EIS 1312 Vol 1

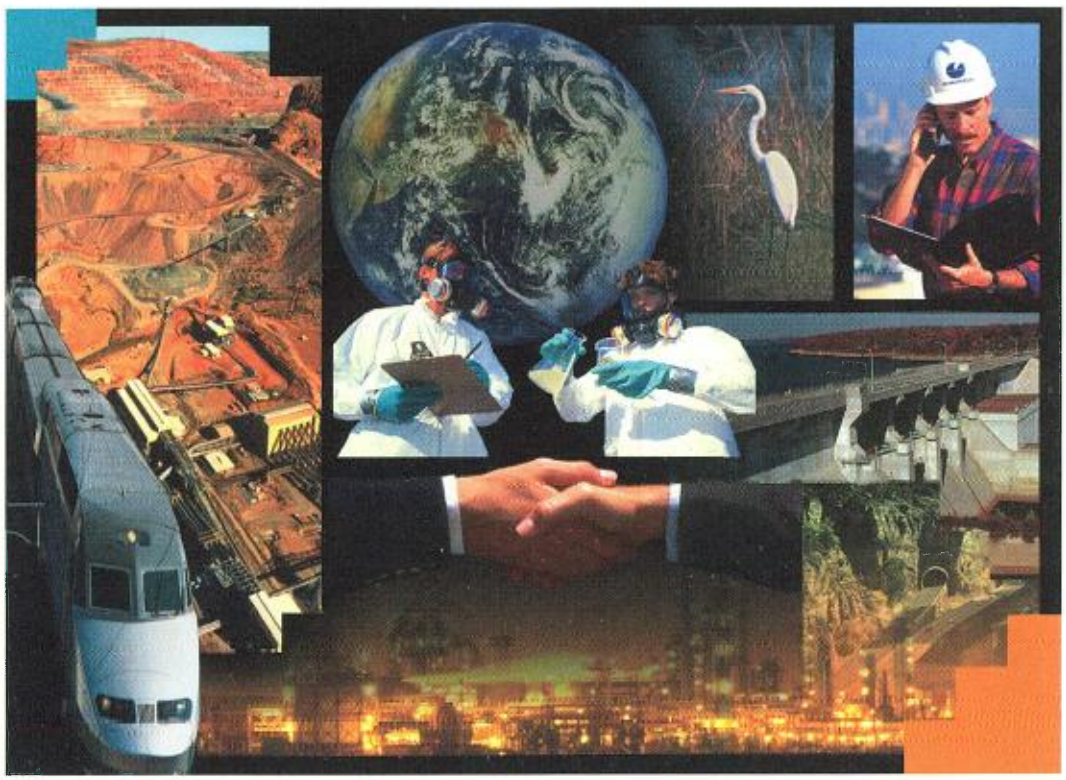
AB020061

Austral Brick solid waste landfill EIS, Horsley Park

REPORT

AUSTRAL BRICK SOLID WASTE LANDFILL EIS, HORSLEY PARK

Volume I - Main Report



Prepared for
Austral Bricks Company

20 November 1997

Woodward-Clyde

AGC Woodward-Clyde Pty Limited
ACN 000-691-690
Level 6, 486-494 Pacific Highway
St Leonards NSW 2065 Australia
Tel +61 (2) 9934 6700 • Fax +61 (2) 9934 6710
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TABLE OF CONTENTS

TABLE OF CONTENTS

TABLE OF CONTENTS

TABLE OF CONTENTS

TABLE OF CONTENTS

TABLE OF CONTENTS

TABLE OF CONTENTS

Figures

Tables

TABLE OF CONTENTS

Plates

Appendices

TABLE OF CONTENTS

CLAUSE 50 CERTIFICATE

ENVIRONMENTAL PLANNING AND ASSESSMENT ACT, 1979

(Section 77)

Name, qualifications and address of person who prepared Environmental Impact Statement	Catherine Brady Bachelor of Arts (Hons), Master of Regional and Urban Planning Senior, Environmental Planner, Environmental Planning, AGC Woodward-Clyde Pty Limited Level 6, 486-494 Pacific Highway ST LEONARDS NSW 2065

This statement has been prepared on behalf of:

Austral Bricks Company Pty Ltd

PO Box 550

PENRITH NSW 2751

being the proponents of the proposed development described below:

Continued Excavation and Extraction of Clay/Shale,
Landfilling with Class 2 Solid Waste and
Rehabilitation of Landfill Area

The proposed development is to be carried out on land shown in the maps included in this EIS which is described as Lot 3 in Deposited Plan 235478.

The contents of this Statement, as required by Clause 51 of the Environmental Planning and Assessment Regulation, 1994, are set forth in the accompanying pages.

Certificate:

I certify that I have prepared the contents of this Statement and to the best of my knowledge

- it is in accordance with clauses 51 and 52 of the Environmental Planning and Assessment Regulations 1994; and
- it is true in all material particulars and does not, by its presentation or omission of information, materially mislead.

Signature:

Name: Catherine Brady

Date: 20 November 1997

The study team wishes to acknowledge and thank members of the community who generously contributed to the preparation of this Environmental Impact Statement. We also wish to thank individuals, organisations and government authorities who participated in the studies and provided their assistance.

As a determination on the project will only be made after the Environmental Impact Statement has been on public display and submissions considered, the future conditional tense is used throughout this document when describing the project, alternatives and assessing impacts.

'Would' is, therefore, used throughout the text in preference to 'Will'.

If, it is decided to proceed with the project after a determination is made, all 'would' references should be interpreted as 'will'.

