **Table 45**.

Table 45: Estimated Total GHG Emissions (50 year period)

Emissions Source	Quantity	Units	GHG Emissions (t CO_2-e)			Total GHG Emissions (t CO_2-e)
			Scope 1	Scope 2	Scope 3	
Fuel Use						
Transport of Construction Materials	1,999	kL	5,394		409	5,804
Construction Equipment Onsite	11,856	kL	31,989		2,426	34,415
Transport of Waste to Landfill	1,452	kL	3,917		297	4,214
Landfill Gases						
Landfill Gas Emissions – Scenario 1*	750,000	t of waste	641, 622			641, 622
Landfill Gas Emissions – Scenario 2*	750,000	t of waste	227,132			227,132
Land Use Change						
Cleared vegetation	12.7	ha	4,572			4,572
Electricity Use						
Purchased Electricity	680,940	kWh		606	123	729
Use of Construction Materials						
Clay	338,831	t			678	678
Gravel	128,472	t			899	899
HDPE (liner)	167	t			363	363
Soil	308,459	t			463	463
Cover Material	75,960	t			114	114
Total – Scenario 1	**na**	**na**	**687,494**	**606**	**5,771**	**693,871**
Total – Scenario 2	**na**	**na**	**273,004**	**606**	**5,771**	**279,381**

The total estimated quantities of fuel, waste disposed, vegetation removed, electricity and construction materials used during the 50 year operation of the project are shown in column 2 of **Table 45**.

The annual Scope 1 and Scope 2 GHG emissions (averaged over the project's 50 year operational life) associated with the project are provided in **Table 46**.

Table 46: Annual Scope 1 and Scope 2 GHG Emissions

Emissions Source	Quantity	Units	GHG Emissions ($t CO_2$ –e per annum)		Total GHG Emissions ($t CO_2$ –e per annum)
			Scope 1	Scope 2	
Fuel Use					
Construction Equipment Onsite	40	kL	108	0	108
Transport of Construction Materials	237	kL	640	0	640
Transport of Waste to Landfill	29	kL	78	0	78
Landfill Gases					
Landfill Gas Emissions – Scenario 1	15,000	t of waste	12,832	0	12,832
Landfill Gas Emissions – Scenario 2	15,000	t of waste	4,543		4,543
Electricity Use					
Purchased Electricity	13,619	kWh	0	12	12
Total – Scenario 1	**na**	**na**	**13,658**	**12**	**13,671**
Total – Scenario 2	**na**	**na**	**5,369**	**12**	**5,381**

For Scenario 1 the project will generate approximately 13,658 t of Scope 1 CO_2-e per annum. For Scenario 2 the project will generate approximately 5,369 t of Scope 1 CO_2-e per annum. For Scenarios 1 and 2, the project will generate approximately 12 t of Scope 2 CO_2-e per annum.

It should be noted that air conditioners, refrigerators and other metal products potentially containing chlorofluorocarbons (CFCs) that may be present in Council's waste stream would, be appropriately separated from the waste stream at the existing WTS at the Armidale Waste Management Centre. Therefore the proposed landfill development would neither contain nor emit any significant quantities of CFC gas from entombed air conditioning or refrigeration systems, or other sources.

8.6.2 Comparison with NSW Emissions

NSW's annual GHG emissions are approximately 162.7 million t CO2-e, of which 5.3 million t CO2-e of emissions in NSW are associated with the waste sector. (DCC, May 2009, Australia's National Greenhouse Accounts: State and Territory Greenhouse Gas Inventories 2007). Thus, the estimated annual Scope 1 and 2 emissions from the project would contribute to approximately 0.25% and 0.10% of the state's annual waste sector emissions for Scenarios 1 and 2 respectively.

8.6.3 Regulatory Requirements

The proposed landfill is to be assessed in accordance with the requirements of the Environmental Planning and Assessment Act 1979 (the EP&A Act) and the Environmental Planning and Assessment Regulation 2000 (EP&A Regulation).

The EP&A Act contains a general requirement to address environmentally sustainable principles. Recent precedents in environmental approvals suggest that a plan to address the negative external costs of GHG emissions is required to address sustainable development principles.

GHG emissions are specifically addressed in the EPA's 'Landfill Guidelines Benchmark Technique Number 11 – Extraction and Disposal of Landfill Gas', which states the following:

- *'A gas extraction system should be used to extract and, where possible, combust landfill gases. This system should reduce the risk of explosion and fire, reduce the contribution to greenhouse gases (methane is 20 to 30 times more potent than carbon dioxide), and lower the level of toxic organic compounds emitted from landfills. In conformance with the EPA's commitment to using landfill as a resource, applicants should evaluate generation of electricity as an option when designing the extraction system';* and
- *Energy should be recovered from the landfill gas where possible, either by directly using the gas or by generating electricity for export.*

This report addresses these regulatory requirements by:

- Providing an assessment of potential GHG emissions from the project using a standard method that is internationally and locally recognised; and
- Identifying abatement measures.

The landfill may trigger National Greenhouse and Energy Reporting (NGERs) and Carbon Pollution Reduction Scheme (CPRS) obligations, depending on its direct emissions and proximity to other large landfills. CPRS obligations will be triggered by individual facilities if their emissions equal or exceed 25 kilo tonnes (kt) of CO_2-e per year. In addition, CPRS obligations apply to some landfill facilities that are near a large landfill that accepts similar waste, where the facility's emissions are at least 10kt CO_2-e a year.

The distance between landfills that triggers the lower threshold will be set in regulations. Businesses will be able to work out whether the lower threshold applies to them from a list of large landfills and their locations that will be published by the Australian Climate Change Regulatory Authority.

The nearest landfill to the proposed landfill is the Armidale Long Swamp Road Waste depot which is approximately 10 kilometres from the proposed landfill site which will be completely filled and capped potentially in the next few years.

Only Scope 1 (i.e. direct) emissions as determined by the *NGERS Act* are used to calculate the threshold. This includes direct emissions from processes such as waste decomposing (generating methane) as well as emissions from fuel combusted on site (e.g. vehicles used on site).

8.6.4 Proposed GHG Management Measures

The following hierarchy was used to develop proposed measures to reduce GHG emissions from the Landfill:

- Avoid
- Reduce
- Abate
- Offset

The above hierarchy is derived from generally accepted principles for sustainable resource management. The following opportunities would be undertaken to reduce/offset GHG emissions associated with the project:

Fuel

- Assess the fuel efficiency of the construction plant/equipment prior to selection and, where practical, use equipment with the highest fuel efficiency or equipment which uses lower GHG intensive fuel such as biofuels (e.g. biodiesel, ethanol).
- Consider the distance of construction material suppliers prior to procurement to reduce transport-related emissions.

Equipment

- Ensure construction equipment and transport vehicles are maintained to reduce energy efficiency losses associated with damaged/unmaintained equipment.
- Ensure electrically efficient equipment is purchased.

Materials

- Plan construction works to avoid double handling of materials.

Vegetation Sequestration

- The trees planted and maintained within the proposed Biodiversity Offset Area have the potential to sequester and store carbon. The trees within the Biodiversity Offset area have the potential to sequester and store (in the vegetation biomass only) an average of 360 t CO_2-e/ha.
- Reduce areas of land clearing. Reductions in land clearing are 24-50 times more effective than replanting vegetation (NSW Energy and Greenhouse Guidelines for Environmental Impact Assessment, 2002).

Other Opportunities

Other opportunities which would be considered during the detailed design stage of the project include:

- Purchasing Green Power.
- Purchasing emissions credits through a program such as 'Greenfleet'.
- Maximising the energy efficiency of the buildings.
- Reducing landfill methane emissions.

Maximising Energy Efficiency

During the detailed design stage additional and more specific energy efficiency and energy reduction measures to be implemented at the landfill facility would be considered, which may include:

- Enhancing the energy efficiency of the buildings by using:
  - Energy efficient lighting systems with low energy lights, wide-panel skylights, task lighting, timers, and motion sensors;
  - Natural ventilation;
  - Energy efficient heating and air conditioning systems, for example systems that incorporate ceiling fans with central air conditioning and heating plant or evaporative air conditioning; and
  - A well insulated building envelope.
  - Using renewable forms of energy. For example, combusting the available landfill gas and generating energy for use on site.

Reducing Landfill Methane Emissions

The amount of landfill gas which would be generated would be dependent upon the fraction of putrescible materials within the waste stream. Reducing the amount of putrescible waste landfilled at the proposed facility would have the greatest impact on reducing the landfill's GHG emissions. It is Council's longer term objective, to begin operating the landfill, as soon as possible in the future (and then until final closure) as a General Solid Waste (non-putrescible) facility, when appropriate additional off-site sorting and/or treatment technologies are able to be procured and successfully employed.

Additional methods which can be implemented to reduce the generation of landfill gas GHG emissions are discussed in the following. The measures to be implemented would be determined once the landfill has commenced operating and the quantity of emissions generated is determined. During the initial operational phase of the proposed development, the landfill's performance with respect to landfill gas production and other associated matters would be assessed and the results discussed with both the DECCW and DoP. Once the filling of Cell 1 is complete, landfill gas monitoring (perimeter well testing) would be conducted to determine if the amount of gas produced requires the installation of a gas extraction/control system.

Three suitable options to manage landfill gas at the landfill include:

- The application of a methane oxidation cap
- Passive venting and using a filter (e.g. activated carbon or the like) to reduce emissions
- Actively collecting the landfill gasses with a landfill gas collection system and flaring the methane (combustion conversion to CO2)

The methane oxidation cap is a "biological' cap (sometimes called a phyto-remediation cap) that is used in preference to the standard compacted clay type of cap. It relies on a biomass that oxidises CH_4 as the landfill gas permeates through the soil media that constitutes the cap. Extensive research into this type of capping demonstrates a reduction in methane emissions from landfills of up to 10 times over a standard compacted clay cap. Currently research is being undertaken in Australia as part of the Australian Alternative Capping Assessment Program that is trying to loosen up the capping requirements nationally so that smaller landfills have an alternative to the prescriptive expensive caps that are typically required.

Landfill methane can be combusted by open flaring, burning to generate heat, or burning in an internal combustion engine to generate electricity. When anthropogenic methane is burned in air to produce carbon dioxide and water, the carbon dioxide produced is equal to the amount that would have been produced by natural decomposition, and is not considered anthropogenic GHG emissions.

Flaring is generally most effective and economically viable where smaller or unreliable quantities of methane are generated. Generation of heat or electricity has an additional benefit of offsetting electricity consumption, which further offsets total GHG emissions. However, these methods are only economically feasible where sufficient quantities of methane can be reliably collected over a long time.

In general, most commercially viable landfill gas to energy operations rely on consistent (i.e. 80% operational time) generation of 1MW for a period of 5-7 years. In order to achieve this, a landfill gas (LFG) flow of about 600m^3/hr is required with a 50% CH_4, composition. To achieve this flow, a landfill will need to have approximately 1 million tonnes of waste in place after about 10 years. The proposed landfill facility would have approximately 150,000 tonnes of waste after approximately 10 years of operation, hence generation of electricity from landfill methane is not likely to be commercially viable.

The amount of methane generated after the proposed landfill is operating would be monitored and assessed to determine whether the amount of methane produced is sufficient for either small scale self generation or commercial scale electricity generation and export.

8.7 Noise

AECOM undertook a noise impact assessment for the proposed landfill site to assess the potential noise impacts associated with both construction and operational activities, in accordance with both the DGRs and DECCW's EA requirements (refer **Appendix A**). The *Armidale Regional Landfill, Noise Impact Assessment Report* (AECOM, December 2009) is presented in **Appendix Q**.

Two noise loggers were used to continuously measure ambient noise levels approximately 30 metres from residences in close proximity to the Project Site for a period of one week. The loggers were placed at the two nearest residential properties (Strathaven and Sherraloy), located 950 metres west and 410 metres south of the proposed Project Site boundary, respectively.

The following is a summary of the main findings of the Noise Impact Assessment report.

8.7.1 Assessment Criteria

Operational Noise

DECCW provides guidelines for external noise emissions from developments provided in the NSW INP. The assessment procedure for industrial noise sources has two components:

- Controlling intrusive noise impacts in the short term for residences.
- Maintaining noise level amenity for particular land uses for residences and other land uses.

Intrusive Noise Impacts

The INP states that the noise from any single source should not intrude greatly above the prevailing background noise level. Industrial noises are generally considered acceptable if the equivalent continuous (energy-average) A-weighted level of noise from the source (L_{Aeq}), measured over a 15 minute period, does not exceed the background noise level measured in the absence of the source by more than 5 dB. This is often termed the Intrusiveness Criterion.

Protecting Noise Amenity

To limit continuing increases in noise levels, the maximum ambient noise level within an area from industrial noise sources should not normally exceed the acceptable noise levels specified in Table 2.1 of the INP. A summary of the intrusive and amenity criteria for the Project is given in **Table 47**. The final criteria are formulated to satisfy the lowest of the amenity or intrusiveness criteria for each time period. Note that the night and evening period criteria have been shown for completeness only, and are not applicable to this assessment since no operations would take place outside of the daytime period.

Table 47: Resultant Environmental Noise Criteria for the two closest receivers

Period	RBL (L_{A90})	Intrusive Criterion = RBL + 5	Ambient L_{Aeq}	Amenity Criteria	Final Criteria
Receiver 1 (Strathaven)					
Day	30	35	42	50	35
Evening	30	35	34	45	35
Night	30	35	35	40	35

Period	RBL (L_{A90})	Intrusive Criterion = RBL + 5	Ambient L_{Aeq}	Amenity Criteria	Final Criteria
Receiver 2 (Sherraloy)					
Day	30	35	45	50	35
Evening	30	35	41	45	35
Night	30	35	34	40	35

Source: AECOM, January 2010

Traffic Noise

Environmental Criteria for Road Traffic Noise

DECCW's ECRTN guidelines have been used to assess traffic noise. **Table 48** presents the road traffic noise criteria from the ECRTN for land use developments with potential to create additional traffic on existing collector and local roads.

Table 48: Road Traffic Noise Criteria

Period	Parameter	Criterion
Collector Roads		
Day (7.00 am – 10.00pm)	L_{Aeq}, 1hr	60
Night (10.00 pm – 7.00am)	L_{Aeq}, 1hr	55
Local Roads		
Day (7.00 am – 10.00pm)	L_{Aeq}, 1hr	55
Night (10.00 pm – 7.00am)	L_{Aeq}, 1hr	50

Source: AECOM, January 2010 - ECRTN, DECCW

According to the DECCW guidelines, Waterfall Way would be classified as a collector road. Long Swamp Road and Canambe Street would be classified as local roads. For traffic generating developments the criteria stipulates that traffic arising from the proposed landfill facility should not lead to an increase in existing noise levels of more than 2 dB(A) for all road types.

Sleep Arousal

The ECRTN recommends that an assessment of sleep arousal due to the passing of heavy vehicles during the night period (i.e. 10pm – 7am) should be conducted. The proposed landfill facility would maintain operating hours outside the defined night period in that there will be no operations before 7am at the proposed landfill facility. Given that no night operations or heavy vehicle movements are proposed, an assessment of sleep arousal is not required.

Construction Noise

In July 2009, DECCW published its *Interim Construction Noise Guidelines (ICNG)* for use in construction noise assessment. This document supersedes the *Environmental Noise Control Manual (ENCM)* and is used as the basis for establishing construction noise criteria.

Under the existing DECCW policy, a CNMP is required to be compiled by the Contractor, prior to construction commencing. Noise level objectives must be set for the daytime and evening periods, and must be complied with where reasonably practicable. Work that is proposed outside of standard working hours, as defined in the *ICNG*, generally requires strong justification.

The *ICNG* recommends that a quantitative assessment be carried out for all *'major construction projects that are typically subject to the EIA process'*. A quantitative assessment, based on a likely 'worst case' construction scenario, has been carried out for the proposed development.

Predicted noise levels at nearby noise sensitive receivers (residential, commercial and industrial premises) are compared to the levels provided in Section 4 of the *ICNG*. Where an exceedance of the criteria is predicted the *ICNG* advises that the proponent should apply all feasible and reasonable work practises to minimise the noise impact.

The initial construction works for the landfill facility would involve partial clearing of the site, the construction of the site access and perimeter road, drainage works, landscaping works and some excavation of the landfill area. Based on the assessed Rating Background Level (RBL) outlined in **Section 8.7.2**, the construction noise criteria would be the RBL+10dB(A) or 40 dB(A) during the day-time at the nearest residential receiver.

Ongoing construction and capping of landfill cells after the initial works were complete would be required to comply with the operational noise criteria for the site.

8.7.2 Existing Environment

Ambient Noise Level Measurements

Two ARL EL-215 noise loggers were used to continuously measure ambient noise levels approximately 30 metres from residences in close proximity to the Project Site for a period of one week. The loggers were placed at the two nearest residential properties, located 950 metres west and 410 metres south of the proposed Project Site boundary, respectively.

The existing noise environment at these receivers is considered to be typical of rural areas. Ambient noise levels during the day are dominated by rural activity, animal sounds and intermittent, passing road traffic. Natural sounds such as wind through trees and grass as well as small contributions of industrial noise from distant water pumps were also audible at times during the assessment. The loggers were set for a sample period of 15 minutes and each one continuously logged from Friday 2nd June until Friday 9th June 2006.

A noise logger measures the noise level over the sample period and then determines L_A1, L_{A10}, L_{A90}, LA_{max} and $L_{A,eq}$ levels of the noise environment. The L_{A1}, L_{A10} and L_{A90} levels are the levels exceeded for 1%, 10% and 90% of the sample period, respectively. L_{Amax} is indicative of maximum noise levels due to individual noise events, such as the passing of a heavy vehicle. L_{A90} is considered to be the "background" noise level. L_{Aeq} is the equivalent continuous sound level. That is, it is a reading of the same sound energy over the sample period as the actual noise environment with fluctuating sound levels.

The background noise level is defined by DECCW as "*the underlying level of noise present in ambient noise when all unusual extraneous noise is removed*". The measured noise levels were analysed to determine a single assessment background level (ABL) for each day, evening and night period, in accordance with the DECCW's INP. The ABL is established by determining the lowest 10-percentile level of the L_{A90} noise data acquired over each period of interest. The background noise level or RBL representing the day, evening and night-time assessment periods is based on the median of individual ABLs determined over the entire monitoring period.

Table 49 presents the RBL's determined for each receiver and assessment period as well as an overall representative L_{Aeq} noise level determined by logarithmically averaging each assessment period for the entire monitoring period. It should be noted that in situations where the RBL is assessed to be less than 30 dB(A), the INP criteria limits the RBL to 30 dB(A).

Table 49: Assessed RBL and Ambient Noise Level

Receiver	RBL and Ambient Noise Levels					
	Day[1]		Evening[2]		Night[3]	
	RBL	L_{Aeq}	RBL	L_{Aeq}	RBL	L_{Aeq}
1 Strathaven	30*	42	30*	34	30*	35
2 Sherraloy	30*	45	30*	41	30*	34

Source: AECOM, January 2010

[1] "Day" is defined as 7:00am to 6:00pm, Monday to Saturday and 8:00am to 6:00pm on Sundays & Public Holidays.

[2] "Evening" is defined as 6:00pm to 10:00pm, Monday to Sunday and during Public Holidays.

[3] "Night" is defined as 10:00pm to 7:00am, Monday to Saturday and 10:00pm to 8:00am on Sundays and Public Holidays

*Where the RBL is found to be less than 30 dB(A), then it is set to 30 dB(A) in accordance with DECCW recommendations.

Full noise logger results are presented in the Appendix A of the Noise Impact Assessment Report (refer **Appendix Q**).

Meteorological Conditions

The INP requires wind effects to be considered where a source to receiver wind speed of less than 3m/s occurs for more than 30% of any assessment period in any season. At wind speeds above 3m/s, noise produced by the wind itself generally obscures noise produced by industrial sources. The INP also requires temperature inversions to be considered for developments where night time operations are proposed. However as the proposed landfill facility would only operate during the daytime period, assessment of noise from the Project Site with a temperature inversion is not required

Meteorological data for a typical year (2002) has been assessed to determine the occurrence of wind conditions on the site that are likely to cause increased noise levels at the receiver. Source to receiver wind speed of less than 3m/s were found to occur for less than 30% of the time for the Day time and Evening assessment periods throughout the year. Whilst the incidence of wind up to 3 m/s approaches 30% in some directions during the night time period, night time operations are not proposed and therefore, in accordance with the INP guidelines, wind effects are not required to be included in the analysis.

Equipment Noise Levels

Sound power levels (SWL) of typical landfill machinery have been used for the purpose of this assessment. These SWLs were based on site measurements, AECOM's experience with similar equipment and the typical midpoint levels recommended in Australian Standard AS 2436 – Guide to Noise Control on Construction, Maintenance and Demolition Sites.

The equipment SWLs used in the model are summarised in **Table 50**.

Table 50: Equipment SWLs

Equipment Description	Sound Power Level dB(A)
Excavator	110
Dozer (D5)	113
Water Cart	105
Compactor (Landfill)	107
Grader	114
Tipper Truck	105
Truck	97
Scraper	114

Source: AECOM, January 2010

8.7.3 Potential Noise Impacts

A three dimensional noise model of the site and surrounds was constructed using SoundPLAN version 6.3. The noise levels at the receivers were calculated according to the CONCAWE algorithms for industrial noise sources.

Noise impacts at receivers nearest the Project Site have been assessed and the results are sumamrised in the following section.

Construction

The noise impact assessment has considered a “typical” construction scenario. Noise impacts during construction are expected to arise from the equipment used in ancillary site preparation works, including the partial clearing of the site, the construction of the site access and maintenance roads, drainage works, landscaping works and some excavation of the landfill area. This “typical” construction scenario was based on the following equipment operating on the proposed site:

- Twenty truck movements per day (ten construction trucks) along the site access road, with a peak of five movements per hour.
- Ten truck movements per hour along the perimeter road.
- One movement per hour along the perimeter road and site access road for the water cart.
- One compactor and one grader located along the western portion of the perimeter road.
- One excavator and one dozer working in the area of Cell 1 (i.e. the nearest Cell to Receivers 1 and 2).

Equipment would generally be distributed across the site, however, a worst case scenario where the equipment is predominantly working at the extremities of the construction area, that is nearest to Receivers 1 and 2, has been used for the purpose of the noise assessment.

Calculated noise levels resulting from construction activities are summarised in **Table 51**.

Table 51: All Construction Plant Operating During Daytime under Neutral Meteorological Conditions

Receiver	L_{eq} dB(A)
1 Strathaven	36
2 Sherraloy	38
3 Riverton	28
4 North 1	32
5 North 2	34
6 Northwest	28

The L_{Aeq}, is approximately 2 to 3 dB(A) less than the L_{A10} of 40dB(A) levels for construction noise (refer **Section 8.7.1**). Therefore, a proposed construction noise objective of L_{eq} 38 dB(A) has been established. The analysis shows that the criteria for construction noise would be expected to be met for all the receivers when equipment is operating in the typical configuration described. Small variations in noise levels would be expected at the receivers based on the variation in the location of the equipment and actual wind conditions, over time, however such potential variation is not considered to be the cause any significant difference in the assessed construction noise levels for all receivers.

Operation

Operational noise would emanate from equipment used at the landfill in the daily operation of the landfill. Noise is expected to be generated from trucks delivering the waste, compaction, grading and covering of the waste materials. Operational hours have previously been identified in **Section 5.5.6**, being between 7am and 5:30pm Monday to Friday, and 8am to 6:30pm on Saturdays.

Two scenarios were used to represent typical operational aspects of the landfill. To represent a 'worst-case' scenario for receivers 1 and 2 (Strathaven and Sherraloy properties), the equipment was generally distributed along the south and the western areas of the landfill. The two scenarios included:

- Scenario 1 - normal filling and compacting operations on the site with the following equipment operating within the working landfill cell:
  - One compactor.
  - One dozer.
  - One tipper truck.
- Scenario 2- operations on the site that would occur in the afternoon with the following equipment operating within the working landfill cell:
  - One compactor.
  - One scraper.
  - One cover truck.
  - One excavator.

The following traffic movements have been incorporated along the site roads for both operational scenarios and would be typical of the worst case operation of the site:

- Two truck movements (one truck) per hour along the site access road (given that the three daily waste vehicles would arrive at the site at times spread throughout the day, and more than one vehicle would not arrive in any one hour period. The two truck movements per hour on the site access road equates to one truck arriving and departing the site).
- One truck movement per hour along the perimeter road.
- One movement per hour along the perimeter road for the water cart.
- The compactor, dozer and stationary truck distributed across the active landfill cell.

It is noted that the truck transporting cover material would not be on site at the same time as the truck transporting waste. The dozer and compactor would generally be confined to locations within the landfill cells. It is not envisaged that these machines would be regularly used on the perimeter road.

Both operational scenarios were repeated in Cell 1, 3 and 5 (refer **Appendix Q**) to determine the worst repeating case noise levels for the nearest sensitive receivers over the 50 year life of the proposed landfill.

The calculated noise levels during operation (and with no mitigation) of the proposed landfill are summarised in **Table 52**.

Table 52: Normal Operations During Daytime under Neutral Meteorological Conditions

Receiver	Location Of Equipment					
	Cell 1		Cell 3		Cell 5	
	Fill	Cover	Fill	Cover	Fill	Cover
1 Strathaven	33	34	33	35	34	35
2 Sherraloy	40*	43*	28	35	27	31
3 Riverton	23	25	25	27	25	27
4 North 1	27	29	30	31	30	32
5 North 2	27	28	29	30	30	31
6 Northwest	23	24	24	26	25	26

Source: AECOM, January 2010

* Denotes exceedance of environmental criterion.

The analysis indicates that without noise mitigation, the environmental criteria of 35 dB(A) would be met for all receivers when equipment is operating in Cell 3 and Cell 5. Where equipment is operating in Cell 1, at the south of the site, the noise level at Receiver 2 would be expected to exceed the criteria by up to 8 dB(A) without noise mitigation. Measures to mitigate exceedances are described in **Section 8.7.4**.

Noise contour plots for operations are included in the Noise Impact Assessment Report (refer **Appendix Q**).

Traffic Noise

During construction, a “worst-case” scenario has been defined as follows, for the traffic that might be expected to be generated per day:

- Ten construction trucks (total 20 movements).
- Five passenger vehicles to and from site (10 movements).

The proposed development would be expected to generate twelve traffic movements per day during normal operational hours as outlined below:

- Three waste vehicles to and from the site (total six movements).
- One cover truck to and from the site (total two movements).
- Two staff vehicles to and from the site (total four movements).

Potential traffic noise impacts might be expected from waste vehicles around the existing WTS and increase in traffic along Waterfall Way for the trucks delivering waste and cover material to the proposed landfill facility.

Waste Vehicles from Long Swamp Road

Assuming that the trucks that currently leave empty from the existing landfill at the Armidale Waste Management Centre would be used to meet the majority of the transport requirements between the WTS and the proposed landfill facility, a maximum increase in traffic noise levels due to trucks associated with the facility of 1.2 dB(A) would be expected. The traffic generated by the proposed landfill facility would not be expected to increase traffic noise levels on Long Swamp Road or Canambe Street by more than 2 dB(A) and would therefore comply with the ECRTN criteria. No significant change to light vehicle traffic noise would be expected.

Traffic along Waterfall Way

The existing vehicle traffic along Waterfall Way has been based on the hourly traffic survey data supplied by Armidale Dumaresq Council. The tables below indicate the traffic generated by the proposal and increased traffic noise levels along Waterfall Way (**Table 53** and **Table 54**). Reference should be made to **Section 8.14** for a specific analysis on traffic related impacts from the proposed development.

The assessment indicates that the volume of traffic movements associated with the proposed landfill facility is not expected to significantly increase traffic noise along Waterfall Way, with a maximum calculated increase in noise levels during the construction period of 0.9 dB(A) between 7am and 8am on weekday mornings. The maximum calculated increase in noise levels for the operational scenario is 0.9 dB(A) between 7am and 8am on weekday mornings.

The traffic generated by the development would increase traffic noise levels on Waterfall Way, by less than 2dB(A) and would therefore comply with the ECRTN criteria.

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Table 53: Increase in Traffic Noise Levels on Waterfall Way – Operation (Worst Case)

Time	Weekdays					Weekend				
	Existing Flow	Traffic Generated*		Proposed Flow	dB Increase	Existing Flow	Traffic Generated*		Proposed Flow	dB Increase
		Light Vehicles	Heavy Vehicles				Light Vehicles	Heavy Vehicles		
7:00	35	2	6	43	0.9	43			43	0.0
8:00	60		6	66	0.4	72	2	2	76	0.3
9:00	69		6	75	0.4	83		6	89	0.3
10:00	73		6	79	0.3	87		6	93	0.3
11:00	79		6	85	0.3	95		6	101	0.3
12:00	72		6	78	0.3	86		6	92	0.3
13:00	75		6	81	0.3	90		6	96	0.3
14:00	80		6	86	0.3	96		6	102	0.3
15:00	90		6	96	0.3	109		6	115	0.2
16:00	79		6	85	0.3	95		6	101	0.3
17:00	58	2	2	62	0.3	69		6	75	0.4
18:00	34			34	0.0	40	2	2	44	0.5
Total	**804**	**4**	**62**	**870**	**0.9**	**965**	**4**	**58**	**1027**	**0.5**

Source: AECOM, January 2010

* Traffic generation based on six waste truck movements, two cover truck movements and four passenger vehicles movements per day with a peak of 6 vehicle movements per hour. Peak traffic movements were applied to each one hour period to determine the maximum impact.