°C	:	Degrees celsius
$\mu g/m^3$	:	Micrograms per cubic metre
µm	:	Micro metre
AADT	:	Annual Average Daily Traffic
ABS	:	Australian Bureau of Statistics
ADI	:	Acceptable Daily Intakes
AHD	:	Australian Height Datum
am	:	Anti meridian
AMCL	:	Australian Manganese Company Pty Ltd
ANZECC	:	Australian and New Zealand Environment and Conservation Council
ARI	:	Average Recurrence Interval
ARMCANZ	:	Agriculture and Resource Management Council of Australia and New Zealand
BHP	:	Broken Hill Proprietary Company Limited
BoM	:	Bureau of Meteorology
BTEX	:	Benzene, Toluene, Ethylene, Xylene
CAMBA	:	Agreement between the Government of Australia and the Government of the People's Republic of China for the Protection of Migratory Birds
CASANZ	:	Clean Air Society of Australia and New Zealand
CBD	:	Central Business District
CFC's	:	Chloro-Fluorocarbons
CO_2	:	Carbon dioxide
CWR	:	Coal Washery Reject
dB	:	Decibel
DLWC	:	Department of Land and Water Conservation
DUAP	:	Department of Urban Affairs and Planning
EF ACT	:	Endangered Fauna (Interim Protection) Act, 1991
EIS	:	Environmental Impact Statement
EMD	:	Electrolytic Manganese Dioxide
EMP	:	Environmental Management Plan
EP&A Act	:	Environmental Planning and Assessment Act, 1979
EPA	:	Environment Protection Authority
EPI	:	Environmental Planning Instrument

ESD	:	Ecologically Sustainable Development
ESP ACT	:	Endangered Species Protection Act, 1992
FAO	:	Food and Agriculture Organisation (United Nations)
g/m^2/month	:	Grams per square metre per month
ha	:	Hectare
HASP	:	Health and Safety Plan
IGAE	:	Intergovernmental Agreement on the Environment
JAMBA	:	Agreement between the Government of Australia and the Government of Japan for the Protection of Migratory Birds and Birds in Danger of Extinction and their Environment
kg/m^3	:	Kilograms per cubic metre
km	:	kilometres
L/sec	:	Litres per second
LEMP	:	Landfill Environmental Management Plan
LEP	:	Local Environmental Plan
m	:	Metres
m^3	:	Cubic metres
m^3/D	:	Cubic metres per day
mg/kg	:	Milligrams per kilogram
mg/L	:	Milligrams per litre
mm	:	Millimetres
NHMRC	:	National Health and Medical Research Council
NIOSH	:	National Institute for Occupational Safety and Health
NPW ACT	:	National Parks & Wildlife Act
NSW	:	New South Wales
NSW NPWS	:	New South Wales National Parks and Wildlife Service
OSHA	:	Occupational Safety and Health Administration
PAH	:	Polyaromatic Hydrocarbons
pm	:	Post meridian
PPE	:	Personal Protective Equipment
PTWI	:	Provisional Tolerable Weekly Intakes
QA/QC	:	Quality Assurance/Quality Control
RAMSAR	:	Convention on Wetlands of International Importance
RAOU	:	Royal Australasian Ornithologist Union
REP	:	Regional Environmental Plan

RL	:	Reduced Level
ROTAP	:	Rare or Threatened Australian Plants
RTA	:	Roads and Traffic Authority
SEPP	:	State Environmental Planning Policy
TCLP	:	Toxicity Characteristic Leaching Procedure
TDS	:	Total dissolved solids
TPH	:	Total Petroleum Hydrocarbons
TSC ACT	:	Threatened Species Conservation Act, 1995
TSP	:	Total Suspended Particulates
USCG	:	U.S. Coast Guard
USEPA	:	United States Environmental Protection Agency
WMMA	:	Waste Minimisation and Management Act, 1995
WMMR	:	Waste Minimisation and Management Regulation, 1996

AHD	-	Australian Height Datum. The standard reference level used to express the relative elevation of various features. A height given in metres AHD is essentially the height above sea level.
Ameliorative	-	To make better, improve.
Aquifer	-	Geological formation, group of formations, or part of a formation capable of transmitting and yielding significant quantities of water.
Aquiclude	-	A geologic formation, group of formations, or part of a formation through which virtually no water moves. Clay is an example.
Aquitard	-	A saturated, but relatively poorly permeable bed, formation or group of formations that does not transmit or yield water freely.
Arisings	-	Contaminated materials derived from other areas of the site.
Background level	-	The level or concentration of the substance or compound, being measured prior to additional activity.
BHP Datum	-	Is a reference level used by BHP to express the relative elevation of various features. To convert BHP Datum to AHD, 12.51 is subtracted.
Biodiversity	-	Refers to the variety of ecosystems and species of plants and animals that can be found in nature. There are three levels at which biodiversity is important: genes, species and ecosystems.
Bioremediation	-	A remediation technology that uses micro-organisms to accelerate the degradation of contaminants in soil or groundwater.
Bund	-	A barrier designed to contain materials within a specific area.
Capping	-	Method of remediation which minimises the potential for infiltration and isolates contamination from human and environmental receptors.
Carcinogenic effect	-	A toxicological effect which results in the transformation of normal cells into cancer cells (neoplasia). These may then multiply rapidly and spread to other tissues.
Containment	-	To stop the uncontrolled movement of materials.
dB(A)	-	The sound level or noise level most appropriate to the human ear is usually expressed in terms of decibels (dB), which is measured as the 'A weighting' filter incorporated in sound level meters.