Table 54: Increase in Traffic Noise Levels on Waterfall Way – Construction (Worst Case)

Time	Weekdays					Weekend				
	Existing Flow	Traffic Generated		Proposed Flow	dB Increase	Existing Flow	Traffic Generated		Proposed Flow	dB Increase
		Light Vehicles	Heavy Vehicles				Light Vehicles	Heavy Vehicles		
7:00	35	5	3	43	0.9	43			43	0.0
8:00	60		5	65	0.3	72	5	3	80	0.5
9:00	69		5	74	0.3	83		5	88	0.3
10:00	73		5	78	0.3	87		5	92	0.2
11:00	79		5	84	0.3	95		5	100	0.2
12:00	72		5	77	0.3	86		5	91	0.2
13:00	75		5	80	0.3	90		5	95	0.2
14:00	80		5	85	0.3	96		5	101	0.2
15:00	90		5	95	0.2	109		5	114	0.2
16:00	79		5	84	0.3	95		5	100	0.2
17:00	58	5	3	66	0.6	69	5	3	77	0.5
Total	**770**	**10**	**51**	**831**	**0.9**	**925**	**10**	**46**	**981**	**0.5**

Source: AECOM, January 2010

* Traffic generation based on 10 construction trucks and five passenger vehicles per day with a peak of five heavy vehicles movements per hour. Peak traffic movements were applied to each one hour period to determine the maximum impact

Sleep Arousal

The operating hours of the proposed landfill facility and limited number of truck movements would be restricted to the daytime operating hours as specified in **Section 5.5.6**. As such, no impact of heavy vehicle traffic through the residential areas along Long Swamp Road and Canambe Street during the night are expected. Therefore the development would not be expected to generate additional night time maximum noise events due to heavy vehicle pass bys.

8.7.4 Mitigation Measures

Construction

A CNMP would be prepared by the construction contractor prior to the start of site works. The CNMP would detail the best practice construction methods to be used, a noise monitoring programme, mitigation measures, a complaint management strategy and contingency plans, if noise exceedance or justified complaints were to occur.

Due to the extremely low existing background noise levels at the receiver locations, all reasonable opportunities to minimise noise emission from the site would be undertaken. The following general measures are typical of the best practice noise management and would be applied to minimise noise emission from the site during the construction period:

- Maximising the offset distance between noisy plant items and nearby noise sensitive receivers.
- Avoiding the co-incidence of noisy plant working close together and adjacent to sensitive receivers.
- Orienting equipment away from sensitive areas.
- Carrying out loading and unloading away from noise sensitive areas.
- Ensuring that vehicles required on site do not ‘queue’ outside the worksite prior to the morning start time.
- Ensuring all construction vehicles enter and leave the site in accordance with site entry controls.
- Ensuring no truck associated with the work is left standing with its engine idling.
- All equipment, including bulldozers, graders, excavators and trucks should have all reasonable and feasible noise controls fitted to reduce noise emission as much as is feasibly possible. The noise attenuation measures could include:
    - The encapsulation of engine chambers.
    - Fitting ‘DECCW’ approved silencers to all power operated plant.
    - The use of reversing alarms which automatically adjust output sound levels according to the prevailing ambient noise level. Preferably, broadband noise alarms should be fitted in place of tonal alarms.
- Notifying the surrounding community via letter drops and/or local media announcements of any forthcoming unusual construction activities.
- Engaging community consultation prior to and throughout the construction phase.

Operation

Noise Control Measures

Permanent heavy equipment used on site would have noise attenuation measures installed where feasible. These could include the enclosure of engine chambers, with careful regard to ventilation requirements of the engines and the fitting of DECCW approved silencers to all power-operated plant.

These mitigation measures would be expected to provide attenuation of between 5-10 dB(A) and should be applied to the dozer, excavator, compactor and scraper.

Reversing alarms are a common source of annoyance complaints from facilities that involve the use of heavy vehicles in their operation. Due to the low existing background noise levels in the vicinity of the Project Site, equipment would be fitted with a reversing alarm, which automatically adjusts output sound levels according to the prevailing ambient noise level be used or alternatively, broadband reversing alarms should be fitted in place of tonal alarms.

With the implementation of these noise control measures and use of attenuated equipment outlined above, the SWLs for the equipment would be as shown in **Table 55**.

Table 55: Attenuated Equipment SWLs

Equipment Description	Sound Power Level dB(A)
Excavator	105*
Dozer (D5)	108*
Water Cart	105
Compactor (Landfill)	102*
Grader	109*
Tipper Truck	105
Truck	97
Scraper	109*

Source: AECOM, January 2010

*5 dB(A) reduction applied for silencing

Noise levels were recalculated at the identified receivers under neutral meteorological conditions with attenuated equipment. The calculated noise levels resulting from the operation of the proposed development with the recommended noise mitigation measures included are summarised in **Table 56**.

Table 56: Attenuated Plant Operating During Daytime under Neutral Meteorological Conditions

Receiver	Location Of Equipment					
	Cell 1		Cell 3		Cell 5	
	Fill	Cover	Fill	Cover	Fill	Cover
1 Strathaven	29	30	30	31	30	31
2 Sherraloy	35	38*	24	31	23	27
3 Riverton	20	21	22	23	22	23
4 North 1	25	25	27	28	28	29
5 North 2	24	24	26	27	27	28
6 Northwest	19	20	21	22	22	23

Source: AECOM, January 2010

* Denotes exceedance of environmental criterion of 35 dB(A)

The results indicate a minor exceedance of the criteria at Receiver 2 (Sherraloy) of approximately 3dB(A) during covering operations of Cell 1. However, it should be noted that the modelling assumes that the plant would be operating on the finished contours of the proposed landfill which would only occur as the cell (or sub-cell) reaches capacity. This represents a “worst case” given that for the majority of the operating life of Cell 1, additional shielding to Receiver 2 would be provided by the natural contours of the site.

With the mitigation measures implemented, the proposed development would be expected to comply with the environmental criteria for the site under the neutral meteorological conditions that have been shown to be typical of the site. Minor exceedances of the criterion of up to 3dB(A) may occur at certain times near the end of the operating life of Cell 1. The day time criterion is equal to the night time criterion, which in turn is set to the INP minimum assessment level. Therefore, in accordance with the guidance given in Section 2.1 of the INP, minor exceedances of 3dB(A) would generally be acceptable.

Maintenance

The ongoing maintenance of equipment would be critical to ensure the continuing compliance with the noise criteria. For this reason an annual compliance monitoring programme would be undertaken to confirm that the site noise emissions remain acceptable over the life of the landfill.

Location of Stockpiles

As far as practical, cover material should generally be stockpiled along the west or south of the active landfill cell in order to provide additional shielding to the most affected receivers.

Minimise Dozer and Scraper Operations

Noise levels at all receivers would be typically dominated by dozer and scraper operations. Therefore, the use of these items of plant would be minimised as far as practical, particularly when working at the extremities of the site.

Dozer and scraper operations would not be undertaken prior to 7am on weekdays and prior to 8am on weekends and public holidays, therefore there would be no noise impact during the night time assessment period.

The operational hours as outlined in the Landfill Licence would be adhered to at all times. In the event that operational works need to be conducted outside of the normal hours DECCW would be informed and the contractor would contact local residents.

8.8 Biodiversity

EA Systems conducted a flora, fauna and habitat assessment of the Project Site in 2006 based on surveys conducted in spring and autumn 2005 and 2006. A final fauna survey was also conducted in November 2009. The *Flora and Fauna Assessment Report* (EA Systems, 2010) is presented in **Appendix E**. The format of the assessment followed the suggested structure outlined in the working draft *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities* (DEC, 2004b). The assessment also applied the 'Assessment of Significance' (seven part test) to threatened species, populations or ecological communities found, or with potential habitat, in accordance with the *Threatened Biodiversity Survey and Assessment* guidelines (DEC, 2004b), the *Threatened Species Assessment Guidelines* (DECC, 2007) and the *Significant Impact Guidelines and Matters of National Significance* (DEH, 2006).

8.8.1 Methodology

Flora

The site was surveyed for flora on three occasions in autumn (3 April) and spring (15 October) in 2005 and in September 2006. On each occasion an assessment of vegetation communities and significant flora species was conducted using a Random Meander search (Cropper 1993). The 2006 survey entailed (20 x 50) nested quadrats consistent with the *Native Vegetation Regulation 2005*, Environmental Outcomes Assessment Methodology (DNR 2005) and random meander targeted searches for threatened species. A number of condition variables were recorded to assess current site condition of remnant woodland areas that are proposed to be cleared including:

- Native plant species.
- Native over-storey cover.
- Native mid-storey cover.
- Native ground cover of grasses, shrubs, and other components.
- Exotic plant cover.
- Number of trees with hollows.
- Over-storey regeneration.
- Total length of fallen logs.

Fauna

Fauna surveys were carried out in autumn (29th and 30th March) and spring (18th and 19th October) 2005, again in September (spring) 2006 and a final survey in November (spring) 2009, to record fauna present on the Project Site and the adjacent TSR. Daytime bird presence was surveyed visually and aurally by habitat search. Searches for reptiles and signs of presence of fauna species involved scanning of trees and logs, searching under rocks, litter and logs, and inspection of tree cavities and hollow stumps. Reptiles and frogs were identified with reference to Cogger (2000) and Swan (1990). Searches for mammals and Koala presence included visual scans, diurnal searches for scats and tracks, and nocturnal spotlighting.

A search for nocturnal fauna was conducted by two to three observers on five nights. On each night a megaphone was used to play back owl calls. Spotlight searches of nocturnal birds were also undertaken. Frogs were identified from their calls with reference to Stewart (1998). An ultrasonic bat detector was used to record bat calls.

Survey conditions were generally conducive to good quality results during the survey period. A total of 119.6 person hours was spent surveying for fauna and 37 person hours was spent surveying flora on the site.

8.8.2 Botanical Survey – Flora

The botanical survey identified 180 species (refer **Appendix E**), including the following:

- 11 trees.
- 29 shrubs (3 exotic).
- 3 climbers/vines.
- 2 mistletoes.
- 35 grasses (7 exotic).
- 98 herbs (24 exotic).
- 2 aquatic plants.

One threatened plant species, Narrow-leaved black peppermint (*Eucalyptus nicholii*) was found on the Project Site. *E. nicholii* is listed as vulnerable under both the *TSC Act* and *EPBC Act*. One Rare or Threatened Australian (ROTAP) plant species, Bendemere white gum (*E. elliptica*) was recorded within the study area (but not within areas of the Project Site identified for clearing), and although locally and regionally significant it is not subject to legal provisions under the *TSC Act* or *EPBC Act*.

8.8.3 Vegetation Communities

Five distinct vegetation communities occur at the site as shown on **Figure 18**. The vegetation communities include:

- Stringybark Woodland
- Cleared Grasslands
- Sedgeland
- Wetlands (dams)
- Box-Gum Woodland

These vegetation communities are summarised in **Table 8-35** and described in more detail in **Appendix E**.

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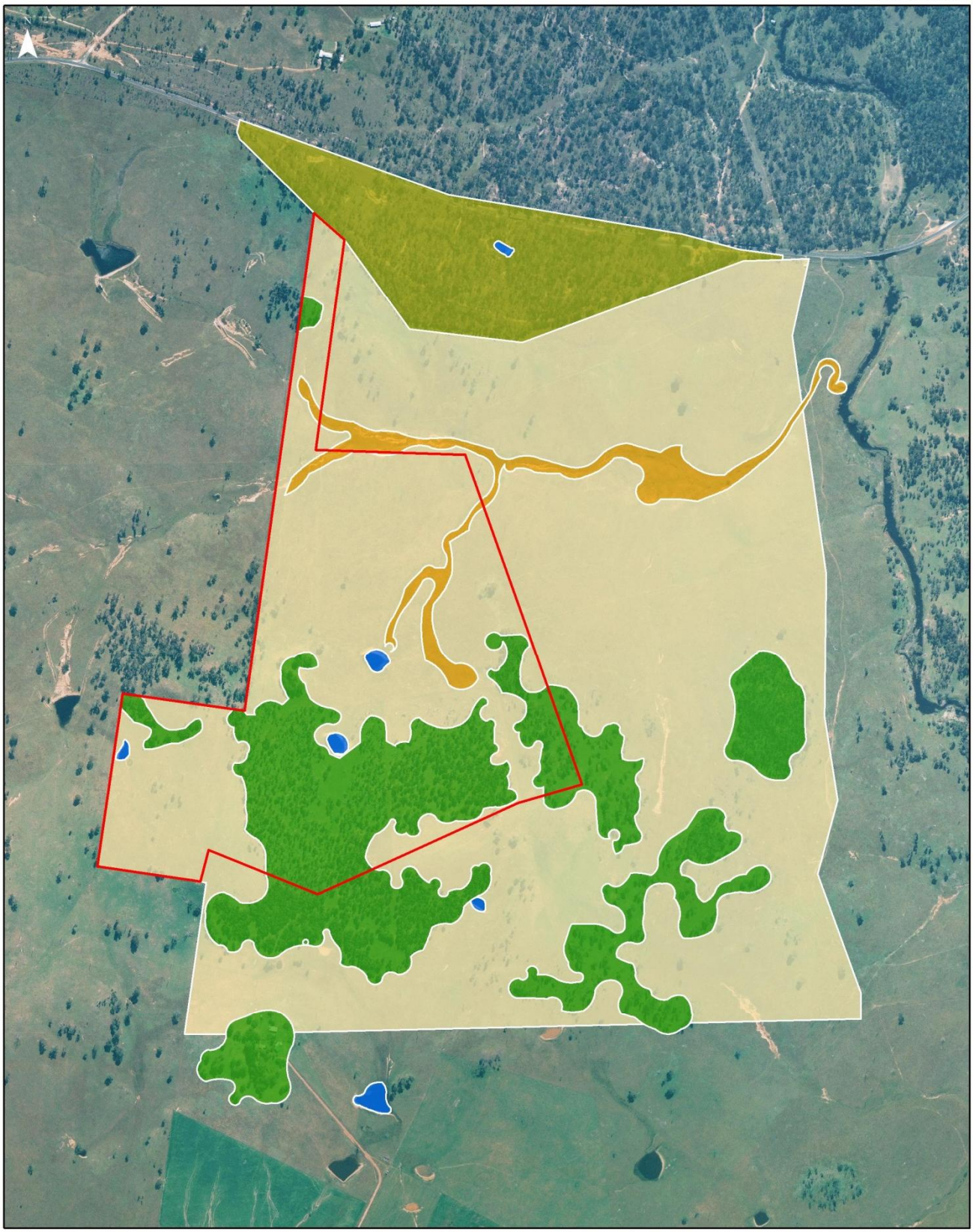
Box-gum woodland
Grassland
Sedgeland
Stringybark woodland
Wetland
Project site
ARMIDALE DUMARESQ COUNCIL - ARMIDALE REGIONAL LANDFILL FACILITY
VEGETATION COMMUNITIES
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Fig 18

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Table 57: Description of the Vegetation Communities Found in the 361 hectare Surveyed Area of the Proposed Armidale Landfill Site

Community Name	Area (% of total surveyed)	Condition/ Habitat Quality	Status	Dominant species	Other species	Characteristics	Disturbances
Stringybark woodland	62.8 ha (17%)	Moderate	Widespread	Trees: • New England stringybark *Eucalyptus caliginosa* • Yellow box *E. melliodora* Shrubs: • Blackthorn *Bursaria spinosa* • Peach heath *Lissanthe strigose* • Guinea flower *Hibbertia linearis* Grasses: • Slender rat's tail grass *Sporobolus creber* • Red-leg grass *Bothriochloa macra* • Rough speargrass *Austrostipa scabra* • Couch *Cynodon dactylon* • Snow grass *Poa sieberiana* • Small lovegrass *Eragrostris leptostachya* • Purple wiregrass *Aristida ramose* • Slender wallaby grass *Austrodanthonia racemosa*	Trees: • Fern-leaved wattle *Acacia filicifolia* • Black she-oak *Allocasuarina littoralis* • Blakely's red gum *E. blakelyi* Shrubs: • Hawthorn *Crataegus monogyna* * • Blackberry *Rubus fruticosus* * • Sweet briar *Rosa rubiginosa* * Grasses / herbs: • Native stinging nettle *Urtica incisa* • Exotic stinging nettle *U. urens* * • Slender sedge *Cyperus gracilis* • Pin rush *Juncus usitatus* • Burr-daisy *Calotis cuneifolia*	• Patchy with largest contiguous patch 32 ha • Trees 4 – 20 metres apart • Very few fully mature trees • Very few hollows • Poor community diversity • Sparse shrub layer • Weed invasion of shrub layer • Forms part of an intermittent band of woodland that is likely to be a significant flora and fauna corridor	• Partially cleared and subsequently regrown • 11-17 log piles per ha
Cleared grasslands	212.6 ha (68%) - 3.3 ha to be cleared for proposed development	Low	EEC – "White box, yellow box, Blakely's red gum woodland (box-gum woodland) under the *TSC Act*	Trees: • Nil Shrubs: • Nil Grasses / herbs: • Couch *Cynodon dactylon* • Slender rats tail grass *Sporobolus creber* • Blown grass *Lachnagrostis avenaceus* • Red-leg grass *Bothriochloa macra* • Small lovegrass *Eragrostris leptostachya*	Trees: • Nil Shrubs: • Hawthorn *Crataegus monogyna* * • Sweet briar *Rosa rubiginosa* * Grasses / herbs: • Pale pigeon grass *Setaria pumila* • Paspalum *Paspalum dilatatum* • *Juncus usitatus* • Spear thistle *Cirsium vulgare* • Pinrush *Juncus usitatus*	• Historically was woodland prior to clearance • Isolated trees remain • No recent regeneration • Lack of non-grass understorey excludes it from the *EPBC Act* listed critically endangered box-gum woodland and derived native grassland ecological community	• Historical clearance • Existing, intensive grazing by sheep and cattle
Sedgeland	9.4 (3%)	Low to moderate	Widespread	Trees: • Nil Shrubs: • Nil Grasses / herbs: • Tall sedge *Carex appressa* • Umbrella sedge *Cyperus eragrostris* • Paspalum *Paspalum dilatatum* • Pinrush *Juncus usitatus*		• Occupies shallow drainage lines throughout the grassland • Intergrades with grassland	• Heavily grazed by sheep and cattle
Wetlands (dams)	< 1 ha (< 1%)	Low to moderate	Widespread	• Tall sedge *Carex appressa* • Umbrella sedge *Cyperus eragrostris* • Water couch *Paspalum distichum* • Spreading knotweed *Persicaria prostrata* • Ribbonweed *Vallisneria gigantea* • Swamp lily *Ottelia ovalifolia*		• Dams support an artificial assemblage of wetland plants	• Heavy trampling by domestic livestock

Community Name	Area (% of total surveyed)	Condition/ Habitat Quality	Status	Dominant species	Other species	Characteristics	Disturbances
Box – gum woodland	29.6 ha (9.4%)	Good	EEC – "White box, yellow box, Blakely's red gum woodland (box-gum woodland) under the *TSC Act* and as the 'box-gum woodland and derived native grasslands' critically EEC under the *EPBC Act*	Trees: • New England stringybark *E. caliginosa* • Yellow box *E. melliodora* • Blakely's red gum *E. blakelyi* • Apple-topped box *E. bridgesiana* • Bendemeer white gum *E. elliptica T* Grasses / herbs: • Kangaroo grass *Themeda australis* • Snow grass *Poa sieberiana* • Slender wallaby grass *Austrodanthonia racemosa var. racemosa* • Native sorgum *Sarga leiocladum*	Trees: • Narrow-leaved peppermint *E. nicholli T* Shrubs: • Spiny parrot pea *Dillwynia sieberi* • Chinese lespedeza *Lespedeza juncea* * • Peach heath *Lissanthe strigosa*	• Occurs on the TSR and is contiguous to a larger patch in the main Gara TSR to the north of Waterfall Way • 140 species recorded • Trees 6 – 20 metres apart • Regeneration common • Abundant hollows and denning sites for mammals and birds • 1 vulnerable and 1 ROTAP species present	• Low levels of grazing through use as a TSR for 90 years • Localised road realignment- previous route of Waterfall Way. • Kangaroo grass and native sorghum rare to absent from heavily grazed block to the south and are indicative of a relatively intact understorey

8.8.4 Threatened Plant Species

Threatened flora species identified at the site and within 20km of the site are shown in **Figures 19** and **20**, respectively. Sixteen threatened plant species have been recorded within 20 kilometres of the study site (**Figure 20**). Ten are considered to have suitable habitat represented in the study area (refer **Appendix E**). These are:

- *Amphibromus pithogastrus* which occurs in moist, grassy seepages.
- *Asperula charophyton* which also occurs in moist, grassy seepages.
- *Bothriochloa biloba* which occurs in disturbed grasslands.
- *Dichanthium setosum* which occurs in grassy woodlands.
- *Discaria pubescens* which occurs in woodlands and forests in rocky situations.
- *Diuris pedunculata* which occurs in moist areas, open sclerophyll forest and grasslands.
- *Eucalyptus nicholii* which occurs in grassy, open forests or woodlands on poor soils.
- *Ozothamnus adnatus* which occurs in grassy open forest and woodland on poor soils.
- *Senecio macranthus* which occurs in moist gullies in sclerophyll forest.
- *Thesium australe* which occurs in grassy woodlands.

Narrow-leaved black peppermint (*Eucalyptus nicholii*) is listed as vulnerable under both the *TSC Act* and *EPBC Act*. Six adult and five juvenile trees were located within the access way corridor (refer **Figure 19**). Narrow-leaved peppermint is endemic to the Northern Tablelands, where it occurs from Niangala to Glen Innes. This species is recorded frequently along Waterfall Way to the east of the study site.

Assessments of Significance (also known as “seven part tests”, conducted under the requirements of Section 5A of the *EP&A Act*) of potential impacts on these species arising from the proposed development are presented in **Appendix E**. The Assessments concluded that there would be no significant impact of the Project Site on threatened species, populations or ecological communities as long as the appropriate compensatory habitat is provided, as well as the appropriate implementation of all other proposed mitigation measures.

A Bendemeer white gum (*Eucalyptus elliptica*) population was located in the Gara TSR to the east of the proposed access way but not within the area identified for clearing. This is a ROTAP species on the Northern Tablelands, where it prefers grassy woodland on sandy soils. The nearest known population is 22 kilometres east of the study area.

8.8.5 Endangered Ecological Communities (EEC)

Box-gum woodland community is classified as an EEC under the *TSC Act* and is also classified as critically endangered under the *EPBC Act* (refer **Appendix E**). Box-gum woodland is an open woodland or forest community dominated by white box (*Eucalyptus albens*), yellow box (*E. melliodora*) and Blakely’s red gum (*E. blakelyi*). Intact sites have a high species diversity, although such stands that contain diversity in all structural layers are rare. The box-gum woodland in the Gara TSR is considered to be relatively intact, with a high diversity of plant species. The cleared grassland community has also retained enough native grasses to qualify as an EEC under the definitions that pertain to the *TSC Act*. The cleared area of grassland is considered to have the potential to regenerate, as it is dominated by native grasses and forbs.

An Assessment of Significance of potential impacts on the box-gum woodland community present on the site is presented in **Appendix E**. The Assessment concludes that there would be no significant impact of the proposed landfill facility on this community as long as the appropriate compensatory habitat is provided, and management measures are implemented.

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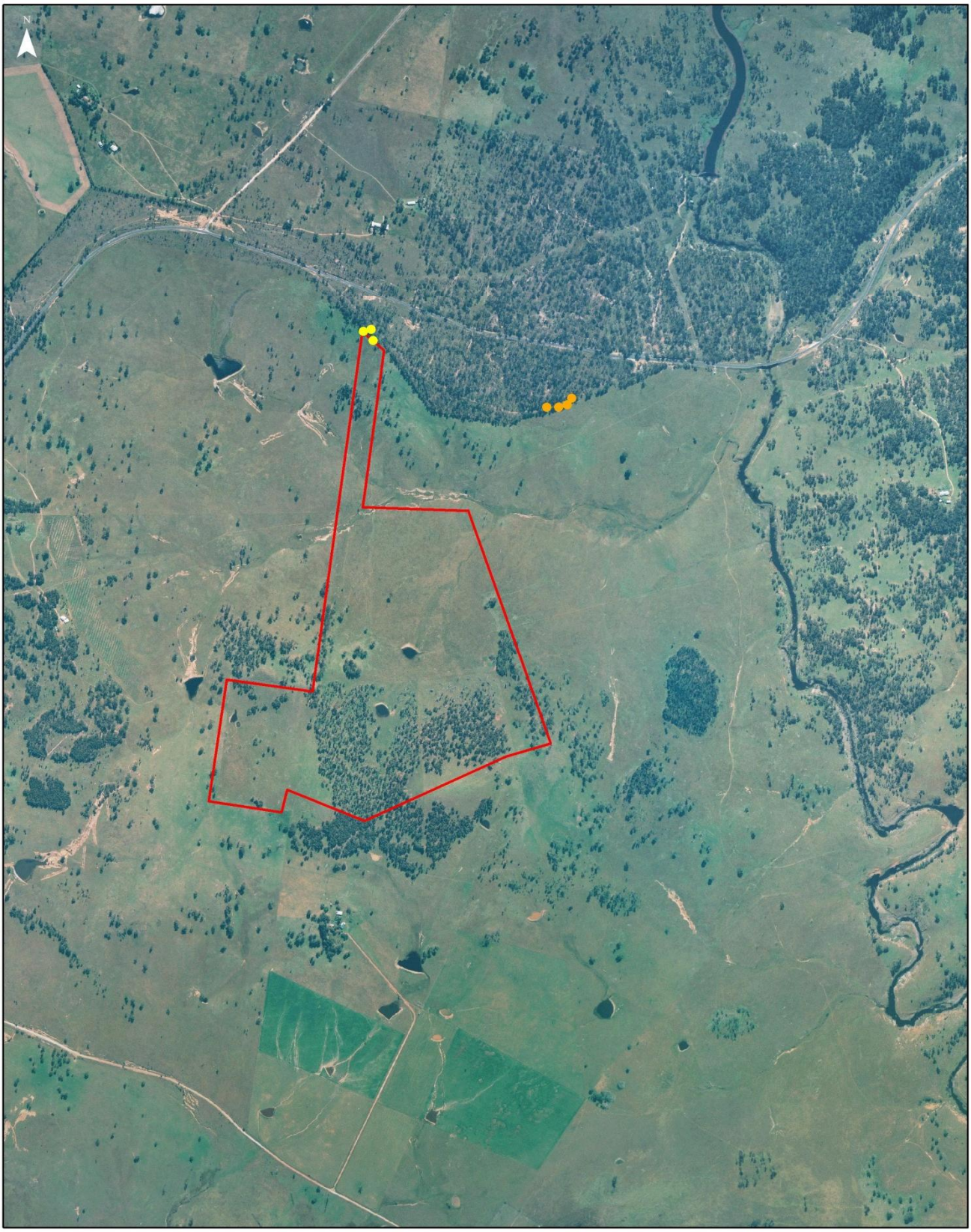

Project site
Narrow-leaved Black Peppermint (*Eucalyptus nicholii*)
Bendemeer White Gum (*Eucalyptus elliptica*)

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INDICATIVE LOCATION OF THREATENED FLORA SPECIES ON THE PROJECT SITE

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Fig. **19**

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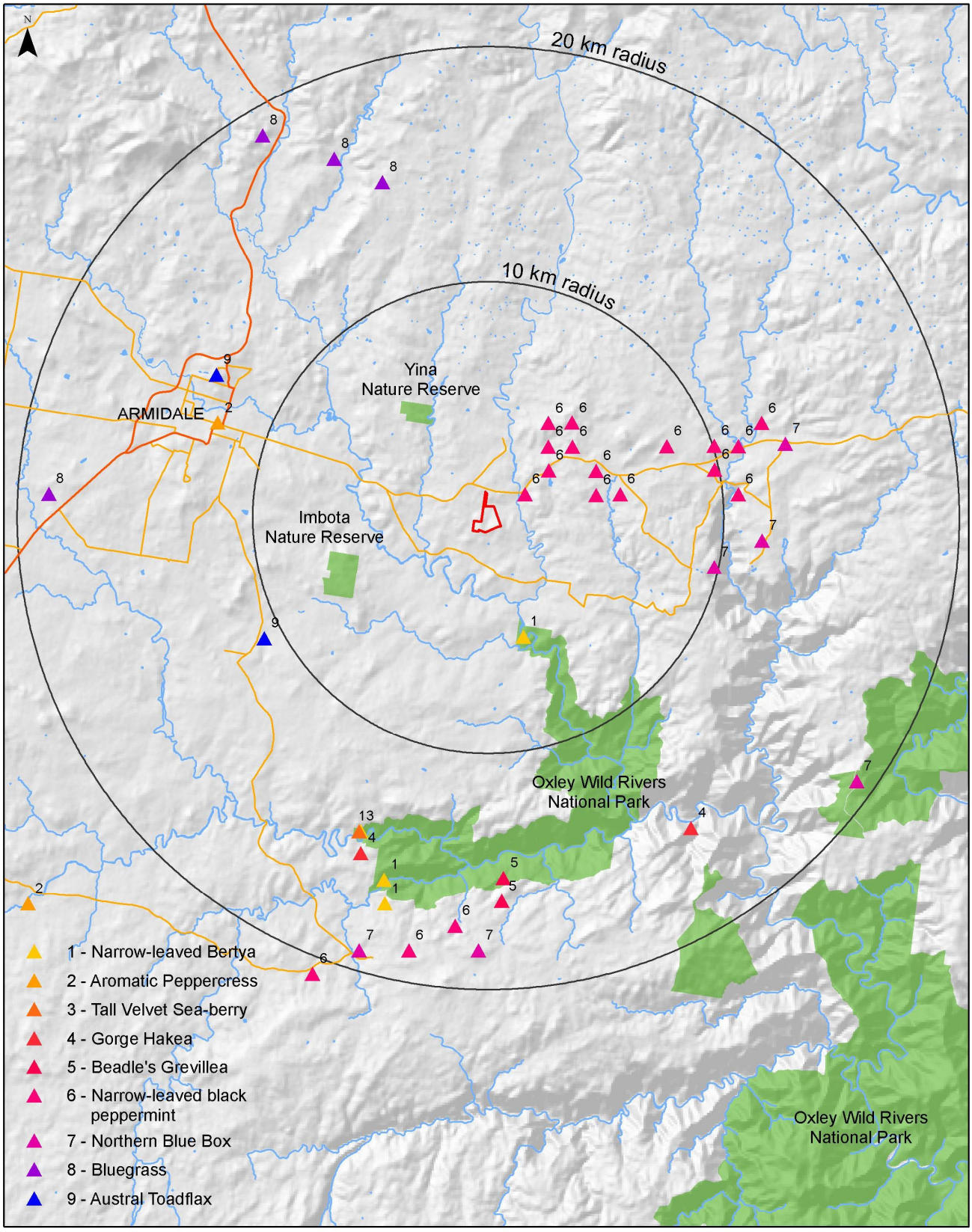

Project site

National Park or Nature Reserve

ARMIDALE DUMARESQ COUNCIL - ARMIDALE REGIONAL LANDFILL FACILITY

RECORDS OF THREATENED FLORA WITHIN 20 KM OF THE PROJECT SITE FROM DECCW NPWS ATLAS OF NSW FLORA DATABASE

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Fig **20**

0 2.5 5 10 km

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8.8.6 Fauna Survey

Fauna surveys were undertaken to determine the presence of fauna within the Project Site and in the adjacent TSR. The following summarises the results:

Birds

Eighty species of birds (1 exotic) were identified within the study area (refer **Appendix E**). Two of these bird species are listed as vulnerable under the *TSC Act*, these being:

- Speckled warbler.
- Diamond firetail.

These two species were located in the box-gum woodland of the TSR and in the stringybark woodland of the Project Site. Three (3) bird species currently subject of a Preliminary Determination to be listed as Vulnerable under the *TSC Act* were also detected in this area including;

- The Little Eagle.
- Scarlet Robin.
- Varied Sittella.

Mammals

Fifteen species of mammals (4 exotic) were detected in the study area (refer **Appendix E**). Two threatened mammal species were amongst this group, these being a single koala which was observed in the box-gum woodland of the Gara TSR (during 2005 survey only) and the eastern bent-wing bat which was detected by echo-location calls in the stringybark woodland. Both these species are listed as vulnerable under the *TSC Act*.

Amphibians

The fauna survey detected eight frog species on the site (refer **Appendix E**), however none of these are listed as threatened species.

Reptiles

Of the ten reptile species detected on the site (**Appendix E**), none are listed as threatened species.

8.8.7 Threatened Fauna Species

Four species of threatened fauna were detected in the study area (**Figure 21**):

- Speckled Warbler.
- Diamond Firetail.
- Koala.
- Eastern Bent-wing Bat.

Family groups of two to three speckled warblers were observed during the autumn and spring surveys in the stringybark woodland and another in the box-gum woodland. Diamond firetails were observed in spring and autumn at the dam in the stringybark woodland and in the box-gum woodland, 100 metres west of the dam in the TSR.

One koala was observed during spotlighting in spring in the box-gum woodland beside Waterfall Way. A detailed search for koala in November 2009 revealed evidence of koala (scats and scratches) near several trees in the stringybark woodland, however no koalas were observed at either the Project Site or the TSR.

Echo-location calls indicated the presence of the eastern bent-wing bat in the stringybark woodland in 2005.

Three bird species currently subject of a Preliminary Determination to be listed as Vulnerable on the *TSC Act* were also detected in this area. One Scarlet Robin territory, a group of Varied Sittellas and a Little Eagle's nest were identified in the stringybark woodland within the landfill footprint.

Searches of DECCW's NPWS Atlas of NSW Wildlife and EPBC Protected Matters search tool revealed 29 threatened species that have been recorded within 20 kilometres of the study area (refer **Figure 22**). Habitat assessments of these species (refer **Appendix E**) revealed that 14 would have suitable habitat within the study site. These are as follows:

- Barking Owl, which forage in eucalypt woodland.
- Black-chinned Honeyeater, which forage in eucalypt woodland.
- Brown Treecreeper, which forage in eucalypt woodland.
- Diamond Firetail, which occur in grassy eucalypt woodland and were recorded on site.
- Eastern Bent-wing Bat, which forage in eucalypt woodland.
- Eastern False Pipistrelle, which forage and roost in eucalypt woodland.
- Hoary Wattled Bat, which forage and roost in tree hollows and rock fissures of eucalypt forest and rainforest.
- Hooded Robin, which forage and breed in eucalypt woodland.
- Koala, which forage and breed in eucalypt woodland and forests and were recorded on site.
- Little Lorikeet, which forage and breed in box-gum and riparian gum woodland.
- Regent Honeyeater, that has marginal foraging habitat by way of eucalypt woodland on site.
- Speckled Warbler, which was recorded on site.
- Square-tailed Kite, which forages in the canopy of eucalypt woodland.
- Squirrel Glider; which forages in eucalypt woodland and nests in small hollows.
- Yellow-bellied Sheathtail Bat, which forages above woodland canopies and roosts in tree hollows.

A seven part test assessment of the significance of the proposed development on all these species is presented in **Appendix E**.

8.8.8 Other Fauna of Conservation Significance

A pair of Little Eagles was observed nesting during the 2005 spring survey in a stringybark tree in the gully above the dam within the stringybark woodland (**Figure 21**). Little Eagles usually breed from the same nest over a number of years but have also been known to readily build a new nest. In the 2009 spring survey the pair had a new nest site in a tall Yellow Box on the western edge of the proposed landfill footprint. This species is protected in NSW and any clearing that may affect the nest tree should be undertaken outside the breeding season.

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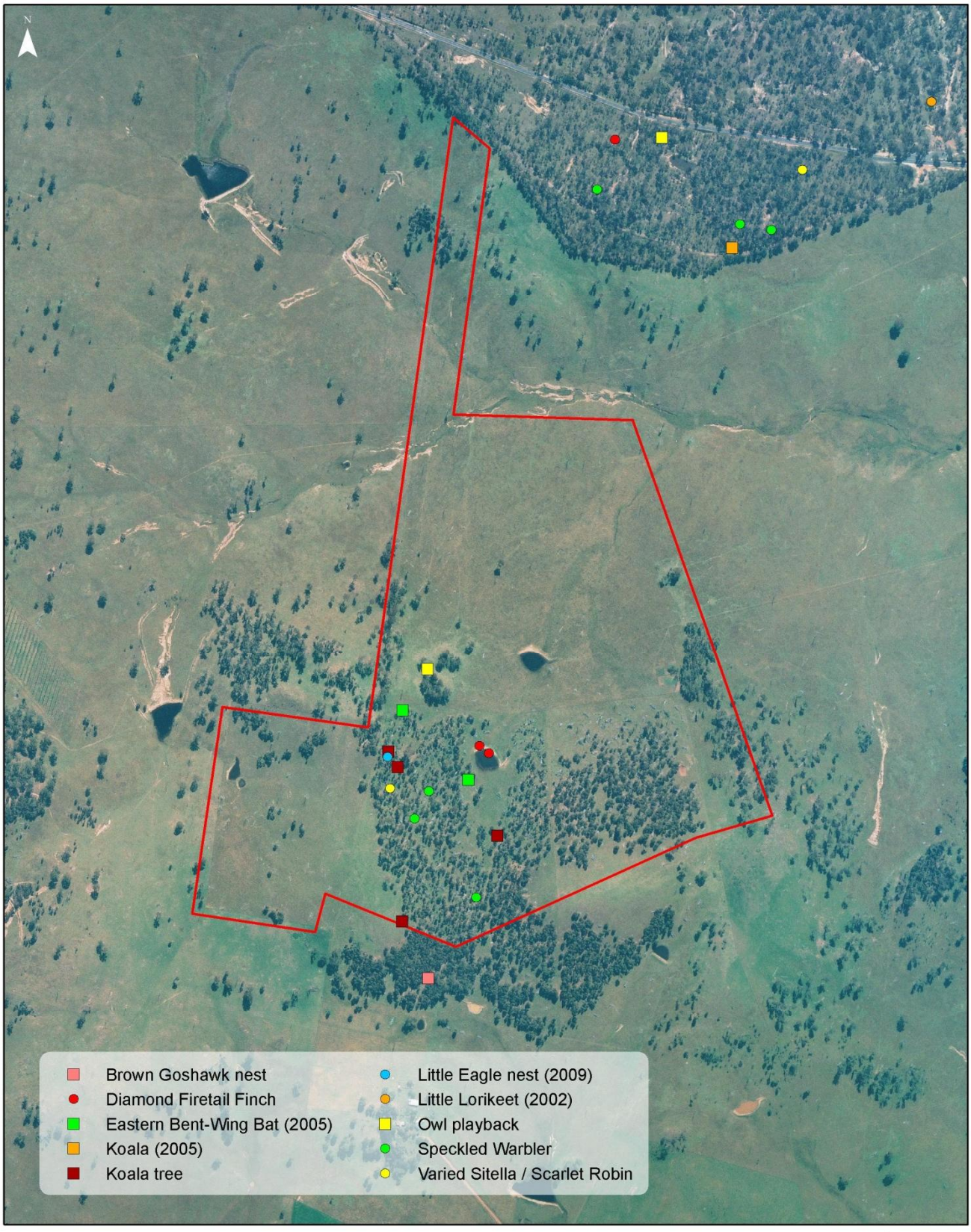

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INDICATIVE LOCATION OF THREATENED AND IMPORTANT FAUNA SPECIES RECORDS OF THE PROJECT SITE

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Fig. **21**

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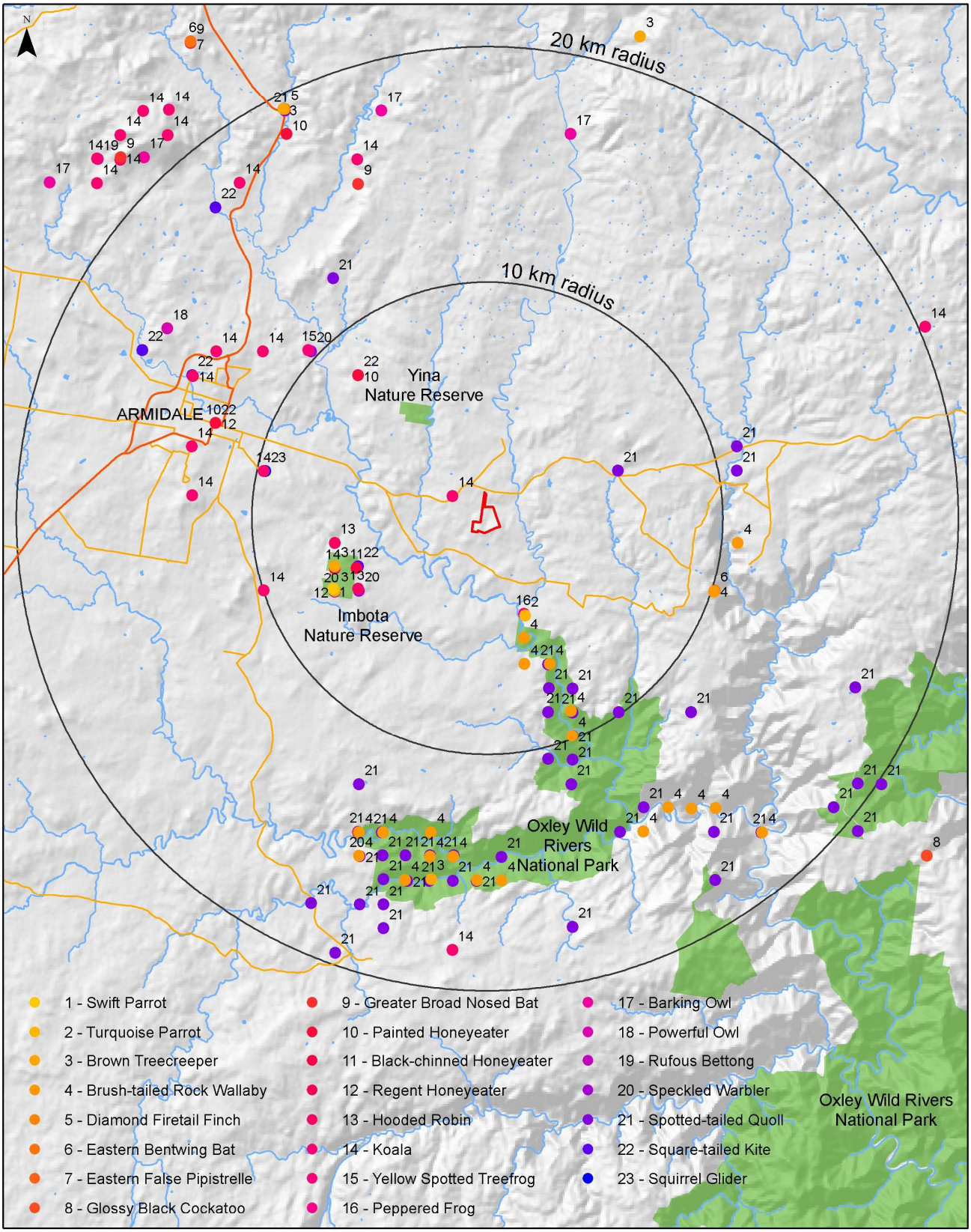

Project site

National Park or Nature Reserve

ARMIDALE DUMARESQ COUNCIL - ARMIDALE REGIONAL LANDFILL FACILITY

RECORDS OF THREATENED FAUNA WITHIN 20 KM OF THE PROJECT SITE FROM DECCW NPWS ATLAS OF NSW WILDLIFE

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Fig. **22**

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8.8.9 Fauna Habitat

Overall, the study area provides moderate quality habitat for threatened flora and fauna. The box-gum woodland along the TSR provides high quality habitat, while the proposed operational area of the Project Site is degraded and provides low quality habitat due to historical clearing of vegetation, fragmentation, scarcity of regeneration, creation of log piles, heavy grazing, weed invasion and pest animal invasion.

SEPP 44 (Koala Habitat Protection) Assessment

As previously mentioned in **Section 6.3.3**, Armidale Dumaresq LGA is listed in Schedule 1 of *SEPP 44* and Part 2 requires that prior to granting consent to a development on land subject to the policy, the Council must consider whether the land constitutes 'potential' or 'core' koala habitat.

Core koala habitat is defined as areas which contain a resident koala population and potential koala habitat is defined as areas of native vegetation where the trees (of the type listed in Schedule 2 of the SEPP) constitute at least 15% of the total number of trees in the upper or lower strata of the tree component. Should core koala habitat be identified, a Plan of Management would be required to be prepared in respect of the habitat and any consent granted in respect of the land would need to be consistent with the Plan of Management.

As discussed, one koala was observed in the box-woodland of the Gara TSR during the 2005 field survey (refer **Figure 22**) and DECCW's NPWS Atlas records list another observation of koalas 2 kilometres to the west of the study area. However, no evidence of koala activity was found in the proposed landfill access route corridor. A recent ecological investigation by EA Systems in 2009 included an assessment in accordance with the requirements of *SEPP 44* and was aimed at identifying 'core' and 'potential' koala habitat. The survey recorded evidence of koala presence within the landfill footprint (scats and scratches), however no koalas were sighted.

Four tree species (yellow box, Blakely's red gum, apple-topped box, and narrow-leaved black peppermint) occurring on the study area are listed as secondary food tree species for koalas (NPWS, 2003). The Bendemeer white gum is also likely to be a secondary food source of koalas. These species occur mainly in the TSR, where the koala was sighted, although yellow box also occurs in the stringybark woodland. The New England stringybark is considered a supplementary food source.

Secondary koala food trees make up 58% of the total number of assessed trees in the box-gum woodland in the TSR, and the remaining 42% are supplementary koala feed trees. Thus the TSR is considered Secondary Habitat (Class A) according to *Appendix B: Categories of Koala Habitat of the NSW Koala Recovery Plan* (DECC, 2008), given that secondary food tree species alone comprise at last 50% of overstorey trees and primary koala food tree species are absent. Most of the trees (>95%) in the stringybark woodland within the landfill footprint are supplementary koala food tree species, and thus is likely to be Secondary Habitat (Class C).

The survey concluded that as the Project Site does not contain any primary food trees, it would not be considered core or potential koala habitat under *SEPP 44* (**Appendix E**).

8.8.10 Endangered Fauna Populations

The tusked frog population of the New England bioregion is listed as an endangered population under the *TSC Act*. Historically, tusked frogs were located throughout the New England Tableland. Despite substantial survey effort over the past decade, only three records of the tusked frog have been reported from this bioregion since 1976. Each of these was far from the study area and no evidence of tusked frog presence was detected during the site surveys. Consequently, the proposal is not likely to affect this population.

8.8.11 Migratory Species

The *EPBC Act* serves to protect migratory species that may not be listed as threatened but are protected under international conservation agreements (e.g. Japan-Australia Migratory Bird Agreement (JAMBA) and China-Australia Migratory Bird Agreement (CAMBA). Nine migratory and 13 marine species were recorded within 20 kilometres of the study area and, based on the habitat requirements of these species, six are considered to potentially occur on site. These are:

- White-throated Needletail.
- Regent Honeyeater.
- Fork-tailed Swift.

- White Egret.
- Cattle Egret.
- Rainbow Bee-eater.

A referral to the Commonwealth Minister of the Environment for impacts on migratory and threatened species was made and concluded that there would be no significant impacts on migratory species, if the proposed mitigation measures are adopted.

8.8.12 Key Threatening Processes

Knowledge of past, current and future threats occurring on a site provide information for the conservation management of threatened species. Several threatening processes listed under the *TSC* and *EPBC Acts* are relevant to the Project Site including:

- Clearing of native vegetation*.
- Loss of hollow bearing trees.
- Removal of dead wood and dead trees.
- Anthropogenic climate change*.
- Competition and grazing by the feral European rabbit*.
- Predation by the European red fox.
- Competition from feral honeybees.

* also listed under the *EPBC Act*

The disturbance history of the site indicates that a number of threatening processes have occurred in the past. Some of these processes currently occur on the subject site and include clearing of native vegetation, competition and grazing by the feral European rabbit, predation by the European red fox and removal of dead wood and dead trees.

Clearing of Native Vegetation

Clearing is defined as the destruction of a sufficient proportion of one or more strata (layers) of native vegetation resulting in a loss, or long-term modification, of the structure, composition and ecological function of a stand or stands. The definition of clearing does not preclude management activities to control exotic species, or native species growing outside their natural geographic range.

Clearing of any area of native vegetation, including areas less than two hectares in extent, may have significant impacts on biological diversity. Destruction of habitat is the major cause of loss of biological diversity. Clearing has been identified as a threat to a number of species, communities and populations listed under the *TSC Act* and could cause species, populations or ecological communities that are not threatened to become threatened.

Remnants of the EEC known as box-gum woodland are subject to varying degrees of threat that may jeopardise their viability. These threats include the following:

- Further clearing (for cropping, pasture improvement or other development).
- Deterioration of remnant condition (caused by firewood cutting, increased livestock grazing, weed invasion, inappropriate fire regimes, soil disturbance and increased nutrient loads).
- Degradation of the landscape in which remnants occur (including soil acidification, salinity, and loss of connectivity between remnants).

The proposed development would entail clearing of approximately 20 hectares of vegetation, including:

- 12.7 hectares of stringybark woodland. This community on the Project Site is in moderate condition and is currently subject to grazing, weed and pest impacts. This community has also been disturbed by extensive clearing of regrowth some 10 to 20 years ago.
- 6.5 hectares of grassland (including 3.3 hectares of degraded box-gum woodland). This community on the Project Site is in low to moderate condition and is currently subject to grazing impacts. The area proposed to be cleared has been partially cleared in the past for an access easement, prior to the realignment of the Waterfall Way.
- 0.6 hectares of box-gum woodland in the TSR, in an area where the woodland is already partly cleared and open.
- 0.5 hectares of sedgeland.
- Two small dams would also be removed.

Loss of Hollow-Bearing Trees

Hollow-bearing trees provide habitat and nesting sites to several species of fauna. Hollows usually occur in old eucalyptus trees in which the more aged the tree, the greater the presence, abundance and size of hollows. The density of hollow-bearing trees required to sustain viable populations is controlled by factors such as the diversity of competing fauna species, population densities and the number of hollows with suitable characteristics.

Few hollows occur within the stringybark woodland at the Project Site with stumps and piles of dead timber providing most of the hollows for some species. Within the box-gum woodland in the TSR however, an abundance of hollows occur. Some of the hollows lost during construction would be relocated to the offset area for use by birds, bats and arboreal mammals. Given the abundance of hollows in the TSR, a substantial shortage is not anticipated as a result of construction.

Removal of Dead Wood and Dead Trees

The “removal of dead wood and dead trees” includes:

- The removal of forest and woodland waste left after timber harvesting.
- Collecting fallen timber for firewood.
- Burning on site.
- Mulching on site.
- The removal of fallen branches and litter as general tidying up.
- The removal of standing dead trees (stags).

Dead wood and dead trees provide essential habitat for a wide variety of native animals and are important to the functioning of many ecosystems. The removal of dead wood can have a range of environmental consequences, including the loss of habitat (as they often contain hollows used for shelter by animals), disruption of ecosystem process and soil erosion.

Dead trees and fallen logs (left in situ) in the TSR enhance the habitat value in the box-gum woodland community. Conversely, log piles in the stringybark woodland provide above-ground harbour for pests and weeds. Most of the timber in the large log piles has little contact with the soil surface. Such timber remains drier and takes longer to breakdown than logs lying on the ground. The relocation of large logs from these piles, placed flat on the ground, could enhance the habitat value of conservation restoration/revegetation areas elsewhere on the site.

Competition and Grazing by the Feral European Rabbit

Rabbits, *Oryctolagus cuniculus*, have spread over most of the southern two thirds of Australia and now occupy approximately 4.5 million km^2. Grazing and burrowing by rabbits can cause extensive erosion problems, reduce recruitment and survival of native plants and alter entire landscapes. Rabbits also threaten the survival of a number of native animal species by altering habitat, reducing native food sources, displacing small animals from burrows and attracting introduced predators such as foxes.

Large numbers of rabbits were observed using the numerous large log piles in the stringybark woodland. The soil in the southern section of the Project Site is shallow and it is likely that rabbits are unable to dig extensive burrows on this site. Ripping of warrens may not be effective in the stringybark woodland and therefore habitat modification may be more suitable for rabbit control. Removal of surface refuge greatly enhances the efficiency and effectiveness of control programmes and slows recolonisation (Williams et al 1995). This may be achieved through measures such as dismantling existing log piles and removing blackberry (*Rubus* spp.) thickets. The potential adverse impacts of feral animal control measures on native species and their habitats would be considered by utilising an integrated feral animal control and wildlife management approach.

Predation by the European Red Fox

Foxes are an adaptable and elusive predator common in rural and urban areas throughout southern Australia. They do not appear to favour any particular habitat and the main determinants of their population size and distribution appear to be food supply, disturbance of natural habitats and refuge availability.

Since their introduction into Australia in the 1870s, foxes have contributed to severe declines and extinctions of a suite of native fauna, particularly among medium-sized (450-5000 g) ground-dwelling and semi-arboreal mammals, ground-nesting birds and freshwater turtles. Recent experimental studies have shown that predation by foxes continues to threaten remnant populations of many of these species.

Foxes were observed in the stringybark woodland on the proposed landfill site. Two threatened ground foraging bird species (speckled warbler and diamond firetail) were observed in this habitat. The speckled warbler nests on the ground and so is at risk of predation by foxes. Log piles provide shelter for both rabbits and foxes. The large numbers of rabbits observed are likely to support large numbers of foxes on the site. The creation of a landfill facility is likely to increase the density of foxes in the region via the provision of a permanent, reliable, supplementary food source that is not affected by climatic conditions.

8.8.13 Recovery Actions

DECCW has formulated a Priority Action Statement (PAS) that addresses the requirements for the recovery of threatened species listed under the *TSC Act*. A number of priority actions have been identified to help recover the threatened species known or potentially likely to occur in the study area, as described in **Appendix H**. These have been incorporated into the mitigation measures identified in **Section 8.8.16**.

Recommended recovery actions have been developed for the:

- Box-Gum Woodland.
- Eastern Bent-wing Bat.
- Little Eagle.
- Little Lorikeet.
- Speckled Warbler, Varied Sittella, Scarlet Robin.
- Diamond Firetail Finch.
- Koala.
- Narrow-leaved Black Peppermint.

8.8.14 World Heritage Values

The Oxley Wild Rivers National Park lies approximately four kilometres south-south-east of the study area. It is listed on the Register of World Heritage Sites because it protects extensive areas of dry rainforest that harbour rich biodiversity including several threatened plants and animals. The park is part of the Gondwana Rainforests of Australia World Heritage Area (GRAWHA). An action is likely to have a significant impact on a World Heritage Area if:

- It modifies or inhibits ecological processes of the site.
- Reduces the diversity or composition of plant or animal communities.
- Fragments, isolates or damages habitat important to biological diversity conservation.
- Causes a long term reduction in rare, endemic or unique plant or animal species or populations.
- Fragments, isolates or damages habitat of such species.

The Assessment of Significance for the proposed development considered known or potentially occurring species within 20 kilometres of the study area. This extensive area includes portions of the World Heritage Area. No specific impacts on threatened species or EEC are considered likely if the proposed compensatory habitat is provided and feral animals are reduced in abundance on the site (**Appendix E**).

8.8.15 Potential Impacts

Potential impacts of the proposal on native flora and fauna were considered in relation to direct and indirect impacts; the sensitivity of the environment; and the nature, extent, frequency, duration and timing of their effects. Apart from continuing agricultural practices in the locality, it is unlikely that there would be other developments, activities or actions that could contribute to cumulative impacts during the operational lifetime of the proposed landfill facility as the Project Site is 12 kilometres from urban development and is in a rural zone.

Habitat Loss and Vegetation Clearing

Impacts to biodiversity resulting from the proposed landfill facility could span timescales that are at least inter-generational, if not permanent. The losses that would occur at the Project Site could also contribute to the already significant level of cumulative loss that has occurred at a regional scale on the New England Tablelands (DEC, 2006).

The proposal would involve clearing which would result in a reduction in the area of woodland and grassland habitat that supports native flora and fauna. Some hollow-bearing trees may be lost in the box-gum woodland in the TSR and stringybark woodland.

Fire

Uncontrolled bushfire may result in temporary loss of habitat and thereby affect the viability of local populations of threatened species and the EEC occurring on the site.

Fragmentation, Edge Effects and Reduced Connectivity

Clearing of parts of the box-gum woodland in the TSR and parts of the stringybark woodland may contribute to fragmentation of woodland habitat in the region with associated edge effects and reduced connectivity.

Weeds

The potential introduction and spread of weeds from the proposed landfill may contribute to the loss of biodiversity through competition from aggressive weed species, provision of food resources and harbour for pest species. Woody weeds with fleshy fruit such as hawthorn, pyracantha and blackberry would encourage fruit eating birds that spread seeds that may damage crops in the nearby olive grove on Strathaven (700 metres to the west of the site) and to the Oxley Wild Rivers National Park (4 kilometres to the south east).

Any potential for the spread of weeds from the landfill site could be associated with soil disturbance and earthworks during the construction and rehabilitation phases of the proposed landfill.

Pest Animals

The potential spread of pest species such as rabbits, foxes, rodents, cats, starlings, crows, flies, fruit-flies and cockroaches from the Project Site could contribute to the loss of biodiversity through competition for resources, direct predation on native fauna or damage agricultural production (such as the olive grove located 700m west of the site).

Disease

The potential spread of animal or plant disease from the proposed landfill facility may contribute to the loss of biodiversity or agricultural productivity, for example, exotic animal diseases like foot and mouth or soil borne plant pathogens which may affect olive trees on surrounding properties.