Designated Development	-	Development (by reference to type, purpose or location) under the Environmental Planning and Assessment Act which requires an environmental impact statement.
Ecologically Sustainable Development	-	Means 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.
Emission	-	The release of constituents into the atmosphere (e.g. gas, steam or noise).
Environmental Impact Statement	-	A formal description of a project and an assessment of its likely impact on the physical, social and economic environment. It includes an evaluation of alternatives and economic justification of the project. The EIS is used as a vehicle to facilitate public comment and as the basis for analysing the project prior to determining the project under relevant legislation.
Estuarine	-	River environment which is influenced by tides.
Fly Ash	-	Light ash component from the coal used to fire the boilers.
Geochemistry	-	Chemistry of the geologic formation.
Groundwater	-	Subsurface water contained within the saturated zone.
Groundwater Mound	-	An area within a natural groundwater surface which is preferentially raised up above the surrounding water levels. Groundwater mounds arise beneath areas where infiltration of surface water occurs at a higher rate that surrounding areas, for example, beneath infiltration ponds, dams, tailings dams and reservoirs.
Habitat	-	The particular local environment occupied by an organism.
Hazardous Waste	-	Any waste that because of its physically, biologically or chemically damaging properties, is capable of causing danger to the life or health of any living thing if it is released into the environment.
Hydraulic gradient	-	The change in static head per unit of distance in a given direction.
Hydrocarbon	-	Compound of hydrogen and carbon. Examples of hydrocarbons include oil and petroleum.
Hydrochemistry	-	Chemistry of groundwater.
Hydrology	-	Surface water and groundwater and their interaction with earth materials.
Inert Waste	-	Any non-liquid waste that, when it is disposed of, is not potentially hazardous or capable of undergoing an

		environmentally significant transformation.
Infiltration	-	The process of surface water soaking into the soil.
In-situ	-	In its original place.
Inter-generational equity	-	The principle that the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations.
Interceptor Trench	-	A trench which creates a drawdown condition in the surrounding area which induces an inward groundwater flow effect in the vicinity of the trench.
Katabatic wind	-	Air which is cooled by the ground at night and flows over sloping land to a valley as cold-air drainage.
L_{A10}	-	Incident noise - the noise level which is exceeded for 10% of the sampling period and is considered to be the average maximum noise level.
L_{A90}	-	Background noise - the noise level which is exceeded for 90% of the sampling period and is referred to as the average minimum or background noise level.
Landfarming	-	Involves the bacteriological breakdown and volatilisation of hydrocarbons during tilling or reworking of the contaminated soils spread to a shallow depth over the ground.
Leachate	-	Liquid released by, or water that has percolated through, waste and which contains dissolved and/or suspended liquids and/or solids and/or gases.
Non-carcinogenic effect	-	A toxicological effect which adversely effects the organism, but does not involve the transformation of cells to cancer cells.
Paleotopography	-	Buried topographic features.
Pan evaporation	-	Evaporation is defined as the quantity of water vapour transferred from a free water surface to the atmosphere. The measurement of evaporation in Australia has been standardised in recent years and observations are now taken by the Class A pan evaporimeter.
Perched groundwater	-	Unconfined groundwater separated from an underlying body of groundwater by an unsaturated zone and supported by an aquitard or aquiclude.
Permeability	-	The property or capacity of a porous rock, sediment, clay or soil to transmit a fluid.

pH	-	A rating used to measure the acidity or alkalinity of a substance or liquid.
Pickling	-	Materials that are to be plated or galvanised are frequently pickled in a weak acid solution and then rinsed in hot water to remove all foreign matter.
Piezometer	-	A pipe in which the elevation of the water level or potentiometric surface can be determined. The pipe is sealed along its length and open to water flow at the bottom.
Porosity	-	In soils, porosity is the ratio of the volume of the soil voids to the total volume.
Potentiometric Surface	-	A surface which represents the standing or total hydraulic head. It represents the levels to which water will rise in tightly cased wells in an aquifer system. The watertable is the potentiometric surface of an unconfined aquifer.
Precautionary Principle	-	The principle that if there are threats of serious or irreversible environmental damage, lack of scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.
Proponent	-	The body putting forward a proposal; in the case of this EIS, BHP is the proponent.
Recovery well	-	Constructed to impose an inward groundwater flow gradient whereby contaminated groundwater is extracted from a series of recovery wells and pumped to the surface.
Rehabilitation	-	Restoration of an area, disturbed by a particular landuse i.e. mining, to a suitable landform and environmental quality.
Remediation Criteria	-	Upper concentration level to which contaminants of concern will be remediated to.
Retention/Sedimentation ponds	-	A pond constructed to temporarily contain wet weather run-off and allow suspended matter to settle to the bottom for surface water quality management.
Risk assessment	-	Process by which scientific data (i.e. soil, surface water, groundwater, sediment quality) are analysed to describe the likelihood of harm to humans or the environment. It is used to facilitate the management of risk
Screening	-	The separation of fine and coarse materials through a physical process.

Silt fence	-	A geotextile product used to limit sedimentation transfer in overland water flow.
Site remediation	-	The clean-up or mitigation of pollution and/or contamination of soil and waters by various methods.
Slag	-	A non-metallic by-product resulting from the smelting and refining of metals.
Soil washing	-	A volume reduction process in which the larger particles of soil are separated from the finer particles.
Species	-	Any of the taxonomic groups into which a genus is divided.
Stabilisation	-	Method of preventing migration of contaminants.
Taxon	-	(pl. taxa) The named classification unit to which individuals or sets of species are assigned, such as species, genus and order.
Thermal desorption	-	A remediation technique which uses a heat source for volatilising organics from the soil, and an off gases treatment system and a particulate collection system for removing particulates.
Total Suspended Particulates	-	Concentration of lead and other heavy metals in air according to EPA sampling methods and analysis.
Validation	-	Assurance that specified end points of remediation criteria have been met.
Vapour Extraction	-	Involves the removal of volatile organic compounds from subsurface soils by mechanically drawing or venting air through the soil matrix.

ES.1 INTRODUCTION

This Environmental Impact Statement (EIS) has been prepared by AGC Woodward-Clyde Pty Limited for Austral Brick Company Pty Ltd (Austral), Horsley Park, NSW. The EIS has been prepared to assess the potential environmental impacts of the proposed continuation of quarrying activities in Void 1 which would result in the westward extension of the void towards Wallgrove Road. As quarrying activities proceed, the void would be rehabilitated through landfilling.

The assessment of environmental impacts of the proposal was carried out in accordance with Part 4 of the Environmental Planning and Assessment Act and the Environmental Planning and Assessment Regulation, 1994. The effects of the proposal on landform, geology, soils, water quality, air quality, the noise environment, flora and fauna, traffic and transportation, surrounding land uses, the socio-economic environment, and heritage and archaeology are assessed in the EIS.

ES.2 NEEDS AND OBJECTIVES

The project would provide a viable extraction and landfilling option which would satisfy demand in the western Sydney area and would be affectively designed and managed, to enable restoration and rehabilitation of the site for a future desirable use.

The project has a number of significant benefits:

- It provides for an expansion of existing extraction operations on site providing a significant resource for brick making operations;
- It satisfies the demand for landfill space identified within the Sydney region owing to the limited capacity and lifespan of current landfill operations;
- It enables a viable use for Void 1 and ensures that the void does not remain as an eyesore in the surrounding landscape or that the land becomes degraded;
- It provides an opportunity to progressively rehabilitate the land by staging landfill activities and revegetating areas which have been filled, according to a comprehensive revegetation strategy; and
- It enables use of the land for purposes which are compatible with the objectives of the Draft Regional Environmental Plan for the Western Sydney Open Space corridor (currently being prepared by DUAP).

ES.3 STUDY AREA AND ALTERNATIVES

Horsley Park is located in the western suburbs of Sydney approximately 35 km west of Sydney CBD, in an area which has traditionally been predominantly rural residential developed for market gardening and horticultural purposes. Other land uses in the area include extractive industries, landfills, Prospect Reservoir and various recreational facilities.

The Austral Bricks premises are located on the eastern side of Wallgrove Road, some 2.7 kilometres south of the F4 Western Freeway. Horsley Road forms the eastern boundary and the Sydney Water Supply Pipeline on the northern boundary provides an effective barrier between the project site and Waste Service's Eastern Creek Waste Management Centre . An

overhead transmission line is located along the southern boundary. The Austral Bricks property has an area in the order of 120 ha.

The site contains three voids (Void 1, 2 and 3) from which quarry material is extracted, two brick manufacturing plants, two brick and paver stockpile areas, two crushing plants, an administration building, sales building and weighbridge. The land which is the subject of this proposal is some 25 ha and extends from Eastern Creek, west to Wallgrove Road and contains Void 1.

The proposal is site specific so consideration of location alternatives was not necessary. However, the suitability of the project site for continued extraction and landfilling purposes was assessed using site selection principals for landfills which were developed by DUAP. The principles of site selection include:

- whether the location has been identified in any strategic waste management plan;
- permissibility of the land use;
- avoiding environmentally sensitive areas;
- compatibility with surrounding land uses; and
- site investigations to confirm suitability.

A variety of alternative waste treatment and disposal options were considered including, incineration, composting, waste transfer and landfilling. The proposed landfill was considered the most appropriate option for waste management in the area given that it would be designed to incorporate environmental safeguards and recycling facilities, and that alternative waste treatment technologies have not been proven to be economically viable waste management alternatives to landfill in NSW.

ES.4 CONSEQUENCES OF NO ACTION OR DEFERRAL

If the proposal did not proceed or was deferred, clay and shale resources contained within the property may not be utilised by Austral, additional landfill capacity would not be provided and Void 1 would not be rehabilitated to a state suitable for redevelopment.

ES.5 PROJECT DESCRIPTION

The key elements of the proposal include:

- Extraction of any suitable clay/shale material from the void to be used by Austral in their brick manufacturing operations. Existing brick making operations, together with all other ancillary activities, would continue at the site.
- Excavation and retention in stockpiles of overburden of up to around 3.7 million m^3 for use as landfill cover material and for site rehabilitation.
- Landfilling of some 300 000 tonnes per annum of Class 2 Solid Waste (inert waste and all solid wastes with the exception of putrescible wastes) and progressively rehabilitating the landfill area.

ES.6 CONSULTATION

Statutory authorities participated in the planning process at an early stage of the proposal. At a Planning Focus Meeting held on 14 August 1997 statutory authorities were given the opportunity to make comments or voice concerns regarding the proposed works. The authorities who attended the meeting included DUAP, Fairfield City Council, Blacktown City Council, NSW EPA, the NSW Department of Mineral Resources, the Western Sydney Waste Board, Sydney Water, the NSW Roads and Traffic Authority, and the Southern Western Sydney Public Health Unit.

ES.7 LANDFORM, GEOLOGY, SOILS AND GEOTECHNICAL

The subject site generally reflects topography of the Minchinbury/Horsley Park area which is characterised by rolling terrain with low to moderate relief. The property is dominated by a hill at the south-western edge of the study area, and Void 1 with an elevation of around 92 mAHD.