Increased Abundance of Undesirable Native Species

An increase in aggressive native birds such as pied currawongs, magpies and noisy miners, and carrion eaters such as crows and Australian ravens, that may be displaced by the clearing activities for the landfill facility or that may be attracted to the site during the operation of the proposed landfill facility could impact on less aggressive native birds.

Traffic

Inappropriate traffic speeds on site access roads may increase the risk of collisions with wildlife and also contribute to dust and noise levels.

Dust

Excessive dust may lodge onto plants and reduce photosynthesis and respiration, thereby affecting plant health and carbon sequestration.

Noise

Excessive noise may disturb native fauna and disrupt their feeding and breeding.

Erosion and Sedimentation

Erosion and sedimentation from earthworks in the construction phase may result in loss of top soil or changed drainage conditions thereby affecting vegetation health.

Pollution, Litter and Illegal Dumping

Uncontained litter, such as plastic bags, can be hazardous to wildlife. The Gara TSR at the entrance to the Project Site is vulnerable to illegal dumping which would be detrimental to the local environment and may significantly impact threatened flora and fauna in this EEC.

8.8.16 Mitigation Measures

Mitigation measures are proposed to avoid or ameliorate potential adverse impacts of the proposal on threatened biodiversity. Progressive rehabilitation of the Project Site would aim to recreate a landscape that is compatible with the surrounding land and comparable to pre-existing land use.

Habitat Loss

Habitat loss from the proposed landfill would be mitigated by implementing the following measures:

- Preparation and implementation of a VMP, including rehabilitation, landscaping and revegetation works to occur on the Project Site during construction, operation and post operation phases. This plan would provide actions designed to:
  - Minimise the extent of clearing: clearing should be undertaken in a staged process consistent with operational requirements.
  - Avoid clearing areas not immediately required for operational purposes.
  - Provide appropriate wildlife friendly fencing for regeneration and revegetation areas.
  - Undertake planting for landscaping and vegetated buffers using locally occurring native species. These areas would be established and planted as early as possible in the construction phase.
  - The maintenance of adequate ground cover on all parts of the landfill site not required for day-to-day operations.
  - Tubestock planting/direct seeding undertaken following autumn rains.
  - Progressive rehabilitation and revegetation of spent landfill areas. Spent cells within the proposed landfill footprint would be progressively rehabilitated to stabilise soils.
  - Revegetation along fringes of proposed water storages (sedimentation basin and leachate pond) to encourage use by native mammal, reptile, amphibian and bird species.

- On-going monitoring of the condition of native vegetation in areas likely to be impacted by the proposed development including revegetated areas such as pit rehabilitation works, landscaping, vegetated buffers and other native vegetation communities occurring on the Project Site.
- Application of assisted rehabilitation (selected replanting of shrubs and seeding if feasible), if understorey response is minimal, especially in treeless areas.
- Ongoing monitoring and follow-up control of weeds and pests that establish on disturbed areas, with particular attention to the eradication of noxious weeds and pests, such as rabbits and foxes.

Offsetting is a means by which the biological shortfall between a rehabilitated (stabilised) landscape and a pre-disturbance landscape can be narrowed. It is proposed to set aside an area of stringybark woodland and native grassland adjacent to the proposed landfill footprint at a ratio of 3:1 to offset the area lost to development. That is, the stringybark woodland and native grassland offset areas would be three times that proposed to be cleared for the proposed landfill. Management of the offset area would be adaptive and reviewed every five years. The Biodiversity Offset Management Plan proposed for the development is detailed in **Appendix H** and discussed further in **Section 8.8.17**.

Actions to be implemented as part of the Biodiversity Offset Management Plan would include:

- Appropriate wildlife friendly fencing.
- Revegetation to fill gaps.
- Managed beneficial clearing to thin dense regrowth in accordance with DECCW guidelines for thinning regrowth (**Appendix H**).
- Relocation of logs.
- Weed and pest animal control.
- Ongoing maintenance and monitoring.

These actions would be implemented once the land is purchased to minimise ecological risks from time lags.

Vegetation Clearing and Relocation of Log Piles

Measures to mitigate against the impacts of vegetation clearing and pile relocation include:

- A Vegetation Clearing Protocol and Native Fauna Management Plan which would include:
  - Pre-clearing collection of locally sourced seeds for direct seeding and/or propagation of tubestock.
  - Minimise the extent of clearing with clearing to occur in a staged manner consistent with operational requirements.
  - Clearly mark areas occupied by *Eucalyptus nicholii* and *E. elliptica* prior to any clearing or construction works. A minimum buffer of at least 30 metres would be designated around these species and these areas are to be avoided during construction and operational phases.
  - Identify and, where possible, avoid clearing 'habitat trees' that contain significant hollows likely to be used by native fauna (arboreal mammals, birds and bats).
  - Where possible, retain dead trees and logs on the Project Site that have not been pushed into piles.
  - Locate the access road for the proposed landfill facility in the existing partially cleared area in the western part of the Gara TSR to minimise clearing of the box-gum woodland EEC.
  - The Vegetation Clearing Protocol would form part of the VMP contained within the LEMP.
- A Native Fauna Management Plan which would:
  - Develop a protocol for responding to the detection of native fauna present in trees and log piles prior to clearing operations.
  - Restrict, where practical, tree clearing and log-pile relocation to late summer and autumn to avoid disturbing spring-breeding birds, including the Little Eagle and species that nest in hollows, as well as over-wintering bats.
  - Retain, if possible, the Little Eagle nest tree within the offset area. Should the tree be unable to be incorporated into the offset area, or in case the pair of Little Eagles abandon the current nest site during construction, a tree of similar age and size would be included in the offset area. Construction would approach the nest site gradually from a more distant starting point to minimise impacts.

Fire

Preparation and implementation of a Fire Management Plan for the landfill site as well as surrounding bushland. This plan would provide for:

- Monitoring of fuel loads.
- Fuel reduction such as slashing, controlled grazing, and controlled burning where appropriate.
- No hazard reduction burning in offset areas in line with DECCW's requirements for offset areas.

Fragmentation, Edge Effects and Reduced Connectivity

Measures to reduce the impact of fragmentation, edge effects and reduced connectivity would include:

- Design layout of landscaping, vegetated buffers and other revegetation works to enhance connectivity between patches of remnant vegetation.
- Progressively rehabilitate and revegetate successively cleared sections of the proposed landfill to minimise the impact of fragmentation of stringybark woodland.

Weeds

Measures to limit the impact of weeds would include:

- The preparation and implementation of a Weed Management Plan (WMP) for all stages of the proposal to minimise the spread of weeds within the proposed landfill site and to adjacent areas of native vegetation. The plan would provide actions to:
  - Control existing weed infestations (in particular, blackberry and hawthorn) on the site prior to commencement of the construction phase.
  - Ensure strict enforcement of wheel wash facilities for all vehicles entering or leaving the site to prevent inadvertent transport of weed seeds attached to mud and or other plant material adhering to underside of vehicles.
  - Provide targeted monitoring and control of invasive species that are harmful to threatened species and EEC and other potentially harmful weeds that may impact on potential habitat for these species. In particular, control and monitoring of invasive introduced grasses, such as Coolatai grass, African lovegrass, Serrated tussock, and Chilean needlegrass which may spread from the Waterfall Way and access route to the Project Site.
  - Minimise the abundance of introduced pests (e.g. European red foxes) on the proposed landfill site and stop them accessing adjacent land, as these are known to spread weeds.
  - Stockpile local topsoil and mulch during construction within the landfill footprint in areas already cleared of vegetation for use in landscaping and rehabilitation works.
  - Minimise the volume of imported topsoil to reduce the risk of introducing weed propagules.
  - Minimise use/impacts of herbicides.
  - Control drainage and run-off that may spread weed seeds or high levels of nutrients.

Pest Animals

Measures to reduce the impact from pest animals include the preparation and implementation of an appropriate Pest Management Plan for all stages of the development to minimise the spread of pests from the landfill site to adjacent areas. Management measures would include:

- Appropriate fencing around the landfill.
- Initial and continued poisoning (baiting) of rabbits, foxes and cats over the entire Project Site to reduce population densities to ultimate extinction.
- Following protocols to protect native fauna outlined in the Fauna Management Plan, undertake initial relocation of all the logs in the log piles that provide harbour for rabbits and foxes within the stringybark woodland in the southern section of the study area prior to commencement of construction works.
- Monitor and follow-up control of vertebrate and invertebrate pests (e.g. rabbits and foxes, flies and insect pests which can infest olives e.g., olive lace bug *Froggattia olivinia*, black olive scale *Saissetia oleae*). Given that the proposed biodiversity offset area would be fenced, it is unlikely that the Project Site would give rise to any larger animal impacts on neighbouring olive groves;

- Minimise exposure of waste to pest species by covering it in a timely manner (daily).
- Installation of a wheel wash for vehicles prior to exiting the proposed landfill facility.
- Employ professional exterminators if an outbreak is detected.
- Monitor and follow-up control of rabbits and foxes and other pests.

Disease Monitoring Protocol

Preparation of a Disease Monitoring Protocol and appropriate contingency plans to deal with outbreaks that may be detected at some point in time during the operation of the proposed landfill facility and for a nominal period of at least 5 years after rehabilitation works and decommissioning of the site. The Protocol would identify and monitor pests, diseases and natural enemies and provide management options on the basis of monitoring results.

In the unlikely event that infected material is brought on site, well maintained fencing would minimise the risk of diseases such as foot and mouth being transferred off-site by pest or feral animals.

There are currently few instances of olive tree diseases in Australia and those existing are controlled through either preventative or remedial measures. With respect to the olive grove on the adjacent Strathaven property, it is unlikely that the proposed landfill would give rise to nematodes and soil-borne fungi which may impact on the olive trees on the property given the mitigation measures identified in this section and the preparation and implementation of a Disease Monitoring Protocol (EA Systems 2010, **Appendix E**).

Shelter for Native Ovifauna

The proposal includes mitigation measures which would provide shelter for native birds vulnerable to some offensive native species including:

- The provision of areas for planting and rehabilitation using locally occurring native species particularly shrubs that will provide shelter for small native birds.
- Control of exotic shrubs (e.g. hawthorn, privet) which provide food for aggressive native species.

Traffic

Speed limits would be applied to the access road and internal perimeter road and would be low in the box-gum woodland where koalas may occur. Appropriate speed control signage would be constructed on roads associated with the proposed landfill facility.

Dust

Dust suppression measures would be incorporated into the final LEMP for all stages of the development.

Noise

A CNMP would provide measures to control noise emissions during construction. Noise abatement measures during operation would be detailed in the final LEMP (see **Section 8.7**).

Erosion and Sedimentation

An ESCP would be prepared as part of the final LEMP for all stages of the development (see **Section 8.1**).

Pollution, Litter and Illegal Dumping

The preparation and implementation of an appropriate Pollution and Litter Management Plan for the operation of the landfill would include:

- Placement of signage specifying no illegal dumping.
- Promotion of community awareness of the biodiversity value of Gara TSR, which has been identified as key habitat by the NPWS, by placing signage similar to “Significant Roadside Environment” at the entrance to the proposed landfill facility.

8.8.17 Offset Management Strategy

DECCW defines a biodiversity offset as:

> *one or more appropriate actions that are put in place to counterbalance specific impacts on biodiversity.*

The proposal would result in the loss of native vegetation and habitat and as such an appropriate offset (compensatory habitat) is proposed at a 3:1 ratio. The offset area would be contained within the Project Site and would enable direct and intensive management of the offset, minimising the disturbance and relocation distance for some older and hollow-bearing trees and associated habitats.

The proposed landfill facility would result in approximately 20 hectares of vegetation being cleared, including 12.7 hectares of regrowth stringybark woodland, 0.6 hectares of box-gum woodland in the TSR, 6.5 hectares of cleared grassland and 0.5 hectares of sedgeland. An offset area of approximately 61 hectares of land is proposed, comprising 40 hectares of stringybark woodland and 21 hectares of grassland. The stringybark woodland offset areas would be located in the southern part of the Project Site and would form part of an existing remnant of stringybark woodland. Offset grassland areas would be located in the northern part of the Project Site. The offset area is shown on **Figure 23** and the Biodiversity Offset Management Plan that would be implemented is detailed in **Appendix H**.

The proposed compensatory offset areas would surround the proposed landfill footprint and connect to the TSR (as shown on **Figure 23**). The development of a vegetation buffer along this corridor would improve the condition of vegetation at the site through increased connectivity to the Gara Remnant Subregional Corridor (refer Figure 2 of **Appendix H**). Rehabilitation of the site would also provide connectivity between remnant woodlands within the Project Site.

The offset area and Biodiversity Offset Management Plan have been prepared in accordance with the recommendations of the DECCW principles for biodiversity offsetting (refer **Appendix H**). Confirmation of the 3:1 offset ratio and accordance with the DECCW principles for offsetting was received from the then DECC in September 2008 (refer **Appendix A**).

The management approach for the proposed landfill offset area is outlined in the sections below and summarised in the SoC (**Section 9.3**).

N
Existing Stringybark woodland
Existing Sedgeland
Existing Grassland
Existing Wetland
Proposed Grassland Offset Area
Proposed Stringybark Woodland Offset Area
Project site
ARMIDALE DUMARESQ COUNCIL - ARMIDALE REGIONAL LANDFILL FACILITY
SIZE AND LOCATION OF OFFSET AREA
Source: EA Systems (2007), AECOM (2007)
0 75 150 300 m
FEB 2010
60011672
Fig 23

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Fencing and Removal of Livestock

Fencing would ensure removal of livestock from the offset area which would substantially improve vegetation, reduce soil compaction, improve soil water availability and enhance plant species richness. The offset area would be fenced and a cattle grid would be built into the access road to prevent cattle movement.

Rehabilitation and Revegetation

Following closure of the landfill, the site would be rehabilitated and revegetated with plant species consistent with the site's pre-existing condition. Revegetation works would include a two year maintenance period and weed control for at least a five year period post-usage of the landfill.

Rehabilitation of offset areas would include:

- Fencing to exclude livestock.
- Ground preparation activities including deep ripping to increase water infiltration and to allow greater root penetration.
- Planting of seeds and saplings (where available) from the site.
- Tree guards (where required) to protect young plants.
- Selected replanting to be undertaken if necessary if understorey regeneration is not satisfactory after one year.

Areas that are not immediately required for operational purposes would not be cleared until necessary, with cells 4 and 5 unlikely to be cleared for at least 30-40 years. Rehabilitation of the landfill footprint would include:

- Progressive rehabilitation of spent cells.
- Topsoil preparation and management (with top soil stored for up to 3 years).
- Planting of tube stock, direct seeding and natural regeneration.
- After one year the survival rates of plants would be assessed and dead plants replaced.
- Adaptive management depending on native flora and fauna response.

Vegetation buffers would be planted along the access road. Buffer planting would be designed to supplement existing native stands and enhance connectivity between patches of remnant vegetation, including the TSR. Native trees and shrubs would be planted to mimic the natural landscape. Planted buffer areas would be maintained for 24 months, with any losses being replaced.

Removal of Mature Trees

Removal of mature trees within the landfill footprint would be limited to the minimum necessary for safe construction. Prior to removal of hollow-bearing trees, hollows would be checked for nestlings and arboreal mammals. All fauna found would be relocated to the offset area.

Weed Control

The management of weeds would be undertaken as required under the *Noxious Weeds Act 1993*. Weed control would involve spot-spraying and thinning/slashing/pulling of noxious weeds where required, and would continue for up to 5 years after planting/seeding of offset areas and spent landfill cells. The following measures would be considered to prevent the spread of weeds:

- Wash down of vehicles in a dedicated area where runoff can be contained.
- Ensure all imported materials to the site are free of weed and disease.
- Avoid transport of topsoil.
- Monitor and control weeds following ground disturbance.
- Appropriate control of drainage and runoff.

Feral Animal Control

Reduction of rabbits through habitat modification would help to control fox and potential cat populations in the area. Other feral animal control measures include:

- The removal of log piles to reduce available harbour for these species.
- Covering waste in a timely manner to reduce exposure.

Relocation of Dead Wood and Dead Trees

Hollow-bearing trees and stags would be relocated to the offset area as logs or erected as stags (if feasible).

Enhancing Structural Complexity

Structural complexity is considered to be a measure of the presence and relative abundance of characteristics such as the number and type of flora species, foliage arrangement, canopy cover, tree diameter and height, tree spacing, understorey vegetation and deadwood. Structurally complex vegetation would support a greater diversity of species.

To re-establish structural complexity and layers of vegetation in the offset area, the following measures would be considered:

- Selecting a mixture of plant species for regrowth.
- Selecting plants that grow to different heights (including different sized trees, shrubs and groundcover species).
- Spacing trees and shrubs at irregular distances.
- Ensuring complex groundcover is provided (including fallen logs and debris).

Monitoring

On-going annual monitoring would include:

- Establishment of plots for ongoing vegetation monitoring.
- Monitoring vegetation regeneration (diversity assessment).
- Monitoring groundcover.
- Photo points.
- Reporting.
- Details of proposed monitoring are included in the Biodiversity Offset Management Plan (**Appendix H**).

8.8.18 Conclusions

The stringent controls to be implemented, the potential eradication of introduced species from the site and the inclusion of approximately 61 hectares of offset compensatory habitat would provide adequate mitigation to ensure there would be no net loss of biodiversity. With the proposed mitigation measures and Biodiversity Offset Management Plan, it is concluded that the proposal would have no long term significant impacts on biodiversity.

8.9 Socio-Economic

8.9.1 Existing Environment

Population

Armidale Dumaresq LGA has experienced moderate growth since the last population census in 2006, with a population increase of 1.6% between 2007-08. The estimated resident population at 30 June 2008 was in the order of 25,000 for the LGA.

Analysis of the age structure of the Armidale Dumaresq LGA in 2006 compared to the State shows Armidale has a relatively younger population than the NSW average with a higher percentage of the population aged under 24, and fewer adults aged over 25 compared with NSW (refer **Table 58**). The median age is significantly lower than NSW at 34 years of age compared to the NSW average of 37.

Table 58: Age Summary for Armidale Dumaresq LGA (2006 Census)

Characteristic	Armidale Dumaresq LGA		NSW Average	
	No. of persons	% of persons	No. of persons	% of persons
Infants (0-4)	1,364	5.8	420,434	6.4
Children (5-14)	3,294	14.1	878,483	13.4
Young Adults (15-24)	4,953	21.2	871,714	13.3
Adults (25-54)	8,371	35.8	2,753,218	42.0
Mature Adults (55-64)	2,399	10.3	719,551	11.0
Aged (65+)	2,988	12.8	905,778	13.8
Median age of persons	34		37	

Dwellings

Analysis of the housing tenure of the population of Armidale Dumaresq LGA in 2006 compared to the NSW State average shows that there was a larger proportion of households who owned their dwelling; a slightly smaller proportion purchasing their dwelling; and a larger proportion of renters, as shown in **Table 59** below.

Table 59: Dwelling (occupied) summary for Armidale Dumaresq LGA (2006 Census)

Characteristic	Armidale Dumaresq LGA		NSW Average	
	No. of persons	% of persons	No. of persons	% of persons
Owned	2,892	33.4	820,540	30.1
Purchasing	2,185	25.3	745,336	27.3
Renting	3,013	34.8	700,645	25.7
Other or Not Stated	558	6.4	203,920	7.5

Employment

Employment data from the ABS 2006 census is provided in **Table** 60 below. Data shows that employment rates vary for the majority of the Armidale Dumaresq LGA compared with the State, with differences in full time employment being lower in the Armidale Dumaresq LGA than in the State. Unemployment levels in the Armidale Dumaresq LGA are also significantly higher than NSW.

Table 60: Employment summary for Armidale Dumaresq LGA (2006 Census)

Employment Status	Armidale Dumaresq LGA		NSW	
	No. of persons	%	No. of persons	%
Full time	5,800	54.1	1,879,631	60.8
Part time	3,402	31.7	842,714	27.2
Employed Away*	400	3.7	103,522	3.3
Employed Not stated	235	2.2	83,576	2.7
Employed (total)	9,837	91.7	2,909,443	94.1
Unemployed (total)	889	8.3	183,157	5.9

* Persons employed but away from work

Economic Structure

The economic structure of the Armidale Dumaresq LGA is reasonably diverse with the highest employment being in the education and training sector (refer to **Table 61**).

Table 61: Employment Distribution (%) based on ABS 2006 Census

Sector	Armidale-Dumaresq LGA	NSW
Agriculture, forestry & fishing	5.3	2.70
Mining	0.24	0.70
Manufacturing	3.24	9.55
Electricity, gas, water & waste services	0.63	1.00
Construction	4.38	7.31
Wholesale trade	2.59	4.70
Retail trade	13.03	11.13
Accommodation & food services	8.69	6.55
Transport, postal & warehousing	1.94	5.00
Information media & telecommunications	1.3	2.37
Financial & insurance services	2.61	4.98
Rental, hiring & real estate services	1.12	1.74
Professional, scientific & technical services	5.99	7.33
Administrative & support services	1.78	3.11
Public administration & safety	6.16	6.01
Education & training	23.05	7.55
Health care & social assistance	12.3	10.46
Arts & recreation services	1.13	1.36
Other services	3.72	3.78
Not stated	0.8	2.65
Total	100	100

Income

Personal income data for the Armidale Dumaresq LGA is provided in **Table 62** and **Table 63** below demonstrates that approximately 50% of the population earn less than $600 per week. Weekly income data is slightly negatively skewed with few people earning greater than $1,600 a week. **Table 63** demonstrates that income in the area is generally lower than that of the NSW average. Median individual and median household income in the Armidale Dumaresq LGA is significantly lower than the State average, however, median family income is only slightly lower than the State average.

Table 62: Weekly personal income for Armidale Dumaresq LGA

Weekly Income	Number of persons	%
Negative/Nil income	85	0.83
$1-$149	600	5.84
$150-$249	671	6.53
$250-$399	1,221	11.88
$400-$599	1,981	19.28
$600-$799	1,829	17.8
$800-$999	1,166	11.35
$1,000-$1,299	1,136	11.05
$1,300-$1,599	788	7.67
$1,600-$1,999	350	3.4
$2,000 or more	346	3.37
Individual income not stated	104	1.0
Total	10,277	100

Table 63: Personal income data for Armidale Dumaresq LGA

Income	Armidale Dumaresq LGA	NSW
Median individual income ($/weekly)	384	461
Median household income ($/weekly)	855	1,036
Median family income ($/weekly)	1,105	1,181

8.9.2 Potential Impacts

Social

Community consultation has been undertaken during the preparation of the EA to identify the issues that are considered of concern to the local community (refer **Section 7.0**). For ease of identification and management of the community issues, they have been categorised into key issues. The key issues for the community are those issues associated with:

- Site Selection.
- Landfill Design and Operation.
- Litter and Indiscriminate Dumping.
- Transport and Traffic.
- Air Quality.
- Noise.
- Surface water, Groundwater and Hydrogeology.
- Ecology, Flora and Fauna.
- Community Consultation.

- Visual Impact Assessment.
- Tourism.
- Cultural Heritage.
- Land Use.

A list of the key issues identified, and how the EA addressed and assessed the issues, is summarised in **Section 7.0**.

Employment

The construction phase of the proposed landfill facility would employ up to 15 people. During operation of the proposed landfill, it is estimated that 2 people would be permanently employed on site, however there may also be other indirect employment opportunities including carrying out environmental monitoring of the proposed landfill, suppliers of goods and services and so on.

Economic Benefits and Gains

The proposed landfill facility would have a positive economic impact on the Armidale Dumaresq LGA particularly through the increase in efficiencies associated with the transport of waste to only one location. Efficiencies will also be achieved through the removal of the need for all Councils involved to seek alternatives at a distance and at greater cost to the community.

In the longer term the capping, rehabilitation and decommissioning of the proposed landfill would be sufficient to allow future land practices in accordance with local zoning, including rural uses such as grazing. The Project Site would be returned to its pre-existing landuse condition. The ongoing use would be determined in consultation with relevant stakeholders and agencies. Rehabilitation of the site would be progressive through the stages of the proposed landfill and would be monitored by the DECCW as part of the EPL for the site. It is not anticipated that the landfill footprint would be rendered sterilised.

Economic Costs and Disadvantages

Costs to develop the proposed landfill facility include the purchase of land and the construction costs associated with the development of an engineered landfill and associated facilities, including all nominated environmental controls.

There would be a direct impact on existing agricultural farming practices that are undertaken on the Project Site due to the acquisition of the land required for the proposed landfill. However, the current landowner would be compensated through the Council's purchase of the land.

There would be a direct impact on agricultural production at the Project Site resulting from the use of existing agricultural land for the proposed landfill facility and associated access road and infrastructure. The proposal includes the progressive rehabilitation of the land over the 50 year life of the landfill, with the ultimate aim of returning the landform to its pre-exiting condition. In the long term the impact on agricultural production on the landfill footprint is considered to be negligible. There would be a long term impact on agricultural production on the land proposed for the biodiversity offset area. It is proposed to rehabilitate and revegetate approximately 61 hectares of stringybark woodland, box-gum woodland, sedgeland, grassland and wetlands surrounding the landfill footprint, however this would offset the loss of habitat within the landfill footprint and provide important habitat and corridors for long term benefits to biological diversity.

There are potential environmental impacts should the landfill operator not have the financial means within which to carry out remediation and implement adequate environmental safeguards. Financial assurance of the landfill operators is an important aspect relating to the ongoing viability of landfill operations.

8.9.3 Mitigation Measures

Social

The key issues as identified by the community and government stakeholders during the consultation process are summarised in **Tables 7-4** and **7-5**. This EA discusses specific mitigation strategies for social impacts relating to visual (including amenity issues), transport and traffic, air quality, noise, surface water, groundwater, flora, fauna, heritage issues and land use impacts. The draft SoC contained in **Section 9.0** outlines mitigation measures that will be implemented during both construction and operation phases and demonstrates Council's commitment to the management of social and environmental impacts of the project.

The landfill footprint would be rehabilitated to its pre-existing agricultural land use therefore no further mitigation measures are required.

Economic

The issue of appropriate compensation is being negotiated between Council and the two land owners who are directly impacted by the land acquisition requirements for the Project Site. Any future impacts relating to agricultural practices on the neighbouring properties, including loss of livestock through predation from introduced predators and crop damage by introduced pests, would be monitored for the life of the project. It is considered that the stringent daily controls on the management of potential vermin and pests would contain potential impacts.

8.10 Indigenous Heritage

Archaeological Surveys and Reports (ASR) was commissioned to undertake an archaeological assessment for the Project Site in 2006. Initial field investigations were undertaken in May 2006 by ASR with appropriate representation from the local Aboriginal community, the Anaiwan Aboriginal Traditional Owners Resource and Cultural Heritage Management Association Incorporation (Anaiwan Aboriginal Traditional Owners). The study sought to identify any Aboriginal sites and/or relics that might be present. The results of the investigation were presented in an initial report by ASR in 2006. Further consultation was also conducted by ASR in order to comply with the requirements of DECCW's *Guidelines For Aboriginal Cultural Heritage Impact Assessment and Community Consultation* document, as required in the revised (2008) DGRs (refer **Appendix A**). This most recent requirement stipulates that "all interested Aboriginal stakeholders" should be appropriately consulted and informed of the proposed development.

Further advertising and consultation with the interested Aboriginal stakeholders was undertaken by ASR in accordance with the requirements of the DECCW guidelines. ASR's initial (2006) report has now been appropriately updated and the final report entitled The *Archaeological Investigation for Sites of Indigenous Cultural Significance for Part 3A Approval – New England Regional Landfill – Waterfall Way, east of Armidale, Northern Tablelands, NSW* (March, 2009) is presented in **Appendix R** and its findings summarised below.

8.10.1 Existing Environment

Environmental Context

The Project Site lies within a landscape of rolling hills generally bisected by drainage depressions. Some ridges are marked by reef-like exposures of meta-sedimentary rock, particularly those at the northern end of the local area. Surface exposures along the drainage lines also exhibit weathered, almost stoneless sedimentary soils. Most slopes retain a surface layer or A-Horizon of weathered coarse, sandy pasture soils formed on the surface of the Armidale beds.

The Project Site lies less than four kilometres to the north of the Gara Gorge on the eastern escarpment of the Northern Tablelands, a complex landform unit within NSW's Great Dividing Range. The Project Site would be within one of several drainage depressions that form the catchment to an unnamed creek that drains to the north-east and then to the east, ultimately flowing into the Gara River, about two kilometres to the north-east of the survey area. In pre-colonial times, clean, drinkable water would have been available from the Gara River to the local Aboriginal inhabitants and it is therefore considered unlikely that this area's potential for use by Aboriginal people, at that time, would have been limited by the lack of access to a reliable water source.

Aerial photography indicates that at least 60% of the area surrounding the Project Site has been cleared for agriculture. Much of the remaining 40% of tree covered land comprises eucalypt regrowth, or trees that are less than about 150 years old. Cattle grazing around these areas has since severely limited the re-growth of understorey species. It is considered that there would have been few reliable potential food resources in the area, however, typical of most, similar "New England" environments, there would have been potential for the presence of kangaroos, koalas, possums, bats, goannas, lace monitors, skinks and other lizards, snakes, turtles, birds and various edible insects. Other potential food resources would also have been available, like "sugarbag" (i.e. the honey of native bees) for example, but perhaps only opportunistically or infrequently.