Void 1 is divided into two zones; the lower platform in the eastern portion from where material has been extracted for the brickworks, and the upper platform in the western portion which is being stripped in preparation for mining activities. The upper platform is at an elevation of approximately 70 mAHD. The western corner of the lower platform is at a lower elevation of some 55 mAHD. The north-western corner of the pit is currently inundated to an elevation of approximately 51 mAHD with stormwater which has accumulated at the lowest point within the quarry area.

The geology underlying the site comprises a silty clay topsoil, clayey residual soil and weathered Bringelly Shale. Fill materials comprising clay and shale, with some sand, gravel, plastic and brick fragments are also present on the site.

Construction of a new access road, extension of Void 1, progressive filling of the void and creation of a final landform may give rise to erosion and sediment transport. However, with the use of familiar and proven construction and operating guidelines and safeguards, no adverse impacts are expected with respect to landform, geology, soils and geotechnical issues.

ES.8 WATER QUALITY AND HYDROLOGY

The hydrogeological regime under the site is one common to the Western Sydney area. The Bringelly Shale formation displays low hydraulic conductivity and contains groundwater that is saline. Interaction between surface waters and groundwater is limited by the surface clays, which act as a confining layer on the rockmass underlying the area.

No adverse impact is expected from site activities on the surrounding surface waters provided that the potential for turbid or contaminated run-off to reach Eastern Creek and to leave the site, is minimised by implementing surface water control measures.

By the maintenance of an inward hydraulic gradient for the duration of the landfilling operation and for some time after closure, leachate would be prevented from escaping from the site. Eventually, water levels within the landfill would recover to a level higher than the surrounding groundwater, thus reversing the hydraulic gradient. At that time, it is expected that the leachate would have matured to a liquid, having characteristics that would be indistinguishable from the natural groundwater.

ES.9 METEOROLOGY AND AIR QUALITY

Suspended particulate matter (dust) and odorous emissions are the main atmospheric pollutants of concern in the area due to the presence of the Eastern Creek Waste Management Centre and numerous brickworks and market Gardens.

During the proposed extraction and landfilling activities dust would be generated from loading and unloading of stockpiles, on-site traffic on unsealed roads, wind erosion from stockpiles, tipping of waste at the active face of the landfill and from the compaction of waste material. Mitigation measures would be implemented to ensure that an acceptable level of dust control is achieved. These mitigation measures would include using water trucks to suppress dust on internal roads, ceasing work during very windy conditions and rehabilitating worked areas as soon as practicable.

As the proposed landfill will only be accepting non-putrescible waste, odorous emissions resulting from the aerobic or anaerobic decomposition of landfill matters will be insignificant.

ES.10 NOISE

During the extraction and landfilling activities, noise generation would primarily be from heavy machinery used to remove clay and shale from Void 1, construct the landfill, place waste in the void and spread waste and landfill cover material. Noise would also be generated by vehicles transporting waste to the project site.

Noise levels from the proposed works were predicted using an Environmental Noise Model which indicated that noise impacts can be maintained within acceptable EPA guidelines provided effective noise barriers such as screening banks are put in place.

ES.11 TRAFFIC AND TRANSPORTATION

The proposed extraction and landfilling activities would generate additional traffic volumes as a result of construction of the landfill and associated infrastructure, transport of solid waste to the site for landfilling and personnel commuting to and from the site. By constructing a vehicle turning lane at the entrance of the site, sealing the landfill access road where it intersects Wallgrove Road, signposting the entrance/exit to the landfill access road and retaining heavy equipment on-site, the impact of the proposed works on traffic flow and road conditions would be minimised.

ES.12 FLORA AND FAUNA

Two vegetation communities were identified on-site. A stand of open woodland is located along the western perimeter of the site and in the vicinity of the sales office, and creekline woodland is located along Eastern Creek.

The proposal would not result in the loss of vegetation or fauna habitat on-site.

ES.13 SOCIO-ECONOMICS

The overall socio-economic benefits of the project are positive. The continuation of extraction activities at the site would result in economic benefits for Austral, as well as economic benefits to the community in the form of job security and the utilisation of a

regionally significant resource. Landfilling activities would satisfy the demand for landfill space in the Sydney region, and would rehabilitate the site for recreation or other uses which would improve the amenity of the local area.

ES.14 ARCHAEOLOGY AND HERITAGE

No aboriginal heritage sites were identified during the field survey. Given that numerous Aboriginal archaeological sites have been found throughout the region, it is highly likely that the site and the areas surrounding the site were once occupied by Aborigines. Had aboriginal sites such as open camp sites and artefact scatters once been present at the site, they would have been buried, destroyed or disturbed by past activities.

A search of the NPWS Register of known Aboriginal Sites revealed that no archaeological sites have been recorded within a 5 km radius of the site of the proposed landfill.

The site contains no items of heritage significance and no historic sites listed by the Heritage Council of NSW occur on the Project Site.

ES.15 LANDSCAPE AND VISUAL

An observation study was undertaken at vantage points surrounding the site. It indicated that several of the vantage points only possess long, partially-restricted views into the site, that vegetation along the eastern and western boundaries of the site shield the proposed landfill area, and that the proposed works would not be out of context with the land use in the surrounding areas. The impact on the visual amenity of the local environment as a result of the proposed works would therefore be negligible.

ES.16 LAND USE AND PROPERTY

Land uses in the area include extractive industrial operations, landfills, rural and rural residential areas, horticulture, market gardens, an amusement park, an electricity substation and Prospect Reservoir water storage.

The Sydney Water Supply Pipeline which connects Warragamba Dam to Prospect Reservoir runs along the northern boundary of the site. Further north is Waste Service's Eastern Creek Waste Management Centre, Autel landfill and Eastern Creek Raceway. Australia's Wonderland amusement park is located approximately 2 km north-west of the subject site. An extensive area containing rural residential and market garden activities lies to the west and south of the site.

The proposed landfilling activities would have minimal impact on existing land use at the site and on the land use of areas surrounding the site. Upon completion of landfilling activities, the site would be rehabilitated and returned to a state which would enable development for a number of regional recreation, open space and leisure purposes, and in doing so would satisfy strategic planning land use outcomes for the area.

ES.17 STATUTORY PLANNING AND CONTROLS

The project site is located within Fairfield Local Government Area and is governed by the provisions of Fairfield Local Environmental Plan 1994 (LEP 1994). The site is zoned 6(c) Recreation Corridor. The proposed works are permissible with development consent.

The State Environmental Planning Policies which are applicable to the project are State Environmental Planning Policy No.11 - Traffic Generating Development, State Environmental Planning Policy No.44 - Koala Habitat Protection and State Environmental Planning Policy No.46 - Protection and Management of Native Vegetation.

The Regional Environmental Plans which apply to the project are Sydney Regional Environmental Plan No.9 - Extractive Industry (No.2) and Draft Sydney Regional Environmental Plan No.20 Hawkesbury-Nepean River 1996.

ES.18 ECOLOGICALLY SUSTAINABLE DEVELOPMENT

The Commonwealth Government defined ecologically sustainable development (ESD) 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 which would assist in the achievement of ESD include:

- The precautionary principle.
- Inter-generational equity.
- Conservation of biological diversity and ecological integrity.
- Improved valuation and pricing of environmental resources.

The proposed works incorporate environmental and economic objectives which collectively summarise the principles of ESD. It fully embraces the principles of ESD and would, following rehabilitation, provide a landform with vegetation endemic to the region which enhances the ecological and habitat value of the local area.

ES.19 HAZARDS AND RISKS

The environmental risks, potential impacts of the proposed development and the ameliorative measures required to alleviate these risks, have been addressed throughout the EIS. These measures would be built into site operating procedures and contingency plans for the extraction, landfilling and rehabilitation phases of the project.

The implementation of a HASP would ensure that on-site personnel would be protected from unacceptable risks from exposure to hazards. The HASP would contain policies and procedures to protect workers and the public from potential hazards, and would be put in place prior to the commencement of works.

ES.20 PESTS AND VERMIN

It is not anticipated that vermin would be a major problem at the site as only inert, non-putrescible solid waste would be received at the landfill, and landfill management procedures would be used to prevent any build-up of vermin populations. Such procedures would include covering waste regularly, compacting waste and ensuring water does not pond on the surface of the site and thereby propagate mosquito breeding.

ES.21 CUMULATIVE IMPACTS

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. The cumulative impact of a project is a combination of each elemental impact of the project. The impact of individual projects within a locality is also considered to be cumulative.

As these works would take place over an extended period of time and the impact of individual factors is considered to be minimal, no significant cumulative impact is anticipated from the project. The cumulative impact of the proposed works with other known projects proposed for the area, is also considered to be minimal.

ES.22 ENVIRONMENTAL MANAGEMENT

Environmental management of the proposed excavation, extraction and landfilling activities would ensure that the project has minimal impact on the physical, social and economic environments of the region. An Environmental Management Plan incorporating appropriate safeguard measures for the detailed design of the project and the contractual arrangements associated with the proposed works, would ameliorate adverse impacts on the environment associated with the general site works.

A Draft Landfill Environmental Management Plan (LEMP) has been prepared in order to identify key environmental management issues and detail the site specific strategic approach that Austral would put in place to meet the Environmental Goals for the landfill's operation as identified in the Environmental Guidelines: Solid Waste Landfills (Landfill Guidelines), EPA, 1996. The Draft LEMP documents procedures aimed at controlling discharges to waters, controlling atmospheric emissions, promoting responsible land management and conservation, and preventing hazards and loss of amenity.

ES.23 FINDINGS

The project would provide for an expansion of existing extraction operations on-site providing a significant resource for brick making operations. It satisfies the demand for landfill space identified within the Sydney region owing to the limited capacity and lifespan of current landfill operations. It would also provide an opportunity to progressively rehabilitate the land by staging landfill activities and revegetating areas which have been filled.

The assessment of the possible effects of the proposal on the environment indicates that there is potential for minimal adverse impacts. These impacts, although minimal can be ameliorated by the safeguards recommended in this EIS.

1.1 THE ENVIRONMENTAL IMPACT PROCESS

The environmental Planning and Assessment Act, 1979 (EP&A Act) provides a system of environmental planning and assessment for New South Wales (NSW). It is a requirement of the EP&A Act that an assessment of the environmental impacts of a proposal must be undertaken prior to any decision to proceed with that proposal.

This Environmental Impact Statement (EIS) has been prepared in accordance with Part 4 of the EP&A Act and the Environmental Planning and Assessment Regulation, 1994 (the Regulation). Part 4 deals with environmental planning control and relates to development which is controlled by an environmental planning instrument (EPI).

The proposed continuation of quarrying activities followed by landfilling and site rehabilitation are identified in Schedule 3 of the Regulation as designated development and hence Section 77(3) (d) of the EP&A Act requires that an EIS be prepared and accompany a development application. Clause 52 requires that the EIS shall have regard to the requirements of the Director-General of Planning. A copy of these requirements is included in Appendix A.

The EIS must also include a certificate required under Clause 50 of the regulation.