No potential source of material that might have been suitable for knapping into stone tools or weapons was observed within the Project Site. If artefacts do exist at this location, it is considered most likely that these would have been imported from a lag deposit stone or outcropping meta-sedimentary formation from outside of the survey area.

Aboriginal Consultation

DECCW's *Guidelines for Consultation* require that all Indigenous heritage investigations be undertaken with an appropriately nominated Aboriginal community representative. In most instances this representative would be nominated by the LALC, however the office of the Armidale LALC had been closed for several months prior to and during the time of ASR's 2006 investigations. ASR was also unable to contact the past-Chairperson of the Armidale LALC at that time. Contact with the Armidale LALC was therefore not possible, however it was considered that the Anaiwan community was instead able to appropriately represent the local Aboriginal community. The Anaiwan Aboriginal Traditional Owners group was subsequently invited to assist with ASR's 2006 investigations, including the site inspection that was undertaken on 29th May 2006. During these investigations, ASR and the Anaiwan group's representatives discussed the proposed survey strategy, the potential for sites to be present and the results of the investigation. The recommendations that the Anaiwan group were most likely to make were also discussed with ASR. The Anaiwan representative agreed to provide ASR with a written statement of their recommendations, a copy of which is included in the appendices to ASR's report (refer **Appendix R**).

DECCW's *Guidelines for Consultation* require that Aboriginal stakeholders should be appropriately consulted and informed of the proposed development. Appropriate advertisements were therefore placed in the local print media, inviting all Aboriginal stakeholders with a potential interest in the project to register their interest within 14 days of publication the advertisement. Copies of the advertisements placed in The Armidale Express on 2 February 2009 and in The Armidale Independent on 4 February 2009 are also presented in the appendices to ASR's report (**Appendix R**).

Two responses to these advertisements were received, one from Nyakka Aboriginal Culture Heritage Corporation Archaeological & Cultural Heritage Consultants (Nyakka – the current name of the group formerly known as Anaiwan Aboriginal Traditional Owners group, referred to above) and another from an individual respondent. The Nyakka group and the individual respondent have both been formerly registered as stakeholders in this project. In February 2009, ASR contacted both respondents to enquire whether either party wished to participate in a stakeholder meeting to discuss the project further. Both parties have subsequently advised ASR that they regard the information already provided as satisfactory and that a formal meeting of stakeholders would not be required.

In February 2010, a representative on the Board of the reappointed Armidale LALC was contacted and informed of the proposal, consultation and site investigations that have taken place. Ongoing consultation with Aboriginal stakeholders will continue during detailed design of the proposed landfill facility. It is therefore considered that all the relevant requirements for Aboriginal Community consultation under DECCW's *Guidelines* document have been appropriately addressed.

AHIMS Site Register

For the purposes of its initial 2006 investigations, ASR undertook a search of the DECCW's Aboriginal Heritage Information Management System (AHIMS) Site Register to identify all previously registered sites within an area of 8km (west to east) by 10km (north to south) distance, centred on the location of the Project Site. Details are included in the Appendices of ASR's report, presented in **Appendix R**. Five sites were identified by this search (refer to Figure 1 within ASR's report). Two of the sites were isolated artefacts (TH/JA 4 and TH/JA 6), however one of these sites, TH/JA 4, located beside Billys Gully and less than three kilometres to the east the Project Site, contained 'at least 2,000 artefacts'. Another site, TH/JA 3, contained 26 artefacts and is located less than 350m to the west of the proposed road corridor, on a knoll overlooking a confluence of two tributaries of the catchment area of the Project Site. It has been estimated that the TH/JA 3 site probably contained at least 500 artefacts, of which 26 have been identified and documented. The vast majority of all the artefacts recorded in all five previously registered AHIMS sites consisted of silcrete. The remainder are from various silicified meta-sedimentary rocks, such as greywacke, for example.

Of the five previously registered sites within 8 to 10km of the Project Site, none are within the immediate vicinity.

Site Survey

A predictive model was developed for the survey area, to assist with development of the survey strategy. The predictive model considers several factors that are likely to affect where Aboriginal people are most likely to have lived, worked or travelled, i.e. where they may have left evidence of their activities. The model also predicts the degree to which evidence might be observable within the present record (on site) (refer **Appendix R**).

It should be noted that within the Project Site there are no stone resources that are considered suitable for knapping material, no mature trees, no reliable water source, no particular food resources, overhangs or shelters and no exposed rock surfaces. The modelling work conducted therefore considers that the following is most likely for this site:

- Isolated artefacts may be present and visible in erosion features.
- Low-density artefact scatters may be present and visible in erosion features, however it is unlikely that any debitage will be visible.
- There is very little potential for any scarred or carved trees to be present as there are few trees likely to be more than 150 years old.
- No shell middens are expected to be present.
- In the absence of any shelters it is not expected that there would be any art sites.
- There would be no surfaces exhibiting engravings or grinding grooves.
- There would be no intact occupation deposits.
- There would be no identifiable mythological sites in or near the Project Site.
- There would be stone quarries.
- There would be visible evidence of burials.
- There would be no surviving or visible Bora rings.
- There would be no stone arrangements.

The site survey undertaken by ASR on 29th May 2006 was assisted by a representative from the Anaiwan Aboriginal Traditional Owners group. The survey was undertaken on foot, in daylight that was considered ideal for observing artefactual material. A further site survey of the TSR area was undertaken on 22nd August 2006, again under suitable conditions. Site photographs taken during the surveys are included in ASR's report, *The Archaeological Investigation for Sites of Indigenous Cultural Significance for Part 3A Approval, New England Regional Landfill* (refer **Appendix R**). Two previously unidentified isolated artefacts were observed during the survey (**Figure 24**) and are described below.

GL ISO1 – Silcrete Flake Scraper

GL ISO1 is an isolated artefact consisting of a silcrete flake scraper measuring 62 x 52 x 24 millimetres. It was found in the southern section of the study area (refer **Figure 24**) in an erosion feature in open dry sclerophyll woodland of predominantly regrowth eucalypts with some casuarina trees. The woodland has been logged and felled timber has been heaped into unburnt piles. There is likely to be significant displacement of surface material, however the artefact depositional location was probably within a 20 metre radius of the find-spot. It is unlikely that this was a camp site. The artefact was probably dropped or left behind accidentally as it is still in a usable condition as a scraper.

GL ISO2 – Silcrete Flake

GL ISO2 is also an isolated artefact consisting of a silcrete flake. The artefact measures 31 x 46 x 15 millimetres and has a possible 'retouch' to both margins, however this could be a result of being trodden on by stock. A photograph of the artefact is presented in ASR's report (**Appendix R**). The artefact was identified within the southern eroded face of the creek bank within an area of cleared pasture, approximately 350 metres from a small, previously recorded camp site on the summit of a hillock overlooking the creek. It is not possible to say where the artefact was originally deposited because these creek bank deposits are likely to be both alluvial and colluvial in origin. The area has also been cleared of vegetation and subjected to stock grazing. If it is assumed that it has not travelled far from where it was originally deposited, then there is potential for other artefacts to exist along either bank of the creek. Finds would however likely consist of isolated artefacts and/or low density artefact scatters, neither of which would be visible. Owing to the likelihood that any artefacts would be sparsely distributed, ASR concluded that it would not be practical to undertake subsurface investigation.

AECOM

Biodiversity offset area
Landfill footprint
Leachate pond
Sedimentation basin
Dry basin
Indigenous heritage site

ARMIDALE DUMARESQ COUNCIL - ARMIDALE REGIONAL LANDFILL FACILITY
LOCATION OF TWO PREVIOUSLY UNIDENTIFIED INDIGENOUS HERITAGE ITEMS

FEB 2010
60011672

0 150 300 600 m

Fig. **24**

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8.10.2 Potential Impacts

Potential impacts of the construction and operation of the proposed landfill would be the disturbance or destruction of archaeological material or depositional contexts via earthworks required for site preparation, construction of the access road, during clearing of vegetation and/or landscaping of peripheral areas or from long term burial beneath the actual landfill mass.

It is reasonable to assume that if there is any artefactual material present within any affected areas of the site, this would most likely occur along the banks of the main creek and would consist of isolated artefacts and/or low density artefact scatters. Where present, these would be expected to be impacted during site clearance and/or other site disturbing activities. It is expected that any artefacts would be sparsely distributed and may be concealed within the sod layer, however it is not considered practical to undertake subsurface investigation in order to potentially recover only a very limited number of further artefacts. It is reasonable to assume, however, that appropriate monitoring of all earthworks conducted along the creek banks might yield additional artefactual material, especially in the vicinity of the artefact find.

It is considered that there is little potential for the Project Site to contain any significant archaeological material, even though the Project Site occurs in a region in which there are known to be places of Aboriginal association. The land is already considerably disturbed and there are few undisturbed contexts in which archaeological material may still occur. If present, such material is more likely to consist of small isolated artefacts or low density open scatters, none of which would be observed other than by chance.

8.10.3 Mitigation Measures

The two isolated artefact finds observed during the site survey were not identified during the initial design stages of the proposed landfill facility, however the overall footprint of both the proposed landfill and its access way have since been re-designed around the location of the two artefact sites. Therefore, it is not expected that these identified items would be impacted by the works.

An appropriate management strategy has been developed to further mitigate any potential for either of the sites to be damaged by activities associated with the construction and operation of the landfill facility. Key elements of the management strategy are discussed below.

Registering of Sites with DECCW

The two artefact sites identified during the archaeological site survey have been registered with DECCW on their AHIMS Site Register.

Stop Work Provisions

The *National Parks & Wildlife Act 1974* requires that “stop work” provisions need to be adhered to by construction teams and all other on-site employees. All employees and/or contractors would therefore be instructed that in the event that they should encounter or unearth any bone or stone artefacts, discrete distributions of shell or any other objects of potential cultural association during earthmoving or other activities, work should cease immediately in the area of that find. The on-site environmental officer would be contacted immediately and would then arrange for a qualified archaeologist to examine the find and advise on an appropriate course of action that would be undertaken prior to any further work being conducted within the vicinity of that location.

Monitoring During Certain Works

It is recommended that an appropriate representative of the Nyakka Aboriginal Culture Heritage Corporation Archaeological and Cultural Heritage Consultants be present during the following activities:

- Turf stripping.
- Clearing of piled timber.
- Removal of existing vegetation within wooded areas of the survey area.
- Any earthworks within 25 metres on either side of the main creek line that crosses the road corridor.

Long Term Protection

Both artefact sites identified during the archaeological site survey would be fenced to provide protection during both the construction and operation phases of the proposed development. Fencing would consist of a circle of vertical posts at a radius of 5 metres from artefact GL ISO1 and 10 metres from artefact GLISO2.

These barriers are intended for the protection of the site during both construction and operation of the landfill and would be in place prior to any such work commencing, where practical.

Indigenous Heritage Management Plan

An Indigenous Heritage Management Plan (IHMP) would be prepared to set out appropriate mitigation measures to protect the known sites and management actions that would be implemented during construction and operation in the unlikely event that further artefacts are encountered. Further consultation with Aboriginal stakeholders would be undertaken during detailed design and prior to construction commencing. Further mitigation measures required would be confirmed through ongoing consultation and development of the IHMP.

8.11 European Heritage

8.11.1 Existing Environment

Investigations into the non-indigenous heritage potential within approximately 500 metres surrounding the site were conducted by desk-top searches. The following registers, lists and documents were searched as part of this assessment:

- World Heritage List (DEWHA).
- National Heritage List (DEWHA).
- Register of the National Estate (Australian Heritage Council).
- State Heritage Register and Inventory (NSW Heritage Office).
- Dumaresq LEP No. 1 (As Amended) (Armidale Dumaresq Council).
- Draft Armidale Dumaresq LEP 2006, Schedule 2 (Armidale Dumaresq Council).
- National Trust Register (National Trust of Australia).
- Dumaresq Shire Heritage Study (EJE Town Planning, 1997).

No listed items were identified within 500 metres of the site. This is most likely due to the Project Site being used primarily for agricultural purposes, with low levels of development.

Travelling Stock Route

Access to the proposed landfill facility crosses a section of TSR dating from at least 1915, although more likely from 1884 when approximately 600,000 hectares of NSW land was set aside as Crown Land to walk stock between properties and to markets. RLPB rangers maintain and police the vast network of reserves, and permits are obtained from the RLPB for walking or grazing stock within the TSR network.

Although formalised as Crown Land during the late 19th Century, many of these routes would have originally been traditional Aboriginal tracks across dry country, linking rivers and scattered water resources such as waterholes and artesian springs (Pearson, 1999). As the requirements of the drovers were the same as the Aboriginal inhabitants – to follow water sources – these tracks were a logical location for stock routes. Eventually, roads (e.g. Waterfall Way) also followed the stock routes for the same reason.

Consultation with the RLPB and also the environmental division of the Department of Lands (Armidale office) was undertaken with the intention of establishing whether any of the TSR have non-indigenous heritage significance. Both the RLPB and Department of Lands advised that this was unlikely as they are not unusual or rare in any way and their greatest significance is usually as remnant vegetation, depending on how much clearing has been undertaken in the surrounds.

8.11.2 Potential Impacts

Although the TSR was established in the late 19th Century, it is considered that any potential significance associated with the TSR in this area is more likely associated with the remaining vegetation (in contrast to the clearing which has taken place in the surrounds), rather than any non-Indigenous heritage values. It is therefore considered that any impact to the non-indigenous heritage potential of the TSR as a result of the project would be negligible.

8.11.3 Mitigation Measures

As no listed items were found within 500 metres of the Project Site and potential impacts on the non-indigenous potential of the TSR are considered negligible, no mitigation measures have been recommended.

8.12 National Environmental Heritage (Oxley Wild Rivers National Park)

Oxley Wild Rivers National Park is part of the GRAWHA, a World Heritage Property protected under the *EPBC Act*. The Oxley Wild Rivers National Park is situated 4 kilometres from the Project Site. The Australian Heritage Database Statement of Significance describes how, in 1986 a number of rainforest reserves located along the great escarpment of eastern NSW, were inscribed on the World Heritage list for their outstanding natural universal values. These rainforest reserves are collectively known as the GRAWHA. Their acknowledged natural values are listed below:

- As an outstanding example representing major stages of the earth's evolutionary history.
- As an outstanding example representing significant ongoing geological processes and biological evolution.
- Containing important and significant habitats for the in-situ conservation of biological diversity.

Given the significance of the area, on 3 August 2007 details about the project were referred to the (former) Commonwealth DEWR (now DEWHA), with a request that a determination be made under the *EPBC Act* (refer **Section 6.2.1**).

DEWR subsequently declared the project to be a "controlled action" under the *EPBC Act*, as it was considered that the proposal has the potential to have a significant impact on the following:

- World Heritage Properties (pursuant to Sections 12 and 15A of the *EPBC Act*).
- National Heritage Places (pursuant to Sections 15B and 15C of the Act).

The proposed development therefore requires assessment under the *EPBC Act* (refer **Section 6.1.1**).

8.12.1 Potential Impacts

Community concerns have been noted regarding potential for pollution of the Gara River through leachate migration from the landfill, which if allowed to occur would then flow into the Oxley Wild Rivers National Park. The issues relating to possible surface and ground water migration are addressed in **Sections 8.3** and **8.4** of this EA. The possible pathways for contamination of the Gara River are via leachate or dirty water entering the unnamed creek to the north of the proposed landfill facility; or via a failure of the landfill liner leading to contamination of the groundwater and eventual discharge to the Gara River. Stringent environmental controls to manage dirty stormwater runoff, leachate containment and emergency storage would be implemented and would reduce the likelihood of impacts to surface and groundwater to negligible levels. Therefore, the impacts on the OWRNP and GRAWHA would be negligible.

8.12.2 Mitigation Measures

The Commonwealth listed issues to be addressed in a letter (August, 2009) including the ongoing integrity of the landfill's liner system and its ability to adequately address all potentially significant leachate migration problems. A Hydrogeological (Leachate) Assessment (AECOM, 2010) and comprehensive literature review were conducted to provide detailed and quantified information about the long term performance of the landfill liner. The full results of the Hydrogeological (Leachate) Assessment and literature review are presented in **Appendix I**.

In order to maximise the security of the liner, to minimise risk to the environment and to also provide a cost effective outcome for the local community, it is proposed that a liner compromising a clay layer in combination with an artificial liner such as a GCL or an HDPE layer (or other equivalent) would be used (refer **Section 5.2** and **Appendix B**).

A WLMP has been developed to ensure that both surface water and leachate are properly and effectively controlled and managed during the operational life of the landfill (**Appendix B**). The WLMP considers all aspects of the surface water and leachate storage at the Project Site, including design of a permanent leachate pond, sedimentation basin and dry basin. The detailed design of the landfill facility would ensure there would be no discharge of operational (i.e. leachate or dirty water) to the receiving environment and all leachate and dirty water up to the 100 year ARI event would be able to be stored on site. The WLMP is presented as an appendix to the LEMP, in **Appendix B**.

8.13 Land Use

8.13.1 Existing Environment

8.13.1.1 Surrounding Land Uses

Land use within a 1km radius of the Project Site includes:

- To the north is agricultural land used for grazing stock (sheep and cattle), the TSR and Waterfall Way.
- To the east land use is predominately agricultural with sheep and cattle grazing the dominate use. The Gara River and vegetated areas are further to the east beyond the Edington Property.
- Land to the south is agricultural, used for grazing sheep and cattle. The Gara Road and vegetated areas are also in this area.
- To the west lies Strathaven, which is estimated to be 7 hectares in area. The property is used for grazing stock (sheep and cattle) and contains an olive grove,.

8.13.1.2 Wider Area

Notable land use in the wider area include:

- Oxley Wild Rivers National Park which lies 4km to the south-east. The park is a World Heritage Area, managed by DECCW (NPWS) with gorges and waterfalls including Wollomombi, the highest waterfall in NSW. Cathedral Rock, Cunnawarra and Carrai National Parks are located to the east beyond OWRNP.
- The towns of Armidale and Uralla are approximately 12km west and 25km south-west of the proposed landfill facility respectively. Armidale has a population of around 25,000 and facilities include the New England Regional Art Museum and the University of New England. Uralla was established and developed after gold was discovered at Rocky River in 1851 and today has a population of 6,000 (ABS, 2006).
- The New England Highway is located just beyond Armidale and links the town of Hexham (just north of Newcastle) with Wallangarra on the NSW / Queensland border.

8.13.1.3 Agricultural Land Classification

As previously stated in **Section 1.6**, the majority of land within a 2km radius of the landfill footprint is classed as suitability Class 4 being 'land suited to grazing but not cultivation', including the land upon which the majority of the landfill footprint would be located. Vegetated areas situated within the landfill footprint are classified as Class 5, 'land not suited for agriculture or only light grazing'.

8.13.2 Potential Impacts

8.13.2.1 Travelling Stock Route

Although permission has been granted for the landfill access road through the TSR by the RLPB (refer **Section 8.11**), there remains the potential for land use impacts to occur. It is possible that stock travelling through the TSR may enter onto the property of Edington, which borders the TSR on the southern side and conversely, it is possible that stock on the Edington property may enter onto the TSR area. Currently, the TSR is fenced off to restrict stock access into this area.

Potential impacts relating to the introduction of pest species and existing habitats on the site are discussed in **Section 8.8**.

8.13.2.2 Agricultural Land Use

There would be impacts relating to a temporary change of use to proposed landfill as some 20 hectares of land would be required for the access road into the landfill facility, landscaping, amenities and haul roads around the landfill, surface water and leachate management and the landfill footprint itself. Land use within this area would be altered from its existing agricultural use to one that is associated with the operations of the proposed landfill for a period of approximately 50 years. The Project Site would, however, be progressively rehabilitated, over the 50 year life of the landfill, to its pre-existing land use condition. Therefore in the long term the temporary impact on agricultural land use would be negligible. There would be a long term impact on land use on the land proposed for the biodiversity offset area. It is proposed to rehabilitate approximately 61 hectares of stringybark woodland, box-gum woodland, sedgeland, grassland and wetlands surrounding the landfill footprint, however this would offset the loss of habitat required for the proposed landfill facility and would provide important habitat and corridors for the long term maintenance of biological diversity that would not occur if the proposed landfill facility were not to proceed.

8.13.3 Mitigation Measures

Travelling Stock Reserve

In order to prevent cattle movement onto the Project Site, a cattle grid would be built into the access road. The cattle grid would be located at the property boundary with the TSR. The existing fence located around the TSR and the Edington property boundary would be retained and maintained in the area adjacent to the access road.

There would be minimal impacts to the existing use of the TSR as the proposed access road intersects the TSR and stock would be permitted to move across the access road and continue along the route. The limited number of truck movements per day would also have negligible impacts relating to obstruction of the access road by moving cattle.

Where required, Council would liaise with the RLPB to ensure ongoing use of the TSR. Management measures to be implemented for flora and fauna species and habitats in the TSR are discussed in **Section 8.8**.

Agricultural Land Use

As noted above, there would be less agricultural land available in the local area as land would be required for the proposed development. However, works required to construct the proposed landfill and associated service infrastructure and compensatory habitat would be contained within the overall Project Site. Fencing would be provided around the Project Site to prevent stock from entering the landfill area or drinking from the surface water features on the site, particularly the leachate pond.

The boundary of the Project Site has been defined to limit impacts such as fragmentation of existing agricultural land practices. For example, the access road into the landfill development area has been aligned to run adjacent to the eastern boundary fence adjoining the property of Strathaven.

8.13.4 End Use

Following closure and rehabilitation of the proposed landfill, the land would be returned to its pre-existing land use condition to enable it to be used for agricultural purposes such as grazing activities. Landfill capping details would be confirmed during the detailed design and through operation of the landfill, and rehabilitation would be undertaken in stages, indicatively over ten year cell completions.

Land use of the 61 hectares surrounding the proposed landfill facility would change over time as the land is vegetated and forms part of the Biodiversity Offset Area, which would link up with the TSR and form part of a regional biodiversity corridor. This would provide important benefits to biodiversity in the long term.

8.14 Traffic and Transport

8.14.1 Existing Environment

Road Network

Major roads in the vicinity of the proposed development site include:

- Waterfall Way.
- New England Highway.
- Argyle-Mining Vale Road.

The local road network is shown in **Figure 25**.

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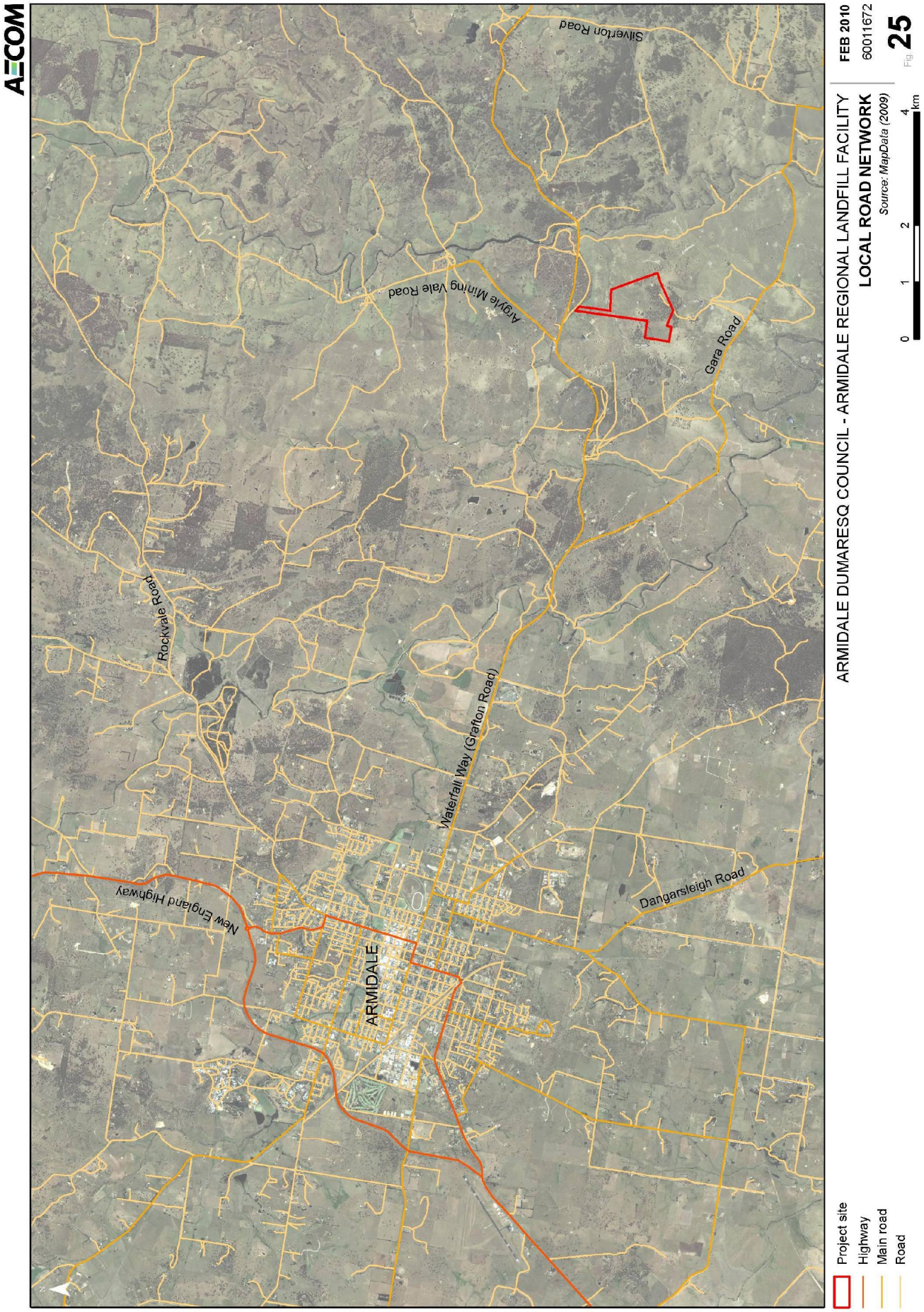
AECOM
Silverton Road
Aiyle Mining Vale Road
Gara Road
Rockvale Road
Waterfall Way (Grafton Road)
New England Highway
ARMIDALE
Dangarsleigh Road
ARMIDALE DUMARESQ COUNCIL - ARMIDALE REGIONAL LANDFILL FACILITY
LOCAL ROAD NETWORK
Source: MapData (2009)
0
1
2
4
km
FEB 2010
60011672
Fig 25
Project site
Highway
Main road
Road

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Waterfall Way

Waterfall Way (MR 76) is an arterial road that runs between Armidale in the west and Dorrigo / Pacific Highway in the east. It is typically a two-lane road with a speed limit of 100 km/h. Traffic volumes vary between 8,000 Annual Average Daily Traffic (AADT) at Bellingen to 2,000 AADT just east of Armidale. Site access to the Project Site will be via Waterfall Way.

New England Highway

The New England (SH9) Highway is a significant RTA arterial road connecting the Hunter Region to the New England area. The highway is a major route for heavy vehicle transport from Sydney to Brisbane and provides an alternative route to the Pacific Highway. The highway alignment 17km to 19km north of Armidale includes a series of sharp curves and crests in a rural environment and over the years has had a poor crash history. A realignment of the road has been planned in the future to improve road safety, reduce increasing maintenance costs and reduce vehicle operating costs and travel times.

Argyle-Mining Vale Road

Argyle-Mining Vale Road is a private, two lane, unsealed road that forms a priority T-Junction with Waterfall Way approximately 500 metres west of the Project Site. This road provides access to Mining Vale Shorthorns Farm which is a commercial cattle / beef operation.

Existing Traffic Volumes

Waterfall Way

The traffic volumes along Waterfall Way have been provided by the RTA permanent count station (92.394) located at Gara River approximately 25km west of Wollomombi and approximately 1 kilometre east of the study area as shown in **Figure 26**.