The overall environmental impact assessment process for this EIS is shown in Figure 1.1.

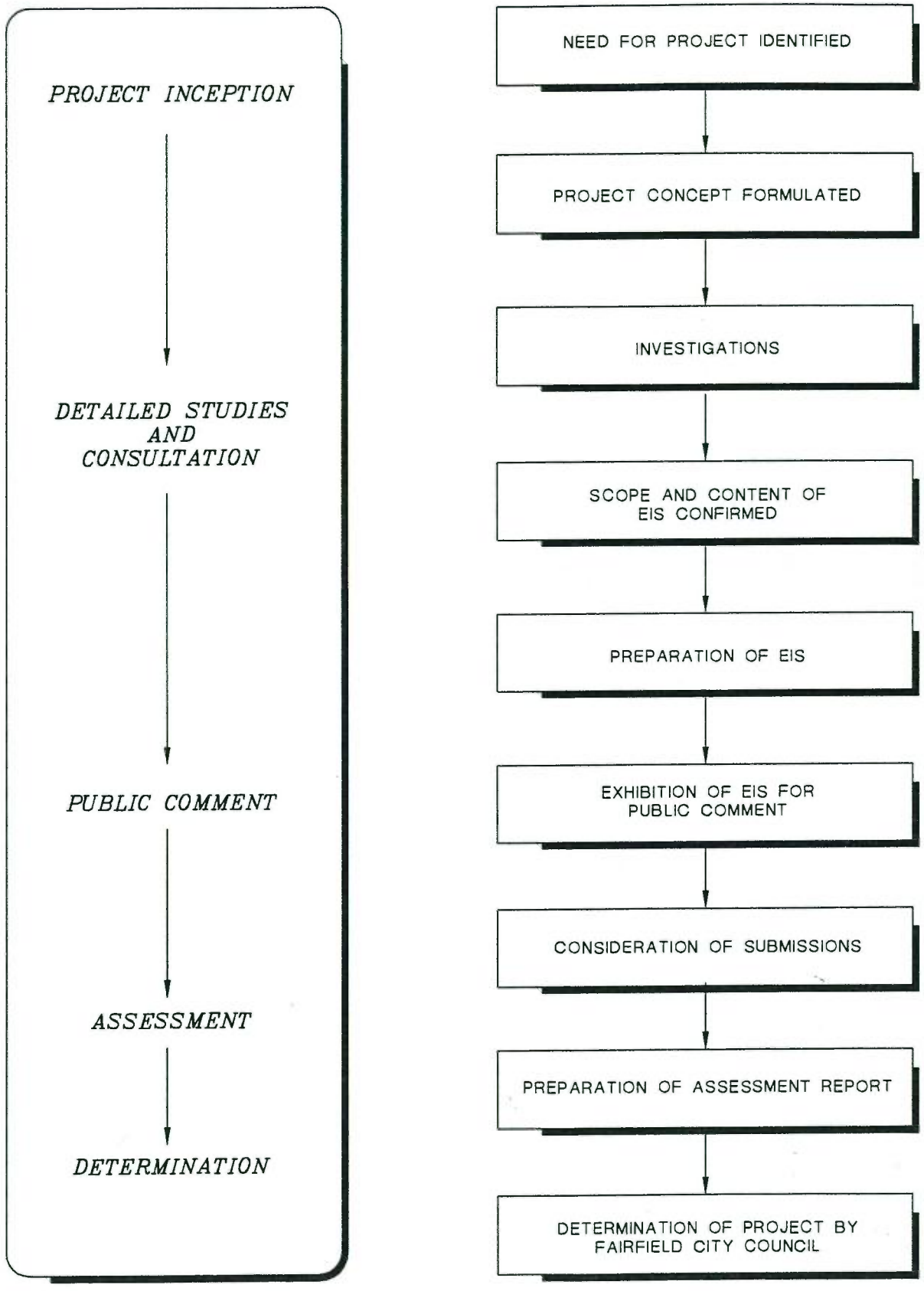
1.2 APPROVALS REQUIRED

On submission of the EIS, a number of approvals and licences would be required for the project to proceed. The relevant statutes which set out these requirements include those listed in Table 1.1.

Table 1.1
LIST OF STATUTES

STATUTE
Clean Air Act, 1961
Clean Waters Act, 1970
Dangerous Goods Act, 1975
Environmental Offences and Penalties Act, 1989
Environmental Planning and Assessment Act, 1979
Local Government Act, 1993
National Parks and Wildlife Act, 1974
Noise Control Act, 1975
Occupational Health and Safety Act, 1983
Pollution Control Act, 1970
Protection of the Environment Administration Act, 1991
Soil Conservation Act, 1938
Waste Minimisation and Management Act, 1995

Approvals and licences required by the statutes listed in Table 1.1 include:



Woodward-Clyde

CLIENT
AUSTRAL BRICK COMPANY PTY LTD

PROJECT
AUSTRAL BRICK SOLID WASTE LANDFILL EIS

REVISION: A	DESIGNED: ST
SCALE: AS SHOWN	DRAWN: HC
DRAWING No: AS601191/0540	CHECKED: SLT
CAD FILE NO: G.046	APPROVED: CB
DATE: 20/11/97	STATUS: FINAL

TITLE
ENVIRONMENTAL IMPACT ASSESSMENT PROCESS

FIGURE
1.1

A4

- Development Consent under the Environmental Planning & Assessment Act, 1979;
- Pollution Control Approval under the Pollution Control Act, 1970;
- Licence under the Clean Waters Act, 1975;
- Permit under the Soil Conservation Act, 1938;
- Licence under the Water Act, 1912; and
- Licence under the Waste Minimisation and Management Regulation, 1996.