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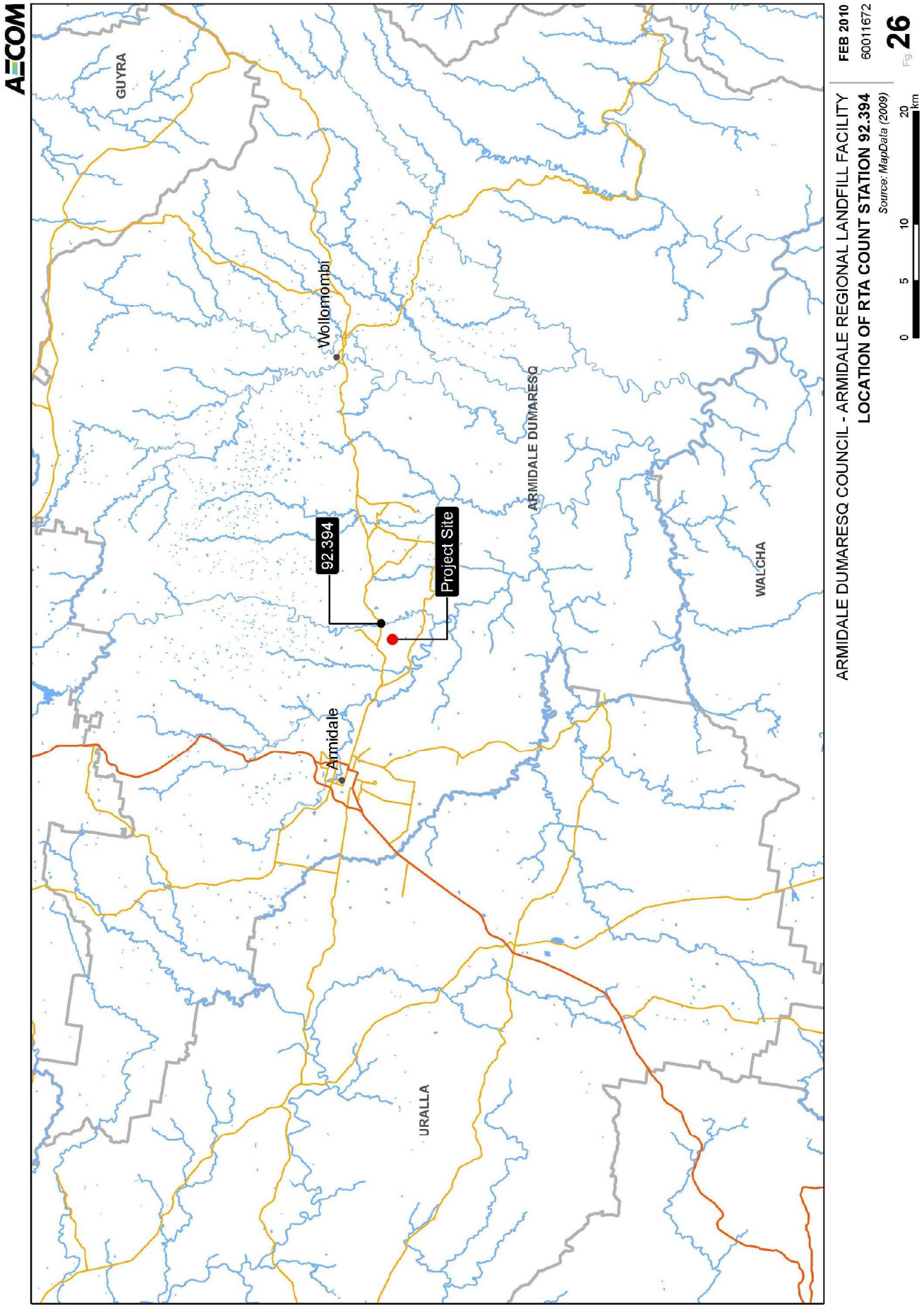
AECOM
GUYRA
Wollomombi
ARMIDALE DUMARESQ
92.394
Project Site
WALCHA
Armidale
URALLA
ARMIDALE DUMARESQ COUNCIL - ARMIDALE REGIONAL LANDFILL FACILITY
LOCATION OF RTA COUNT STATION 92.394
Source: MapData (2009)
0
5
10
20
km
FEB 2010
60011672
Fig 26

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The surveyed traffic counts from the RTA count station are two way flows collected for the year 2004 and are as shown in **Table 64**. It should be noted that the data from the RTA count station has been recorded as axle pairs, which records the number of axle pairs passing the count station, for example a typical car would be recorded as 1 axle pair, a truck with three axles as 1.5 axle pairs and a semi-trailer with six axles as 3 axle pairs. The traffic data reported in terms of axle pairs does not permit a direct comparison with traffic data recorded in vehicle numbers. For this reason a conversion factor of 1.3 has been adopted to covert the count data in axle pairs to vehicles.

Table 64: Waterfall Way Average Annual Traffic Flows, 2004

Traffic Flow Type	Axle Pairs	Vehicles[1]
Average Annual Daily Traffic (AADT)	1406	1082
Average Annual Weekday Traffic (AAWT)	1359	1045
Average Annual Weekend Traffic (AAWE)	1460	1123
Average Annual Public Holiday Traffic (AAPH)	2109	1622

Source: RTA Permanent Count Station 92.304

[1] AADT (axle pairs)/1.3 = AADT (vehicles). AADT sourced from RTA (2004)

Comparing the annual average daily flow by day of the week for the year 2004 indicates that the weekend traffic flows approximate mid-week flows, or total two way weekday flows (axle pairs per day) of between 1,296 and 1,678 (Monday to Friday) with 1,415 and 1,506 (Saturday and Sunday). Flows on a public holiday are the highest with an average flow of 2,109.

Figure 27 shows the variation in traffic flow on Waterfall Way, by hour of the day for an average weekday in August 2004.

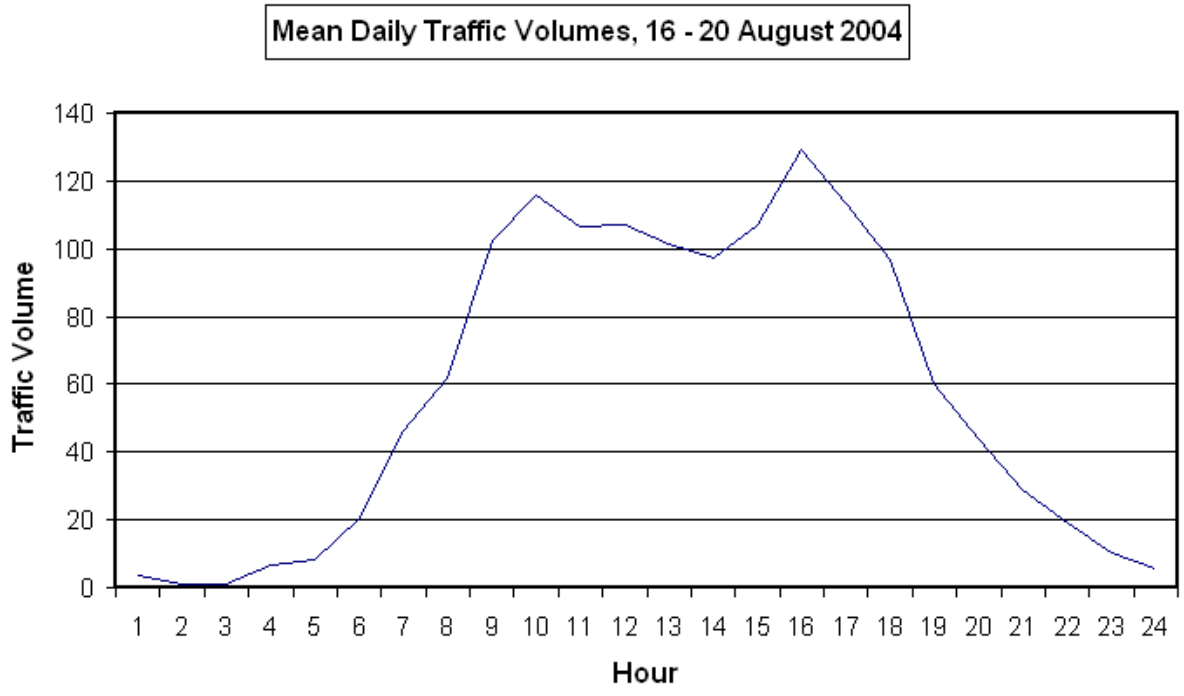

Figure 27: Waterfall Way – Variation in Average Weekday Traffic Flow (Two Way) by Hour of the Day, 2004

The hourly weekday distribution of traffic indicates that the AM peak is between 9-10 am representing 8% of the daily flow, while the PM peak hour is between 3-4 pm representing 9% of the daily flow. Therefore, in order to estimate the proportion of peak hour traffic flows to AADT for design purposes, it has been assumed that trips made during the peak hour represents 9% of the daily total. The peak hour flow on Waterfall Way based on the above average annual flows is shown in **Table 65**.

Table 65: Waterfall Way Average Annual Traffic Flows, 2004

Type	Axle Pairs	Vehicles
Average Annual Peak Hour Daily Traffic	127	97
Average Annual Peak Hour Weekday Traffic	122	94
Average Annual Peak Hour Weekend Traffic	131	101
Average Annual Peak Hour Public Holiday Traffic	190	146

Source: Maunsell AECOM

Note: AADT (axle pairs)/1.3 = AADT (vehicles). Design hour volume (two way) = 9% of AADT (vehicles).

Armidale Town Centre

Vehicles travelling to / from the Project Site will approach via the key roads within the Armidale Town Centre. The AADT on these key roads has been sourced from RTA traffic count data for the year 2004 as listed in **Table 66**. The peak hour traffic volumes have been estimated based on 9% of AADT flows occurring in the peak hour (similar to Waterfall Way discussed above).

Table 66: Traffic Flows along Key Roads within Armidale Town Centre

Road Name	RTA Counter	2004 AADT		Forecasted Peak Hour (9% of AADT)
		Axle Pair	Vehicles	
Glen Innes Road	92.399	3015	2319	209
Marsh Street	92.400	8398	6460	581
Barney Street (east of Marsh Street)	92.405	6179	4753	428
Grafton Road (east of Cooks Road)	92.406	2692	2071	186
Miller Street	92.409	3873	2979	268
Uralla Road	92.404	4823	3710	334
New England Highway	92.760	3573	2748	247

Source: Maunsell AECOM

Note: AADT (axle pairs)/1.3 = AADT (vehicles). AADT sourced from RTA 'Traffic Volume Data For Hunter and Northern Regions 2004'

Approximately 6% of traffic along Waterfall Way has been estimated to comprise of heavy vehicle movements based on Austroads classified traffic count data (provided by Council) for the year 2003.

The *RTA Guide to Traffic Generating Developments Version 2.2 (2002)* specifies that a two lane rural road, with a design speed of 100km/hr, 5-6% heavy vehicles, on rolling terrain and with a peak hour flow of 420 vph (60/40 directional split) should have an operational capacity of Level of Service B. Level of service B indicates that the operation of the road is good, with minor vehicle delays and spare capacity.

Based on the RTA traffic count data, Waterfall Way has an estimated average annual peak hour flow (two way) of approximately 97 vph which indicates that it is currently operating at a Level of Service A. Level of Service A indicates that the operation of the road is good, with minor vehicle delays and considerable spare capacity capable of accommodating future growth in traffic.

Key Haulage Routes

The existing key haulage routes within and surrounding the City of Armidale include:

- Barney Street.
- Waterfall Way.
- Uralla Road.
- Canambe Street.
- Grafton Road.
- Marsh Street.
- Glen Innes Road.
- New England Highway.
- Long Swamp Road.
- Kentucky Street.

Connection with the adjacent LGAs of Uralla and Guyra is via the New England Highway. Council advised in 2006 (email dated 26 June 2006) that strategic routes are suitable for accommodating heavy vehicle movements associated with the proposed landfill facility.

8.14.2 Potential Impacts

Potential impacts associated with development of the proposed landfill facility are expected to be related to changes in:

- Traffic flows.
- Traffic generation.
- Traffic distribution.

The Traffic Assessment has considered these potential impacts by developing models to predict potential traffic changes that may result in impacts. The analysis is provided below.

Traffic Flows

For the purpose of intersection design for the proposed landfill site access on Waterfall Way, a design year of 2028 has been adopted to provide indicative background traffic flows whilst the landfill facility is in full operation. This design year was assumed during earlier preliminary investigations (AECOM, 2007) which took into account a 20 year design from 2008 (which at the time was the assumed opening year). The landfill would be in full operation by 2028, therefore it is considered to still be an appropriate design year for assessment of impacts resulting from the operation of the proposed landfill facility. The forecast number of trips generated by the proposal would remain stable throughout the 50 year design life and it is only the baseflow that would change in the future.

Table 67 sets out the projected daily and peak hour traffic flows on Waterfall Way. A 2% per annum increase in AADT from the year 2001 to 2004 (RTA, 2004) was calculated from the RTA count station 92.374 located at Gara River. For the purposes of this assessment a 2% per annum regional growth was therefore applied to forecast the AADT on Waterfall Way for 2008 and 2028. The peak hour traffic volumes have been estimated based on 9% of AADT flows occurring in the peak hour and assuming the peak direction flow is 60%.

Table 67: Estimated Daily and Peak Hour Flows for the 2004, 2008 and 2028

Year	Annual Average Daily Volumes		Design Hour Traffic Volumes	
	(Axle Pairs)	(Vehicles)[1]	Two Way[2]	Peak Direction[3]
2004	1406[4]	1082	97	58
2008	1522	1171	105	63
2028	2261	1740	156	93

Source: Maunsell AECOM

[1] AADT (axle pairs)/1.3 = AADT (vehicles). [2] Design hour volume (two way) = 9% of AADT (vehicles).

[3] Peak Direction=60% [4] Year 2004 AADT from RTA permanent count station 92.374

It has been assumed that no committed developments are proposed adjacent to the proposed landfill site which would significantly increase the traffic volumes on Waterfall Way over the next 18 years. The peak hour flow in 2028 was estimated to be approximately 156vph which indicates that Waterfall Way in 2028 would continue operating at Level of Service A (that is, minor delays experienced with considerable spare capacity).

Traffic Generation

The forecast number of trips generated by the proposal is approximately 6 vehicle movements per day (one way), including:

- 3 waste (heavy) vehicles.
- 1 (heavy) vehicle transporting cover materials (if cover materials are to be transported from offsite).
- 2 staff (passenger) vehicles.
- The majority of vehicles to access / egress the site will be heavy vehicle types classified as Austroads Class 3 (two axle truck) to Class 9 (six axle articulated vehicle, that is, semi-trailer).

It should be noted that traffic generation for the purposes of this assessment is considered a worst-case scenario as it is considered unlikely that all vehicle movements would occur during the same day, or at the same time during the same day. Given that the amount of waste volumes to be directed to landfill is expected to decrease over time due to increasing recycling rates (refer to **Section 2.4**), traffic movements to the proposed landfill facility may decrease over time and thus potential impacts on traffic generation are considered acceptable.

Traffic Distribution

The proposed landfill facility would service primarily Armidale, Uralla, Walcha and Guyra LGAs, therefore all traffic would approach the Project Site from the west along Waterfall Way. As Waterfall Way currently has a Service Level A, it has sufficient capacity to accommodate the proposed landfill traffic with no significant decrease in level of service.

8.14.3 Mitigation Measures

Intersection Arrangement

Based on the low traffic volumes projected on Waterfall Way for the design year 2028 (approximately 1740 vpd [assuming 2% growth over 20 years], that is, 870 vpd per lane assuming a 50/50 split) and the low number of vehicles accessing / egressing the site per day (approximately 6), it is considered that a priority T-Junction intersection arrangement is the most suitable design to cater for the forecast vehicle movements accessing / egressing the Project Site.

To assist heavy vehicles to negotiate left in / left out turns, in particular in high speed areas, the following design requirements are recommended:

- Taper flares.
- Turn radius of 15m (15R).
- Kerb and channel around the left turn radius at the edge of the pavement.

Council is proposing to provide an auxiliary (right turn) passing lane at the proposed intersection of the Project Site and Waterfall Way. The intersection would be located in the vicinity of a crest (to the west) and horizontal curve (to the east), as well as being within a high speed limit along Waterfall Way (100 kph) and although the available sight distances and forecast traffic volumes do not currently warrant an auxiliary right turn lane, it is considered that a Type B (Austroads) right turn intersection configuration (refer **Figure 28**) should be employed to enhance safety and improve traffic flow, as regional growth along Waterfall Way increases over the next 15 to 25 years.

Left turn vehicle movements from the east have been assumed to be negligible as the key areas of attraction are from the west (Armidale, Uralla and Guyra). Additional infrastructure measures to improve safety for left turn vehicle movements are therefore not deemed to be necessary.

Key Haulage Routes

As there is likely to be a low number of heavy vehicles accessing / egressing the Project Site per day (approximately 4-6 heavy vehicles per day) and given the existing low traffic flows (on average 3577 AADT (vehicles) along the key roads identified within Armidale Town Centre, Waterfall Way and New England Highway, it is considered that the existing key haulage routes are adequate to cater for the low number of forecast heavy vehicle movements generated as a result of the proposed landfill facility.

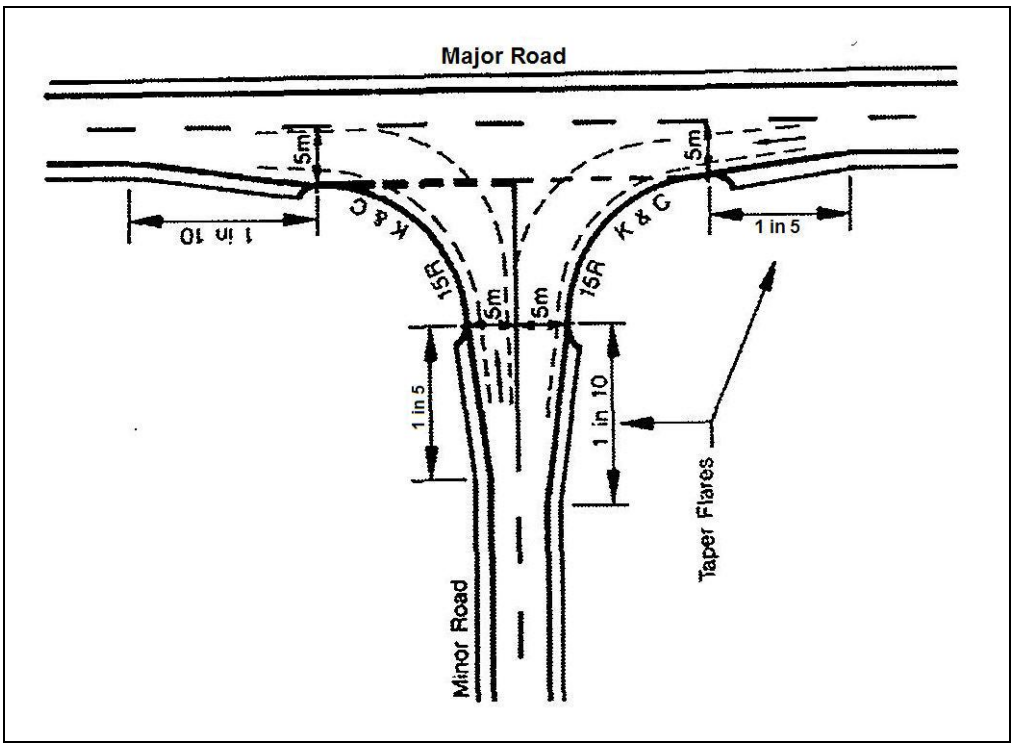

Figure 28: Austroads Type B Priority T-Junction Arrangement with Auxiliary Right Turn Lane

Source: Austroads, Part 5 Intersections at Grade

8.15 Hazards

8.15.1 Existing Environment

Potential hazards are considered those that may place the local community in danger, either through loss of life or property. For the purpose of identification and assessment of relevant hazards, receivers are considered to be residential dwellings and their occupants that are located within a 2 kilometre radius of the Project Site. The locations of all such receivers surrounding the proposed landfill are identified in **Figure 5**. Other receivers that may be impacted by hazards include the landfill operators, waste delivery truck operators and all other personnel involved in site management, as well as any non-routine visitors to the site.

8.15.2 Potential Impacts

Potential hazards may be expected to arise from either the operation of the proposed landfill facility or incidences around the landfill that may create a hazard. A hazard is usually an uncontrolled event and therefore it is assumed that additional, as-yet-identifiable hazards may arise throughout the landfill's operational life. For the purposes of this assessment, however, the following are considered to be the likely hazards that may potentially occur at the proposed landfill facility:

- Bushfire encroaching onto the site (the operational parts of the landfill facility should be considered to be a potential fuel source during any bushfire).
- Hazardous materials coming onto site.
- Vandalism of the landfill (deliberate lighting of fires at the landfill or destruction of fences or other property, for example).
- Explosions on site through methane build up or ignition of fuels.
- Natural hazards such as flooding or geological subsidence.

The potential impacts from the above hazards include:

- Damage to residential properties (and risk to life / health) around the proposed landfill facility.
- Increased risk of spread of fire from the landfill which would act as a fuel source should it be ignited.
- Damage to bushland, habitats and fauna.
- Potential impacts to soils and surface water features on the Project Site through hazardous materials or leaking fuels.
- Structural integrity of the landfill.

Bushfire-prone land has been mapped by Council, in consultation with the NSW RFS. No bush fire prone areas currently exist within 1km surrounding the Project Site and the site of the proposed landfill is generally clear of vegetation due to the rural land practices that are the dominant land use in the area. However, given the hazards described above and the proposed vegetation to be planted in the biodiversity offset area, bushfire impacts have been assessed and management measures have been identified.

SEPP 33 – Hazardous and Offensive Development

In determining whether a proposed development is potentially hazardous or offensive, the guideline document Applying *SEPP 33 - Hazardous and Offensive Development Application Guidelines* has been applied.

SEPP 33 defines a potentially hazardous and offensive industry as discussed in **Section 6.3.2**. The proposed landfill facility is not defined as an industry and therefore the provisions of *SEPP 33* and a PHA is not strictly required. However, in accordance with the guidelines, the risk screening methodology has been undertaken.

The risk screening methodology is based upon the class, quantity and location of all dangerous goods proposed to be brought on site as a result of the proposed development, as well as any potential impact that these goods may impose.

All dangerous goods that are expected to be received and/or stored on the site are listed in **Table 68**.

Table 68: Dangerous Goods Expected to be Received and/or Stored on the Site

Class Dangerous & Hazardous Goods	Description	Quantity
Class 1	Explosives	• None.
Class 2	Gases	• None.
Class 3	Flammable liquids	• Petrol – small quantities, up to 20 litres for use in landscape maintenance equipment such as whipper snippers. • Diesel – approximately 2000 litres for use in site vehicles.
Class 5	Oxidising agents and organic peroxides	• None, or possibly <5-litre containers of cleaning fluids.
Class 6	Poisonous (Toxic) and infectious substances	• Pesticides and herbicides (<5-litre containers).
Class 7	Radioactive substances	• None.
Class 8	Corrosive Substances	• <5-litre containers of cleaning / maintenance fluids, petrol, chemicals.
Class 9	Miscellaneous dangerous goods	• Small quantities of oil and water based paints, <20 litres per container. • Oils (Automotive) 5-20 litre containers.

Source: Maunsell AECOM

The proposed landfill facility is intended to receive solid waste only, originating from municipal (i.e. household rubbish), commercial and industrial sources. All mixed solid waste received at the proposed landfill facility would have firstly been subject to a resource recovery process conducted at the Armidale Waste Management Centre. No materials or discreet loads from private sources would be accepted at the proposed landfill.

It is possible that waste received at the proposed landfill facility may contain an insignificant fraction of potentially hazardous materials that have been collected from a typical household. These would usually be in the form of residual cleaning products. This percentage is extremely small, however, and well below the dangerous goods storage thresholds identified in the DoP screening method. Other potentially hazardous materials that may be brought onto the site would be related to cleaning and vehicle maintenance.

A quantity of up to about 2,000 litres of diesel fuel would be stored on site for use in on-site vehicles, such as loaders. This would be stored in a tank with associated fittings and pipelines designed to comply with Australian Standard AS1940:2004 (Storage and Handling of Flammable and Combustible Liquids). The tank would be contained within a bunded area which would not be linked to any other part of the site. In accordance with industry standards, this bund would have a capacity of 110% of the tank's capacity in order that any potential spill would be fully contained within the bund, without any risk of overflow.

Under *SEPP 33*, diesel is categorised as Class C1 Flammable Liquid. The tank for storage of diesel fuel would be contained within its own bund and would be kept entirely separate from other materials. The definitions that pertain to *SEPP 33* consider that diesel is not potentially hazardous.

The development is not potentially hazardous or offensive, according to the requirements of *SEPP 33* and a PHA is not required. However the proposed landfill facility would require an EPL as it is a scheduled activity under the *POEO Act*.

8.15.3 Mitigation Measures

It is considered that the proposed development would not pose a significant risk to human health or the biophysical environment, either during construction or operation. This is as a direct result of the adoption of sound design principles, in conjunction with the implementation of comprehensive measures that will ensure that neither hazardous nor offensive discharges from the development site would occur.

Mitigation measures relating to the management of potential hazards, as identified in the assessment, are addressed in the following sub-sections.

Hazardous Materials

Relevant Materials Safety Data Sheets (MSDS), spill containment and other safety equipment would be installed and maintained. This includes bunds around storage tanks, fire extinguishers and drains. All wastes arriving at the proposed landfill facility would be screened for hazardous materials prior to entering the landfill facility.

Vandalism

The proposed landfill facility will be securely fenced in order to protect from vandalism.

Explosions

Measures to avoid explosions include:

- Fire prevention practices around the landfill facility including:
  - Regular mowing of grassed areas surrounding site buildings.
  - Frequent covering of material delivered to the landfill.
  - Removal of escaped litter and rubbish.
  - Installation of fire fighting equipment on site.
- Controlled burning at the periphery of the site.
- Gas accumulation monitoring.
- Remediation of uncontrolled landfill gas emissions.

Natural Hazards

The potential for flooding and appropriate mitigation measures has been addressed in **Section 8.3.3** (Surface Water Management). A fault line investigation was undertaken to determine the presence of a reported fault line in and around the Project Site. These investigations are summarised in **Section 8.2** (Geology). The management of bushfire would include a Fire Management Plan for the Project site as well as surrounding bushland which would be prepared and implemented as part of the LEMP.

An appropriate Emergency Response Plan (ERP) or similar would be developed as part of the LEMP prior to construction. The ERP would provide management measures for identified hazards including natural hazards (refer **Section 9.2.5**).

8.16 Visual

The following identifies the visual impacts of the proposed landfill facility on residences in the immediate vicinity of the Project Site, as well as on several residences further away from the site (refer **Figure 29**).

8.16.1 Existing Environment

The regional terrain is typical of the New England Tablelands, visually characterised by a flat, plateau-like landscape that is both intermittently cleared and vegetated. The local landscape is predominantly cleared, pastoral land although significant areas of extant vegetation also exist around the local area, with sporadic, gently rolling, irregularly shaped hills and valleys that are commonly little more than 50 metres high.

The highest point of the proposed landfill facility is to the south. The site slopes gently northwards to an unnamed creek that flows to the east to the Gara River. To the south-east the terrain descends gradually and eventually meets the banks of the Gara River, approximately 1 kilometre east of the Project Site.

8.16.2 Methodology

Potential Views to the Site

Three dimensional (3D) visual representations of the various viewpoints considered in this assessment were prepared using Geographical Information Systems (GIS) software. All existing trees and known tree heights were included in these 3D representations and the final profile of the proposed landfill mass was also superimposed onto each (refer **Figures 30** to **35**). That is, in order to highlight the potential for visual intrusion into each of the subject viewpoints, the final profile of the landfill mass has been coloured red / orange on these visual representations to provide an exaggerated indication of how the proposed landfill facility may affect existing views. It should be noted, however, that the visible surface of the final landfill mass would be landscaped, re-vegetated and profiled and would effectively match colours and visual textures of the surrounding, undeveloped landscapes. The visual appearance of the operational phases of the landfill development would vary over time, however these phases would not appear as visually intrusive as the red / orange 3D representations of the landfill mass presented in **Figures 30** to **35**.

Visual Analysis

The 3D visual representations were used to identify and assess the visual impacts of the proposed landfill facility from affected residential properties. In order to measure the potential impact on each view to the proposed landfill site, the following desirable outcomes were used to determine the potential impact for each possible viewpoint. The desirable outcomes are as follows:

1) The construction phase of the development should not cause any significant visual impacts.
2) The appearance of the development should not detract from the visual amenity of any publically accessible viewpoint (i.e. from Waterfall Way).

Each of the potentially affected viewpoints to the proposed landfill facility has been assessed against these desirable outcomes.

8.16.3 Potential Visual Impacts

The landscape of the Project Site would be progressively altered during both construction and operation of the proposed landfill facility.

Construction

Visual impacts associated with construction would result from vegetation clearing and construction activities.

Vegetation clearing - Progressive clearing of vegetation would be required during all five stages of landfill cell construction, thereby altering the visual character of the local landscape and impacting on the effectiveness of existing visual (i.e. vegetation) buffers surrounding the site. As the proposed landfill facility is located within a sparsely vegetated, undulating landscape, it is not considered that the limited amount of vegetation clearing proposed would significantly alter the visual quality of the overall landscape.

Construction related activities - Construction works would include excavation, pond/basin construction, road construction, erection of the amenities building and movement of construction plant such as dozers and excavators. Exposed works areas and heavy vehicle movements would impact on the local landscape and visual character of the Project Site. These impacts would occur in the short to medium term but would be temporary, therefore no impacts to landscape and visual amenity are anticipated in the long term as a result of construction activities.

Operation

Visual impacts associated with operation of the proposed landfill facility would result from operational landfilling activities and rehabilitation of the Project Site.

Operational landfilling activities –The proposed landfill operations would give rise to works areas and waste materials at the landfill face, stockpiling of cover materials and movement of heavy vehicles around the site. These impacts would occur progressively over the life of the landfill. In addition, existing mature vegetation surrounding the Project Site would provide some level of visual screening from certain vantage points.

Rehabilitation of the Project Site – The proposed landfill footprint would be progressively rehabilitated as each cell is filled, capped and revegetated over the 50 year life of the proposed landfill facility. There would also be extensive rehabilitation (including revegetation) of the areas surrounding the landfill footprint as part of the proposed biodiversity offset area. The revegetation would alter long distance views across the site, however once mature the vegetation would provide additional screening of the proposed landfilling operational activities.

The following viewpoints (refer **Figure 29**) were considered in the assessment of the visual impacts of the proposed landfill mass on the landscape:

- The view from Receiver 1, Strathaven (1060 Waterfall Way), approximately 950 metres west of the Project Site.
- The view from Receiver 2, Sherraloy (600 Gara Road), approximately 410m south of the Project Site.
- The view from Receiver 3, Riverton (1352 Waterfall Way), approximately 1.9 kilometres east of the Project Site.
- The view from Receiver 4, approximately 1.5 kilometres north of the Project Site.
- The view from Receiver 5, approximately 1.4 kilometres north of the Project Site.
- The view from Receiver 6, approximately 1.9 kilometres northwest of the Project Site.

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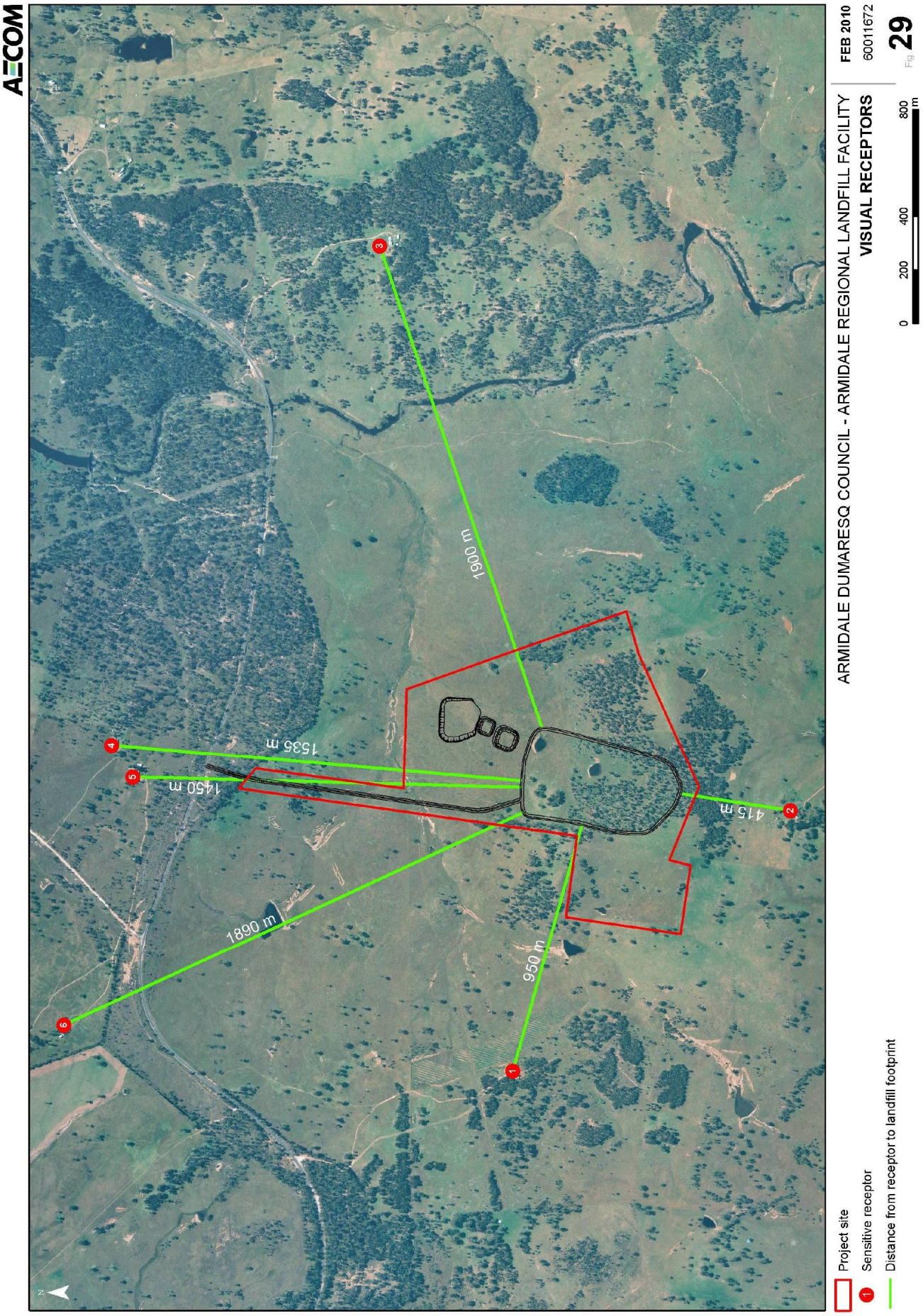
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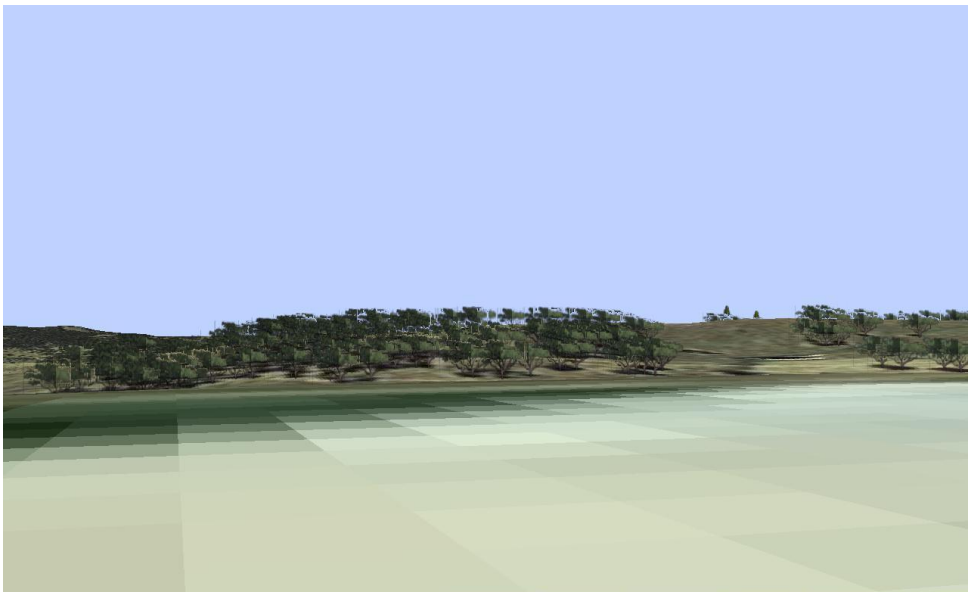

Figure 30: View from Receiver 1 - Strathaven

Strathaven (1060 Waterfall Way) is located approximately 950 metres west of the proposed site. The view from the location of the residence at this property of the proposed landfill mass is effectively masked by existing landforms. No specific mitigation measures would be required with respect to potential visual impacts on this residence.

Figure 31: View from Receiver 2 - Sherraloy

Sherraloy (600 Gara Road) is located approximately 410 metres south of the proposed site. The view of the proposed landfill mass from the residence at this property is considered to be reasonably significant but would also be partially masked by existing vegetation.

As part of the proposal, a biodiversity offset area would be provided comprising stringybark woodland, grassland, box-gum woodland, sedgeland and wetland. The areas of offset to the south of the landfill mass would comprise predominantly stringybark woodland, which when mature would provide considerable screening of the landfill site from Sherraloy.

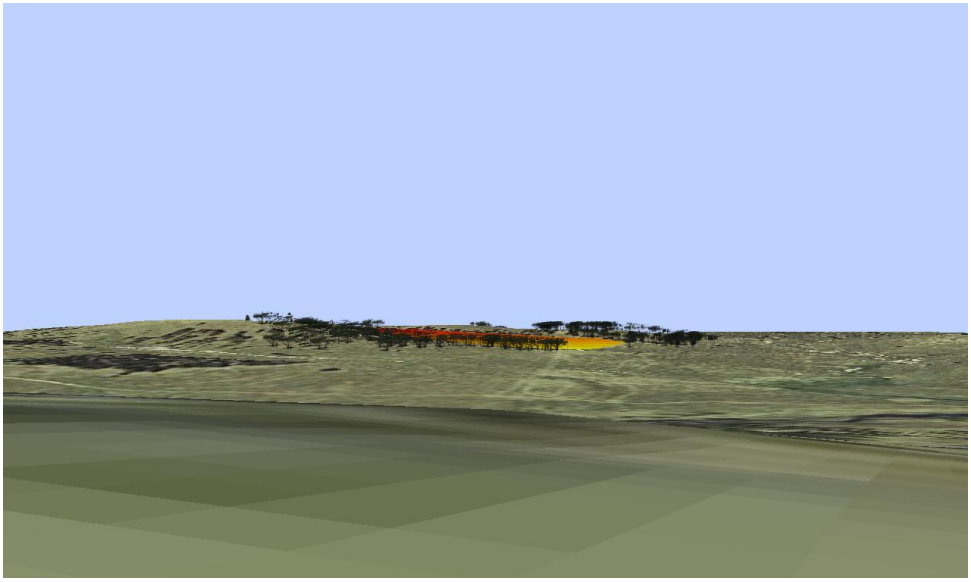

Figure 32: View from Receiver 3 - Riverton

Riverton (1352 Waterfall Way) is located approximately 1.9 kilometres east of the proposed site. The view of the proposed landfill mass from the residence at this property is also considered to be reasonably significant but would be partially masked by existing vegetation. The visual impact would be present for the duration of the proposed landfill life as the receiver has views across the whole site, albeit partially obstructed by existing vegetation that would be retained. In addition, additional woodland provided as part of the biodiversity offset area would, when mature, provide additional screening of the landfill mass.

Views of the leachate pond, sedimentation basin and dry basin would be partially screened by existing vegetation, however the size and form of the basins would be similar to farm dams which are common in the surrounding agricultural landscape.

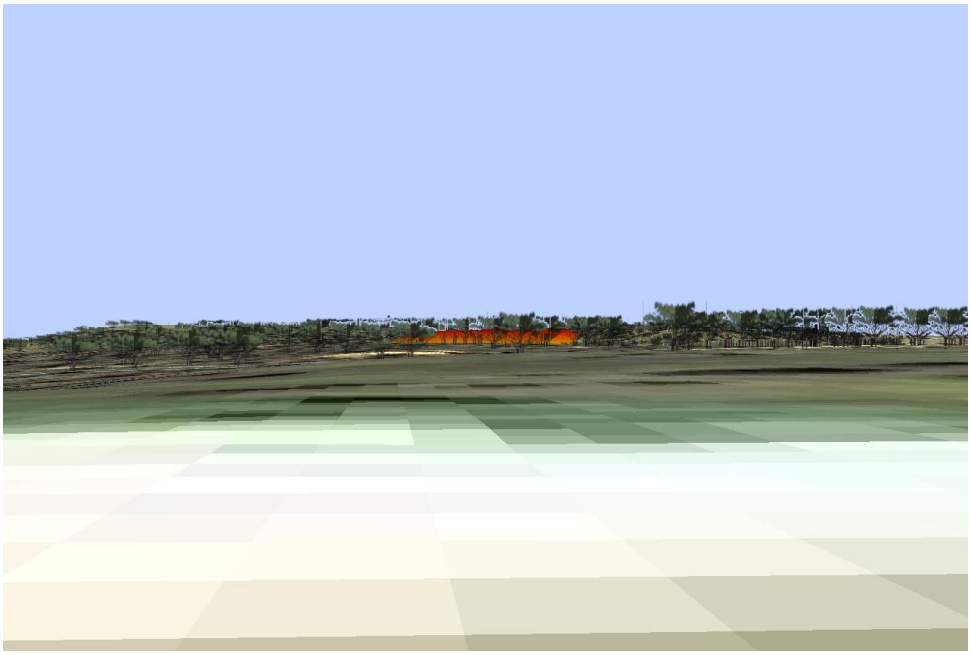

Figure 33: View from Receiver 4 – approximately 1.5 kilometres north of the Project Site

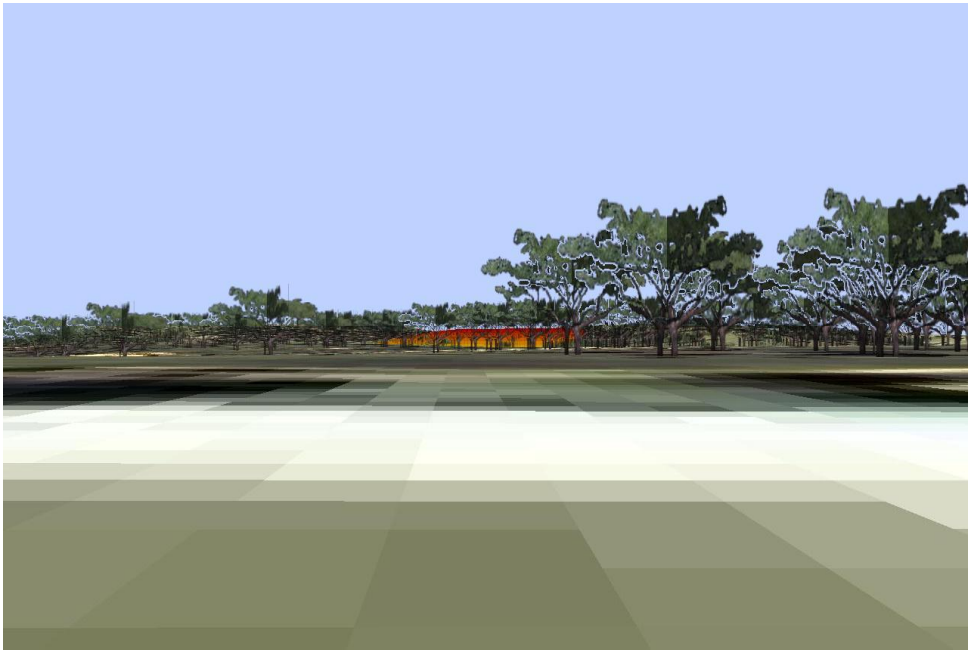

Figure 34: View from Receiver 5 – approximately 1.4 kilometres north of the Project Site

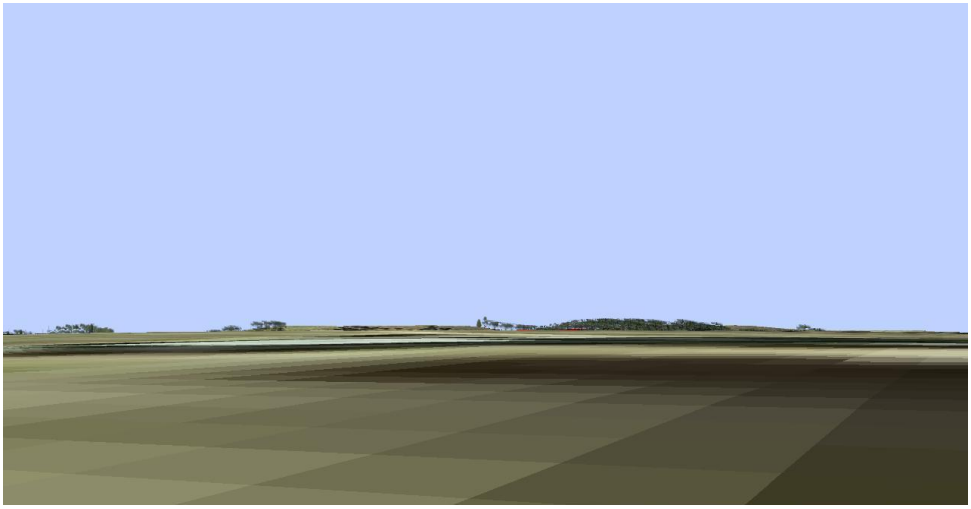

Figure 35: View from Receiver 6 – approximately 1.9 kilometres northwest of the Project Site

Views towards the Project Site from Receivers 4 and 5 are considered to be reasonably significant, however these views would be partially masked by existing vegetation. Views from Receiver 6 would be less significant due to the considerable distance of this receiver from the Project Site. The biodiversity offset area would, when mature, provide additional screening of the proposed landfill mass from these receiver locations.

8.16.4 Mitigation Measures

Construction and Operation Activities

In order to minimise the impact of construction and operational activities that would occur, best practise site management measures would be implemented including (but not limited to):

- Ensure appropriate sizing and placement of stockpiles;
- Maintain orderly and tidy construction and maintenance areas;
- Retain existing vegetation on future cells for as long as possible until removal is required;
- Ensure frequent covering of material delivered to the landfill; and
- Ensure removal of escaped litter and rubbish.

Vegetation

Extensive revegetation of the areas surrounding the landfill footprint would be conducted for the purposes of providing a 3:1 biodiversity offset to compensate for existing vegetation that would be cleared from within the proposed landfill footprint area. Appropriate consideration would be given to the planting of any "quick growing" species to obscure views in the short term. It is considered that strategically locating significant portions of the required plantings within key areas between the landfill site and any significantly impacted viewpoints would provide screening for long distance views of the proposed landfill facility.

All existing vegetation within the property boundary but outside the proposed landfill and associated infrastructure footprint would be maintained throughout the life of the proposed landfill project.

The final location and nature of all plantings to be undertaken across the Project Site would also be subject to NSW RFS bushfire regulations.

8.17 Climate Change

This section assesses the projected climate changes in the region of the proposed landfill. The potential climate change risks and adaptation responses for incorporation into the design phase of the landfill project is also outlined here.

Design of new infrastructure is generally based on past climate history. Future climate change raises the possibility that adjustments to the historical pattern of extreme climatic events (such as increased frequency of very hot days or heavy rainfall intensity) or through gradual changes (such as shifts in seasonal or annual patterns of rainfall and/or temperature) may likely lead to premature deterioration of infrastructure assets.

Whether the impacts of climate change occur from extreme events or gradual changes, damage to infrastructure and services is likely to be costly unless appropriate measures are taken to adapt. Incorporating climate change adaptation measures early in the design and planning phases of a new landfill development helps ensure that the facility is able to resist future changes in climatic conditions. Climate change adaptation and options for the proposed landfill is discussed in **Section 8.17.5**.

Worldwide industrial development since the first industrial revolution has caused GHGs to be released into the atmosphere in great volumes. These gases have resulted in enhancement of the naturally occurring greenhouse effect. This enhancement of the greenhouse effect, combined with major land use changes and some natural climate variability, has led to the changes in the climate which are currently being observed.

Evidence for climate change has become more compelling over the last two decades with the release of the reports of the Intergovernmental Panel on Climate Change (IPCC). These reports present a detailed evaluation of the science of climate change, with compounding evidence of its consequences. The IPCC's latest report – the Fourth Assessment Report – concluded that warming of the climate system is now unequivocal and that most of the warming in the past 50 years is 'very likely' (more than 90% in probability) due to observed increases in GHGs from human activities.

Because of the inertia of the climate system, even if GHGs released in the atmosphere are dramatically reduced, the warming trend is very likely to continue during the 21st Century.

When addressing the challenge of climate change, two kinds of approaches can be implemented :

- Climate change mitigation which aims to reduce GHG concentrations in the atmosphere in order to reduce the rate and overall magnitude of future climate change.
- Climate change adaptation which aims to adjust human and natural systems to cope with new climatic conditions and improve their resilience to face climate change impacts.

The proposed landfill facility will be impacted by a changing climate (such as changed rainfall patterns and temperature) and will also contribute to climate change as GHGs will be generated during construction, operation and post closure. A GHG assessment (AECOM, 2010) has been undertaken and is discussed in **Section 8.6**.

8.17.1 Existing Climate

The main features of existing weather conditions are summarised as follows:

- The climate is typically dry and continental with hot summers. January experiences the highest temperatures, with mean daily minimum and maximum temperatures of 13.4°C and 27.1°C respectively. Winters are cold, with July experiencing the coldest temperatures with mean minimum and maximum daily temperatures of 1.1°C and 12.1°C respectively.
- Rainfall records show the annual mean rainfall to be around 792 millimetres per year. The minimum mean monthly rainfall of 35.5 millimetres is recorded in April, and the maximum mean monthly rainfall of 110.5 millimetres is recorded in November. The highest daily rainfall recorded in the region occurred in December 1994 with 97 millimetres over a 24 hour period.
- The predominant wind direction in the morning is equally from the east and west, while afternoon winds are predominately from the west.

8.17.2 Projected Climate Change

Climate change will impact different regions in different ways. Understanding these impacts ensures that future infrastructure is built to withstand and resist a changing climate for future generations. The future climate of the Armidale region has been forecasted as part of the NSW Climate Change Action Plan. The projected climatic changes for the Armidale region by 2050 include:

- A hotter climate over all seasons.
- Increased rainfall in summer, spring and autumn.
- Drier conditions (due to increased evaporation) in spring, autumn and winter.

(DECC, 2008, Summary of Climate Change Impacts – New England/North West NSW Region)

Changes in mean and extreme precipitation are expected to be the main risks associated with climate change for the project. The mean and extreme precipitation projections for Armidale are detailed in the following sections.

Mean Rainfall Projections

Regional projections for 2050 indicates that spring and autumn rainfall is likely to increase by 5% to 10%, summer rainfall to increase by 10% to 20% and winter rainfall to decrease by 10% to 20% (DECC, 2008). The projected regional mean rainfall changes are illustrated in **Figure 36**.

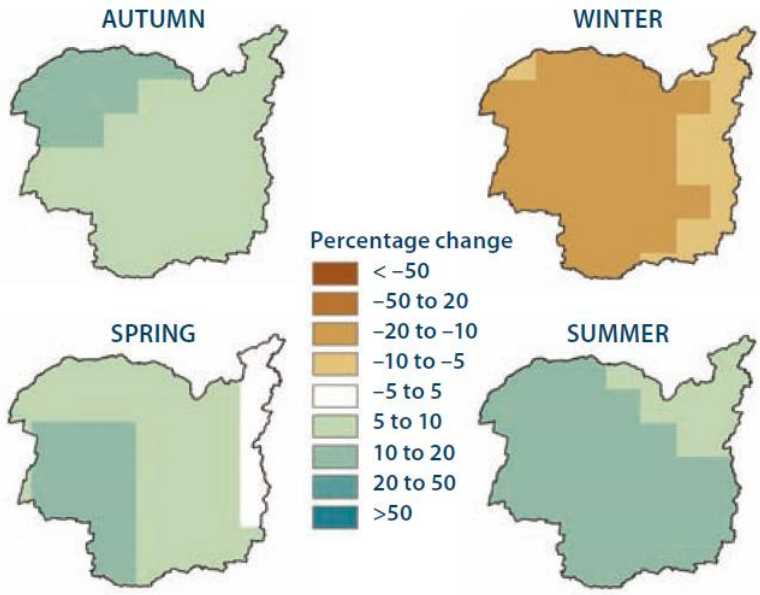

Figure 36: Projected Changes in Seasonal Rainfall by 2050

Source: DECC, 2008, Summary of Climate Change Impacts – New England/North West NSW Region.

Extreme rainfall projections

As shown in **Table 69** below, extreme rainfall projections show a slightly increasing trend annually and for most seasons, except for spring.

Table 69: Extreme rainfall projections for the NSW north-east region

		2030	2070
Extreme Rainfall (1 in 40 year event / 1 day duration), expressed as % of intensity change compared to 1961-2000 climate	Annual	+5%	+5%
	Summer	+5%	+5%
	Autumn	+5%	=
	Winter	+5%	+5%
	Spring	-10%	+10%
Extreme Rainfall (1 in 40 year event / 3 days duration), expressed as % of intensity change compared to 1961-2000 climate	Annual	=	+5%
	Summer	=	=
	Autumn	+20%	=
	Winter	+5%	=
	Spring	-10%	+10%

Source: CSIRO 2004b

8.17.3 Potential Climate Change Impacts and Risks for the Proposed Landfill Facility

This section assesses the potential risks associated with climate change for the proposed landfill facility.

As shown in **Figure 37** changes in mean and extreme precipitation are expected to be the main risks associated with climate change for the project. As such, observed and projected changes in mean and extreme precipitation are presented in order to assess the landfill's vulnerability.

The risk assessment for the proposed landfill facility focused on these specific vulnerabilities. No observations and projections of relative humidity and potential evaporation were available. These climate variables have not been considered in this assessment.

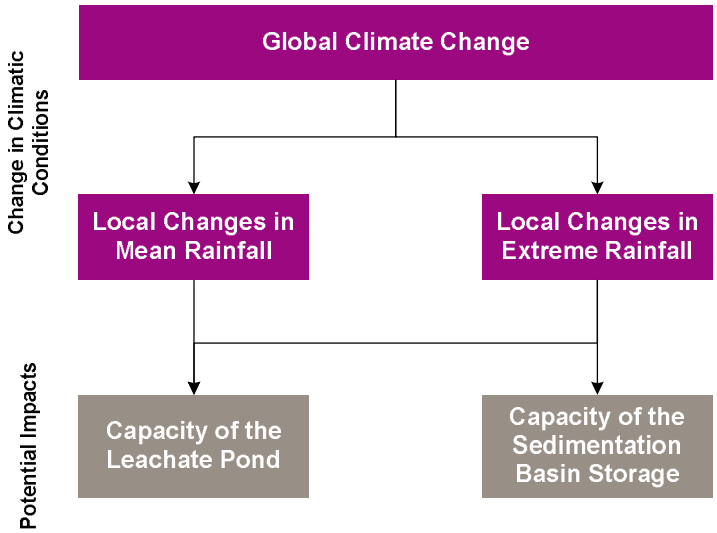

Figure 37: Potential Climate Change Impacts to Landfill

To assess the vulnerability of assets and infrastructure to future climate change, AECOM uses risk assessment matrixes based upon the AGO report *Climate Change and Risk Management: A Guide for Business and Government*. **Table 70** provides details on the risk ratings applied. **Table 71** documents the potential risks for the proposed landfill facility, considering the projections of future precipitation change.

Table 70: Risk Rating Matrix

Likelihood	Consequences				
	Insignificant (1)	**Minor (2)**	**Moderate (3)**	**Major (4)**	**Catastrophic (5)**
Almost certain (5)	M (5)	M (10)	H (15)	E (20)	E (25)
Likely (4)	L (4)	M (8)	H (12)	H (16)	E (20)
Possible (3)	L (3)	M (6)	M (9)	H (12)	H (15)
Unlikely (2)	L (2)	L (4)	M (6)	M (8)	M (10)
Rare (1)	L (1)	L (2)	L (3)	L (4)	M (5)

Notes:
E = >20: Extreme risks demand urgent attention at the most senior level and cannot be simply accepted as a part of routine operations without executive sanction.
H = >12: High risks are the most severe that can be accepted as a part of routine operations without executive sanction but they will be the responsibility of the most senior operational management and reported upon at the executive level.
M = >5: Medium risks can be expected to form part of routine operations but they will be explicitly assigned to relevant managers for action, maintained under review and reported upon at senior management level.
L = <5: Low risks will be maintained under review but it is expected that existing controls will be sufficient and no further action will be required to treat them unless they become more severe.

Table 71: Risk Rating Matrix for Armidale landfill

Risk Scenario	Climate Variable	Risk Description and Flow-on Effects	Risk Rating 2030	Risk Rating 2070
The leachate pond is not designed to cope with future rainfall patterns	Mean rainfall and extreme rainfall	An increase in rainfall intensity could potentially result in overtopping of the leachate pond due to a higher volume of rainfall.	Medium	Medium
The leachate pond is not designed to cope with future rainfall patterns	Mean rainfall and extreme rainfall	A decrease in rainfall would mean that the leachate pond has been designed for a high volume of precipitation that is unlikely to occur in the future.	Low	Low
The sedimentation basin is not designed to cope with future rainfall patterns	Mean rainfall and extreme rainfall	An increase in rainfall intensity could potentially result in overtopping of the sedimentation basin due to a higher volume of rainfall.	Medium	Medium
The sedimentation basin is not designed to cope with future rainfall patterns	Mean rainfall and extreme rainfall	A decrease in rainfall would mean that the sedimentation basin has been designed for a high volume of precipitation that is unlikely to occur in the future.	Low	Low

8.17.4 Climate Change Mitigation Measures

The climate change mitigation measures are detailed in the GHG Assessment (**Section 8.6** and **Appendix P**).

8.17.5 Climate Change Adaptation Measures

A water balance model was used to determine the size of the leachate pond. The daily rainfall values used in the water balance model were amended to include the projected rainfall changes. As the projected climate change data for Armidale is predicted for rainfall by the year 2050, the amended rainfall data set was applied for the last three decades of landfill operation i.e. from the 21st year to the end of the 50th year. The rainfall data used in the modelling was amended to reflect the projected worst case rainfall scenario i.e. maximum wetting, based on the data in **Section 8.17.2**, as follows:

- Autumn (from March to May): 10% increase in daily rainfall.
- Winter (from June to August): 20% decrease in daily rainfall.
- Spring (from September to November); 10% increase in daily rainfall.
- Summer (from December to February): 20% increase in daily rainfall.

As quantitative assessment of future evaporation could not be predicted, it is assumed that the effect of climate change on evaporation is negligible. As evaporation rates are predicted to increase, the assumption of negligible evaporation in effect represents the worst case scenario for storage requirements). On running the water balance model with the above revised rainfall values and assuming that evaporation rates remain the same, it was determined that a leachate pond size of 12ML would provide sufficient capacity for the volume of leachate that would be generated by the proposed landfill facility, including allowance for climate change predictions.

8.18 Cumulative Impacts

8.18.1 Introduction

Cumulative impacts can result from a number of different elements within a project as well as from a number of different projects with interacting impacts in the same locality. Cumulative impacts of the proposed landfill facility may occur as a result of another existing or future project proposed within the locality.

8.18.2 Potential for Cumulative Impacts with Other Proposals

The proposed landfill development would be situated 12 kilometres west of Armidale, within a rural setting. There are no industrial sites in close proximity to the Project Site. Consequently, there would be no cumulative impact arising from the proposed landfill facility and other industries on the locality's surface water quality, traffic, biodiversity, social or economic values, air quality or noise arising from this project. All other impacts of the proposed development have been identified and individually addressed previously in this EA.

Council has conducted a search of its DA database and Complying Development Certificate (CDC) approvals within a 5km radius of the proposed landfill site. The search has identified that no significant DAs or CDCs have been approved since 1 January 2003 (to date). In addition, a search of the DoP Major Project Register undertaken in January 2010 returned no listing of proposed developments within the Armidale Dumaresq, Guyra, Uralla or Walcha LGAs. Therefore there are no other proposals or developments that would need to be further considered, with respect to cumulative impacts.

8.18.3 Potential Cumulative Impacts of the Proposal

The potential cumulative effects that have been identified during the EA and identified by stakeholders and the community during the consultation include:

- The potential for the proposal to impact upon the air quality of the area, primarily with regard to odour and litter.
- The impact of the proposal upon ambient noise levels in the area.
- The impact of the proposal upon the surrounding road network.
- The potential for the proposal to impact upon water quality in the surrounding creeks and catchments.
- The potential for the proposal to further limit habitat and reduce ecological values in the area.

Odour impacts are discussed in **Section 8.5.3** and litter impacts are discussed throughout **Section 8.0**. The proposal is not anticipated to cause an odour nuisance in the surrounding areas.

Noise impacts are discussed in **Section 8.7**. Noise levels generated during construction and operation of the proposed landfill facility would be acceptable.

Traffic impacts are discussed in **Section 8.14**. The proposed development is not expected to create a significant traffic impact.

Surface and groundwater management measures are discussed in **Section 8.3** and **Section 8.4** respectively. The mitigation measures proposed, including diversion of clean water from the site, provision of emergency leachate and dirty water containment and a regular program of surface and groundwater quality monitoring, would contain contaminated runoff on site. Long-term water quality objectives for the region would not be significantly affected by the proposed development, as long as water management at the site is conducted appropriately.

Ecological impacts are discussed in **Section 8.8**. Mitigation measures for the proposed landfill facility would be implemented as described in **Section 8.8.16** and **Section 8.8.17**, including a biodiversity offset area; revegetation with endemic species; and weed, pest and vermin monitoring.

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9.0 Statement of Commitments

9.1 Introduction

In accordance with the DGRs, the following SoC is provided. As required by the DGRs, the SoC for the proposal describes measures for environmental mitigation, management and monitoring which would be undertaken as part of the proposed project during detailed design, construction and operational activities, to ensure that the potential impacts identified in this EA are appropriately managed.

9.2 Environmental Management

9.2.1 Environmental Objectives

Council is committed to the following objectives of the proposed landfill facility:

- Provide a long-term, fully licensed waste disposal facility capable of servicing the population of Armidale Dumaresq and other participating, surrounding LGAs.
- Protect the surrounding environment (including connectivity to the Oxley Wild Rivers National Park), through implementation and management of environmental controls and contingency measures.
- Continue efforts to ensure wastes are managed throughout the Armidale Dumaresq LGA in accordance with the waste management hierarchy and the principles of the WARR Act, where disposal of wastes to landfill are considered to be the final waste management option.
- Progressively ensure that new technologies are implemented in relation to resource recovery and environmental management of the proposed landfill throughout its life (including both operational and rehabilitation phases).
- Encourage and facilitate community participation for matters relating to waste disposal.
- Operate a waste disposal facility that is sympathetic to the amenity of the area in which it is located.
- Ensure that the proposed landfill facility is operated so that any emissions are in accordance with environmental health regulations and guidelines stipulated within relevant local, State and Federal Government policies and legislation.
- Provide a rehabilitated landfill that is complementary to the surrounding rural land use and that will not produce an adverse environmental legacy for any future generations.
- Council will continue to support strategic developments in relation to the establishment, operation, and continued management of the proposed landfill facility that are aligned and supported in a regional context to the strategic direction of the NIRW group.

9.2.2 Environmental Licensing

The proposed landfill facility would be designed in accordance with the DECCW *Environmental Guidelines: Solid Waste Landfills, 1996* (the *Guidelines*). Council would also seek an EPL from DECCW under the *POEO Act* to operate the proposed development as a landfill for “General solid waste (putrescible)” materials (formerly known as “Solid Waste Class 1” materials). The new landfill will not be licensed to accept clinical (hospital) waste or chemicals. Council would also consult with the DECCW regarding the potential requirement for a discharge licence for the discharge of clean stormwater from the Project Site.

9.2.3 Landfill Environmental Management Plan

Key principles of the LEMP are to provide:

- An environmental management tool for the construction and operation of the proposed landfill facility.
- A means of identifying and focussing on the key environmental, operational and rehabilitation issues.
- A means of identifying baselines for monitoring.
- An outline of reporting requirements.
- A guide for interaction with relevant government authorities, including DECCW.
- A means to comply with the DGRs and the EPL.

The LEMP would address both construction and operational environmental management requirements.

The LEMP would be prepared prior to any construction work being undertaken and would provide a detailed description of the construction staging, tasks and management measures. The LEMP would include appropriate strategies and management measures to control and manage environmental risks, assess environmental performance and comply with relevant statutory requirements during the construction and operation of the proposed landfill facility.

The LEMP would include identified sub-plans which provide tailored management protocols and measures for minimising impacts of the project as discussed earlier in this EA. The sub-plans include:

- Erosion and Sediment Control Plan (ESCP).
- Construction Noise Management Plan (CNMP).
- Vegetation Management Plan (VMP).
- Vegetation Clearing Protocol.
- Native Fauna Management.
- Fire Management Plan.
- Weed Management Plan (WMP).
- Pest Management Plan.
- Disease Monitoring Protocol.
- Pollution and Litter Management Plan.
- Water and Leachate Management Plan (WLMP).
- Indigenous Heritage Management Plan.

Please note, the LEMP is a working document, and the management strategies outlined are intended for review on an annual basis. Where necessary, the LEMP would be amended as new strategies and technologies become available. The updating and reissuing of the LEMP and any of its sections would be undertaken by Council.

9.2.4 Environmental Monitoring and Reporting

The LEMP and its sub plans provide a process for continuous improvement of the environmental management of the proposed landfill facility, through ongoing monitoring and regulatory management procedures.

The Proponent would provide a telephone hotline for the reporting of complaints or emergencies. Complaints received by the hotline would be recorded and immediately addressed. Further information on environmental management and monitoring in regards to the specific operations and components of the proposed landfill facility is provided in the SoC in **Section 9.3**.

During the construction and operational stages of this proposal, environmental reporting is considered a vital component. Reporting information would include the following:

- Non-compliance reports.
- Remedial actions undertaken resulting from the reporting of an incident.
- Checklists to address operational compliance.
- Details of any stakeholder consultation and meetings.
- Outcomes of any auditing that is carried out.
- The findings of any monitoring that is conducted.

The Proponent would ensure that all reporting undertaken in relation to environment and OH&S issues would be in compliance with the relevant licence conditions and regulatory requirements.

Environmental Officer

During construction and operation of the proposed landfill facility, an Environmental Officer would be identified who would have responsibility for implementing and monitoring the LEMP in liaison with the Operations Manager. The Environmental Officer would be suitably qualified and experienced in order to oversee the environmental performance of the proposed landfill facility and compliance with statutory and other obligations including the conditions of approvals and licences.

9.2.5 Occupational Health & Safety

An OH&S Management System would be developed for inclusion in the LEMP for the proposed landfill facility. It would include the development of an ERP, in consultation with the relevant emergency authorities where necessary. The ERP would include the following information:

- Contact details for all emergency services in the area.
- The contact details (including before and after hours) of all relevant Council, contractor and government department personnel
- First aid procedures.
- Fire fighting procedures.
- Reporting requirements for all incidents that are considered dangerous or potentially dangerous or where damage has been caused.

Council would ensure and that all personnel are well informed through training on the required procedures in the event of an emergency.

9.3 Statement of Commitments

The SoC prepared in respect of the proposed construction and operation of the proposed landfill facility has been compiled on an issues basis and is informed by the environmental risk analysis and impact assessment undertaken as part of this EA. The SoC has been written in a format which can be incorporated into an approval issued to act as the conditions of that approval, shown in **Table 72** below.

Table 72: Statement of Commitments

Commitment
General Commitments 1. The Proponent will undertake the activities, the subject of the Project Approval in accordance with the general descriptions and details provided in this EA, including the mitigation and management measures identified in this EA 2. The Proponent will gain all necessary approvals and permits supporting both construction and operation 3. The Proponent will prepare and implement the following management plans for the project: - A LEMP and associated sub-plans; and - A Biodiversity Offset Management Plan 4. The Proponent will ensure that the final design landfill footprint of the proposed landfill facility is determined in consideration of relevant environmental constraints with a view to minimising the potential impacts of the proposal
Landform and Soils 5. The Proponent will implement an ESCP as part of the LEMP
Geology 6. The Proponent will undertake investigations of the potential geological fault during construction and will then undertake further detailed assessment if evidence of a geological fault is encountered
Surface Water 7. The Proponent will implement a WLMP as part of the LEMP 8. The Proponent will adopt the Water Sensitive Urban Drainage (WSUD) principles in the design criteria for the control and treatment of drainage runoff 9. The Proponent will ensure all leachate produced is monitored in accordance with the proposed landfill facility's licensing arrangements under the *POEO Act* 10. The Proponent will ensure that monitoring is undertaken as detailed in the Water Quality Monitoring Program and Management Plan

Commitment
Groundwater 11. The Proponent will implement a Leachate Management System as part of the LEMP and designed in accordance with the relevant *Landfill Guidelines Benchmark Techniques* 12. The Proponent will implement a WLMP 13. The Proponent will ensure that monitoring is undertaken as detailed in the Water Quality Monitoring Program and Management Plan and in accordance with an EPL.
Air Quality 14. The Proponent will ensure that air quality management practices identified in this EA will be included in the LEMP
Greenhouse Gas 15. The Proponent will undertake a regular review of the viability of retro fitting the landfill with alternative landfill gas management techniques
Noise 16. As part of the LEMP, the Proponent will prepare a CNMP in accordance with the relevant DECCW *Guidelines*
Biodiversity Issues 17. The Proponent will ensure that the LEMP contains appropriate measures to avoid or reduce secondary/downstream impacts on biodiversity. The LEMP will include the following management sub plans: - Native Fauna Management Plan - Fire Management Plan - Pest Management Plan - Disease Monitoring Protocol 18. The Proponent will adhere to the mitigation measures identified in the Biodiversity Offset Management Plan
Socio-Economic 19. The Proponent will undertake community consultation as identified in this EA
Indigenous Heritage 20. The Proponent will prepare and implement an Indigenous Heritage Management Plan 21. The Proponent will fence off and avoid significant Aboriginal heritage sites
National Environmental Heritage 22. The Proponent will implement a WLMP to appropriately manage both surface water and leachate during the operational life of the landfill
Land Use 23. The Proponent will build a cattle grid into the access road 24. The Proponent will ensure grazing stock do not enter the landfill area
Traffic and Transport 25. The Proponent will upgrade the T-junction intersection on Waterfall Way

Commitment
Hazards 26. The Proponent will ensure relevant Materials Safety Data Sheets, spill containment and safety equipment is installed at the proposed landfill facility 27. The Proponent will ensure the proposed landfill facility is fenced to prevent vandalism 28. The Proponent will monitor landfill gas accumulation 29. The Proponent will prepare and implement an ERP for fire protection, flood hazards, and OH&S practices
Visual 30. The Proponent will provide vegetation screening of the landfill facility using plantings of species endemic to the local area 31. The Proponent will maintain all vegetation outside the landfill footprint but within the boundaries of the Project Site for the life of the landfill
Climate Change 32. The Proponent will allow a freeboard in the design of the landfill dry basin (that captures overflows from the leachate pond and sedimentation basin) to capture the 100 year storm event 33. The Proponent will implement and adhere to the mitigation measures identified in the Biodiversity Offset Management Plan

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10.0 Residual Risk Assessment

10.1 Approach

The Residual Environmental Risk Analysis for the proposed landfill facility is based on a process adapted from Australian Standard AS 4360:2004 Risk Management, as well as environmental risk tools developed by other organisations. The process is qualitative and is based on the Residual Risk Matrix shown in **Table 73**.

Residual Environmental Risk is assessed on the basis of the significance of environmental effects of the proposal and the ability to confidently manage those effects to minimise harm to the environment.

The significance of environmental effects is given a numerical value between 1 and 5 based on the receiving environment, the level of understanding of the type and extent of impacts and community response to the environmental consequences of the proposal. This enables both the actual and perceived impacts to be considered. The manageability of environmental effects is similarly given a numerical value between 1 and 5 based on the complexity of mitigation measures, the known level of performance of the safeguards proposed and the opportunity for adaptive management. The numerical value allocated for each issue is based upon the following considerations:

Significance of Effects

5.	Extreme	Undisturbed receiving environment; type or extent of impacts unknown; substantial community concern.
4.	High	Sensitive receiving environment; type or extent of impacts not well understood; high level of community concern.
3.	Moderate	Residual receiving environment; type and extent of impacts understood; community interest.
2.	Minor	Disturbed receiving environment; type and extent of impacts well understood; some local community interest.
1.	Low	Degraded receiving environment; type and extent of impacts fully understood; uncontroversial project.

Manageability of Effects

5.	Complex	Complicated array of mitigation measures required; safeguards or technology are unproven; adaptive management inappropriate.
4.	Substantial	Significant mix of mitigation measures required; limited evidence of effectiveness of safeguards; adaptive management feasible.
3.	Straightforward	Straightforward range of mitigation measures required; past performance of safeguards is understood; adaptive management easily applied.
2.	Standard	Simple suite of mitigation measures required; substantial track record of effectiveness of safeguards; adaptive management unlikely to be required.
1.	Minimal	Little or no mitigation measures required; safeguards are standard practice; adaptive management not required,

The numbers are added together to provide a result which provides a ranking of potential residual effects of the proposal when the safeguards identified in this EA are implemented.

Table 73: Residual Risk Matrix

Significance of Effects	Manageability of Effects				
	5 Complex	**4 Substantial**	**3 Straightforward**	**2 Standard**	**1 Minimal**
1 Low	6 (Medium)	5 (Low/Medium)	4 (Low/Medium)	3 (Low)	2 (Low)
2 Minor	7 (High/Medium)	6 (Medium)	5 (Low/Medium)	4 (Low/Medium)	3 (Low)
3 Moderate	8 (High/Medium)	7 (High/Medium)	6 (Medium)	5 (Low/Medium)	4 (Low/Medium)
4 High	9 (High)	8 (High/Medium)	7 (High/Medium)	6 (Medium)	5 (Low/Medium)
5 Extreme	10 (High)	9 (High)	8 (High/Medium)	7 (High/Medium)	6 (Medium)

10.2 Analysis

The analysis of residual environmental risk for issues related to the proposed landfill facility is shown in **Table 74**. This analysis indicates the environmental risk profile for the proposal based on the assessment of environmental effects, the identification of appropriate safeguards, and the SoC included in this EA.

Table 74: Risk Profile

Issue	Significance	Manageability	Residual Risk
Landform and Soils	3	2	5 (Low/Medium)
Geology	2	2	4 (Low/Medium)
Surface Water	3	2	4 (Low/Medium)
Groundwater	3	3	6 (Medium)
Air Quality	3	2	5 (Low/Medium)
Greenhouse Gas Emissions	2	3	5 (Low/Medium)
Noise	3	2	5 (Low/Medium)
Biodiversity Issues	4	3	7 (High/Medium)
Socio-Economic	2	2	4 (Low/Medium)
Indigenous Heritage	1	2	3 (Low)
European Heritage	1	1	2 (Low)
National Environmental Heritage	3	3	6 (Medium)
Land Use	2	1	3 (Low)
Traffic and Transport	2	3	5 (Low/Medium)
Hazards	1	2	3 (Low)
Visual	1	2	3 (Low)
Climate Change	3	2	5 (Low/Medium)
Cumulative Impacts	1	1	2 (Low)

The above residual risk analysis indicates that the proposed landfill facility presents an overall low/medium risk in relation to each of the identified environmental issues provided that the recommended mitigation measures are implemented.

11.0 Sustainability

11.1 Ecologically Sustainable Development (ESD)

ESD is defined by the National Strategy for Ecologically Sustainable Development (NSESD) 1992 as:

> *using, conserving and enhancing the community's resources so that ecological processes, on which life depends, are maintained, and the total quality of life, now and in the future, can be increased*

The principles of ESD as defined in the *EP&A Act* and the *EP&A Regulation 2000* have been considered during all aspects of the project development. The relevant requirements of the *EPBC Act* have also been taken into account.

11.2 New South Wales Requirements for Ecologically Sustainable Development

The principles of ESD are listed under Schedule 2 of the *EP&A Regulation 2000* as:

- The "*precautionary principle*" i.e. if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.
- "*Inter-generational equity*" i.e. the present generation should ensure that the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations.
- "*Conservation of biological diversity and ecological integrity*" i.e. biological diversity and ecological integrity should be preserved as much as possible by investigating appropriate design and site options that minimise the impact on biological resources including threatened species and their habitats and ecologically sensitive communities.
- "*Improved valuation, pricing and incentive mechanisms*" i.e. environmental factors should be included in the valuation of assets and services.

11.2.1 Precautionary Principle

Throughout the development of the proposed landfill facility, Council has aimed to balance the need for this development with the need to reduce potential environmental impacts which may result as a consequence of the development. As part of the EA process a number of environmental studies, assessments and investigations have been carried out to identify these environmental impacts (as detailed in **Section 8.0**), including a GHG inventory and a climate change risk assessment.

The precautionary principle has been incorporated into the proposal through the nomination of mitigation measures to address environmental issues which have then been developed in the SoC and the LEMP. The proposed mitigation measures have been developed to reduce the likelihood or consequence of these identified impacts, hence minimising potential impacts from the proposed landfill facility. The mitigation measures which have been developed are subject to review and amendment throughout the life of the operation.

As discussed in **Section 3.3.1**, impacts on the biophysical environment have the greatest potential for significant impact unless appropriate mitigation measures are employed. Precaution to prevent environmental damage has been exercised in the following ways:

- Potential climate changes have been included in the design and storage capacity of the leachate storage pond, to ensure adequate leachate storage capacity is provided throughout the life of the landfill.
- The project would involve clearing of vegetation that is an existing carbon store/pool. The biodiversity offset area, which would be vegetated as part of the project, has the potential to sequester and store a greater amount of carbon than the area which would need to be cleared for the development.

11.2.2 Principle of Intergenerational Equity

The proposed landfill facility is part of Council's long term waste management planning of the area and as such the landfill has been planned to provide a service for the disposal of community waste for a period of 50 years or more.

The landfill has been designed in accordance with the NSW EPAs *Environmental Guidelines: Solid Waste Landfills* (January 1996). These environmental guidelines focus on the environmental management of landfills and describe how the landfill should be constructed, operated, closed and rehabilitated to minimise environmental impacts. The guidelines are based upon 'benchmarks', which are aimed at achieving the most environmentally beneficial outcomes for the effective treatment and disposal of waste. These guidelines have been used to ensure that the landfill operates effectively into the future and does not give rise to any long term environmental effects from its construction and operation.

11.2.3 Conservation of Biological Diversity and Ecological Integrity

Conservation of biological diversity and maintenance of ecological integrity has been the key driver for the proposed biodiversity offset area (refer to **Section 8.8**). Biodiversity offsetting is a way of balancing the need for land for development purposes with the need to protect threatened species and conserve biodiversity. The basic principle of biodiversity offsets is that the reduction in the biodiversity value of a development in one area can be "offset" (or counter balanced) by improving the biodiversity of another area. To offset the impact of the proposed landfill facility, it is proposed that the biodiversity surrounding the landfill footprint be improved.

A Biodiversity Offset Management Plan has been produced in consultation with the DECCW. As part of this plan, it is proposed that for every hectare of land which is disturbed by the proposed landfill facility, three hectares of land would be purchased for the offset area. The offset area is to be located adjacent to the proposed landfill operational area and would consist of approximately 61 hectares of predominantly stringybark woodland and grassland.

The biodiversity offset area would be maintained, monitored and managed by Council. Management of the area would include weed/pest/vermin control. The management of the area would be adaptive and would be reviewed every five years (refer to **Section 8.8** for detail of the proposed biodiversity offset area).

11.2.4 Improved Valuation, Pricing and Incentive Mechanisms

AECOM has endeavoured to ensure that the project and design are priced to reflect their true value and impact on the environment.

Environmental protection measures have been incorporated into the development of the proposed landfill facility. The inclusion of such measures into the design would add to the cost of the construction and operation of the project but would reduce the risk of impacts from the proposal on the environment (including ground and surface water and other environmental attributes). The landfill capital and operating costs, including all the environmental and mitigation costs, such as the biodiversity offsets, would be met by the user in accordance with the "polluter pays" principle.

11.2.5 Climate Change

The *EP&A Act* contains a general requirement to address environmentally sustainable principles including climate change. Recent precedents in environmental approvals suggest that a plan to address the negative external costs of GHG emissions is required to address sustainable development principles.

A GHG Emissions Inventory report has been prepared for the proposed landfill. This report provides a quantitative estimate of the net emissions from the landfill and proposes a number of methods by which the emissions can be avoided, reduced, abated or offset (**Section 8.6** and **Appendix P**). The report concluded that the majority of the GHG emissions associated with the project would be associated with the release of the landfill gas methane, generated as putrescibles waste decomposes in the landfill under anaerobic conditions.

The amount of landfill gas which will be generated will be dependent upon the fraction of putrescible materials within the waste stream. Reducing the amount of putrescible waste landfilled at the proposed facility will have the greatest impact on reducing the landfill's GHG emissions. Other methods which can be implemented to reduce the generation of GHG emissions are discussed in the Greenhouse Gas Emissions section of this report.

12.0 Conclusions

Armidale, and surrounding districts, are facing imminent closure of its existing local landfill at the Armidale Waste Management Centre, predicted to reach capacity by 2010. Consequently, there is an urgent need to find an alternative waste disposal solution for this region.

Council has investigated alternative options to land filling including do-nothing, composting, mechanical biological treatment and thermal treatment, but concluded at this stage that land filling putrescible solid (class 1) waste in conjunction with a number of waste avoidance/recycling initiatives to be the best option for this region. Council is still committed to finding, assessing and installing new waste disposal technologies which would, over time, significantly increase waste recovery and reduce the amount of waste being directed for landfill disposal.

The process of identifying a suitable location for the proposed landfill facility commenced in the mid 1990s culminating in Council investigating 11 sites for the establishment of a new landfill facility. Based upon a stringent EA rating and weighting process along with an intensive community consultation program, the Project Site was considered the preferred option. In this site selection process, no issues were identified that would preclude the selected site for use as a landfill, if designed and constructed to modern standards and utilising best practice.

The proposed development fulfils the region's need for a long term local waste management strategy with identified positive social impacts including employment (albeit limited) and reduction of waste disposal costs to the local community when combined with a continued waste reduction/avoidance program by Council for this region.

The potential impacts of the proposed landfill facility on water (surface and groundwater pollution), air (greenhouse, dust, methane, odours), noise, litter, feral animal/weeds and heritage have been fully assessed and it is considered that with the adoption of the proposed mitigation measures outlined in this EA, there would be a negligible impact on the surrounding environment.

Although the proposed landfill site is located in a sensitive water catchment, Council's commitment to stringent controls for leachate management, surface water management, groundwater and surface water monitoring and landfill lining would ensure that there is no discharge of contaminated ground and/or surface waters to the receiving water bodies in this catchment.

There would be some habitat loss or disturbance to development as a consequence of the proposal, however this habitat loss would be offset by the proposed 61 hectares of offset compensatory habitat, which meets the requirement of the DECCW for an offset compensatory habitat ratio of 3:1. It is concluded that the inclusion of approximately 61 hectares of offset compensatory habitat would provide adequate mitigation to ensure no net loss of biodiversity.

The seven part test and *Commonwealth EPBC Act Referral* both concluded there would be no significant impacts on biodiversity, the environment and heritage arising from this proposal.

It is concluded that identified potential impacts from the proposed landfill can be appropriately managed through the implementation of specific mitigation measures and commitments outlined in this assessment. The findings of the environmental assessment presented in this EA and accompanying technical studies confirm that the proposed landfill facility has a strong justification for proceeding and is considered to be suitable for approval under Part 3A of the *EP&A Act*.

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14.0 Contents of Following Volumes

The technical reports that support this EA are contained in three separate volumes.

Volume 2 comprises:

- Appendix A – Director General's Requirements, 2005 and 2008; and Government Consultation
- Appendix B – AECOM, 2006: Armidale Regional Landfill Environmental Management Plan (Draft)
- Appendix C – Maunsell AECOM, 2004: Regional Landfill Siting Study Final Report
- Appendix D – EA Systems, 2006: Hydro-Geological Assessment

Volume 3 comprises:

- Appendix E – EA Systems, 2009: Flora and Fauna Assessment
- Appendix F – RCA Australia, 2007: Hydrogeological Investigation
- Appendix G – AECOM, 2010: Landfill Concept Design Drawings
- Appendix H – EA Systems, 2009: Biodiversity Offset Management Plan

Volume 4 comprises:

- Appendix I – AECOM, 2010: Landfill Liner Literature Review and Hydrogeological (Leachate) Assessment
- Appendix J – NSW Department of Public Works and Services, 2002: Landfill Siting Study, Aerial Photographic Survey
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- Appendix O – Holmes Air Sciences, 2009: Air Quality Assessment Report Proposed Armidale Landfill
- Appendix P – AECOM, 2010: Greenhouse Gas Inventory
- Appendix Q – AECOM, 2010: Armidale Regional Landfill Noise Impact Assessment
- Appendix R – Archaeological Surveys & Reports Pty Ltd, 2009: The Archaeological Investigation For Sites Of Indigenous Cultural Significance For Part 3A Approval New England Regional Landfill Waterfall Way, East Of Armidale, Northern Tablelands, NSW

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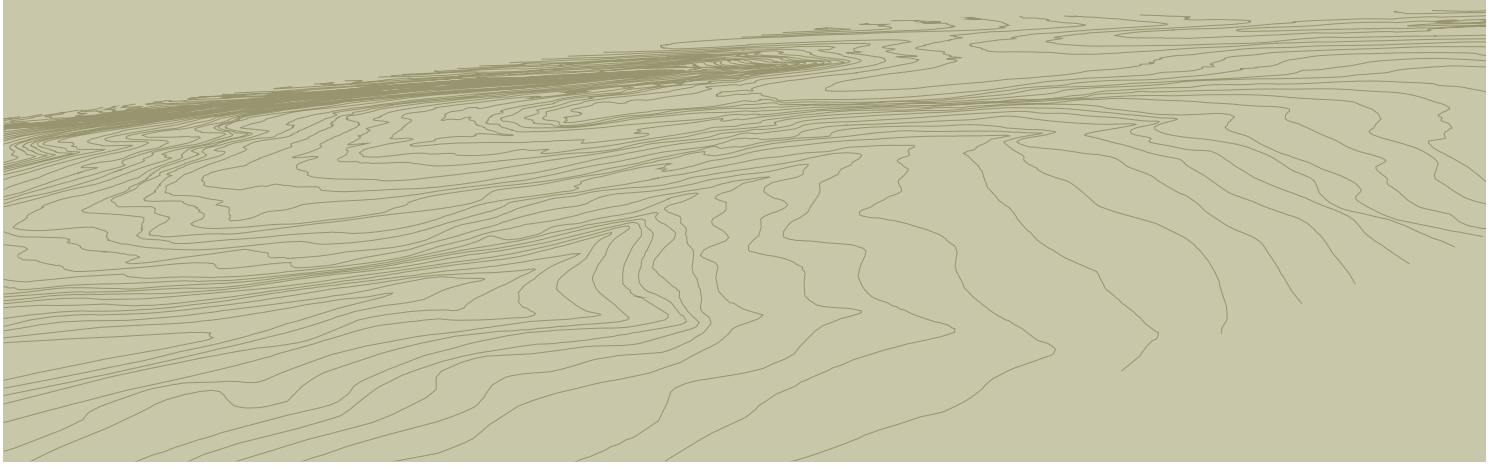
ARMIDALE REGIONAL LANDFILL

Environmental Assessment



ARMIDALE REGIONAL LANDFILL

Environmental Assessment Publications

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