Contractors would also be required to comply with all statutory requirements which relate directly to work practices.

1.3 INTERDISCIPLINARY INVESTIGATIONS

The preparation of the EIS has involved interdisciplinary investigations by a number of technical experts.

The study team members are listed in Appendix A.

The investigations included:

- a review of relevant information;
- consulting with Fairfield and Blacktown City Councils, and relevant government departments and statutory authorities to identify their requirements for matters to be addressed;
- scoping of relevant issues;
- responding to issues raised during the consultation phase;
- undertaking specialist studies, field work, research and assessment of findings;
- evaluating information; and
- analysing and presenting information.

1.4 SCOPE OF ENVIRONMENTAL IMPACT ASSESSMENT

Specialist assessments were conducted in the following matters:

- landfill design;
- environmental monitoring and management of the quarrying activities and the landfill;
- topography, geology and soils;
- geotechnical issues;
- hydrology;
- water quality;
- meteorology and air quality;
- noise impacts;
- flora and fauna;

- visual analysis;
- traffic and transportation;
- socio-economic issues;
- land use, planning and zoning;
- archaeology and heritage;
- current ecological issues;
- hazards and risks;
- pest and vermin control;
- construction impacts; and
- cumulative impacts.

The scope of work undertaken for this EIS has been established to meet the requirements of:

- relevant government legislation;
- the community;
- Department of Urban Affairs and Planning (DUAP);
- relevant government departments and statutory authorities; and
- the proponent.

1.5 THE PROPONENT

Austral Brick Company Pty Ltd (Austral) is a publicly owned company which manufactures bricks, blocks, tiles and pavers. Austral has quarries and brick manufacturing premises at Horsley Park, Eastwood, Brookvale, Punchbowl and Rochedale. Austral employs a total of 600 employees of which 350 work at the Horsley Park premises.

1.6 BACKGROUND TO THE PROJECT

Austral proposes to continue quarrying activities in Void 1 which would result in the westward extension of the void towards Wallgrove Road. As quarrying activities proceed the void would be rehabilitated through landfilling. The three key elements of the proposed works include:

- Any suitable clay/shale extracted would be used by Austral in their brick manufacturing operations. Existing brick making operations, together with all other ancillary activities, would continue at the site.
- Excavation and retention in stockpiles of overburden of up to around 3.7 million m^3 for use as landfill cover material and for site rehabilitation.
- Landfilling of some 300 000 tonnes per annum of Class 2 Solid Waste (inert waste and all solid wastes with the exception of putrescible wastes) and rehabilitating the landfill area.

Excavation, extraction and landfilling activities would be staged to enable progressive rehabilitation of Void 1 and its extension and the return of this portion of the site to a landform compatible with the pre-existing Cumberland Plain topography. Land uses which

could be accommodated on site following site rehabilitation would be compatible with the objectives of the Draft Regional Environment Plan for Western Sydney Open Space Corridor currently being prepared by DUAP.

2.1 WASTE MINIMISATION AND MANAGEMENT PRACTICES

2.1.1 Overview

The *Waste Minimisation and Management Act 1995* provides guiding principles for the management of waste including a requirement for 60% reduction in the amount of waste disposed of in NSW and the establishment of a waste management hierarchy based on parameters including avoidance, re-use, recycling, reprocessing and disposal.

The Act provides a strategic approach to waste management by calling for the establishment of Waste Management Regions which:

- *provide for an integrated approach to the assessment and planning of waste management;*
- *ensure that waste planning and management is undertaken in an efficient and cost-effective scale; and*
- *ensure that regional waste management activities reflect State wide policy.*

2.1.2 The Waste Catchment

The waste catchment determined by the Act relates to NSW as a whole. It comprises eight Waste Boards set up by the State Government to develop a regional strategic approach to waste management.

The project site falls within the area managed by the Western Sydney Waste Board (WSWB) which comprises Bankstown, Baulkham Hills, Blacktown, Fairfield, Hawkesbury, Holroyd, Liverpool, Parramatta and Penrith Local Government areas. Each Council has a nominated person(s) on the Board which has clear objectives for waste management including:

- *to co-ordinate the waste services provided in and for the Waste Board's waste management region;*
- *to ensure that the constituent councils adopt efficient waste management practices and policies; and*
- *to operate in accordance with the principles of ecologically sustainable development (ESD).*

2.2 STATE AND REGIONAL INITIATIVES

State waste initiatives are managed by the State Waste Advisory Committee set up by the Minister for the Environment. The committee advises the Minister on waste reduction priorities, state wide waste reduction programs, regional waste plans and the funding and implementation of waste reduction programs.

The WSWB reports to the State Waste Advisory Committee. A *Draft Regional Waste Plan for the Western Sydney Region* (1997) has been prepared by the WSWB with the objective of reducing waste to landfill by 60% by the year 2000, according to the principles of ESD.

2.3 WASTE MANAGEMENT OBJECTIVES

The *Waste Minimisation and Management Act 1995* has as its two main principles:

- *the achievement by the end of 2000 of a 60% reduction in the amount of waste disposed of in New South Wales (being a per capita reduction based on 1990 disposal rates); and*
- *establishment of a waste management hierarchy of the following order:*
  - *avoidance;*
  - *re-use;*
  - *recycling and reprocessing; and*
  - *disposal.*

The draft Regional Waste Plan states that diversion of waste from landfill could be achieved by:

- avoidance and domestic recycling;
- recycling and re-use of building/demolition and commercial/industrial materials;
- green or organic composting (domestic and commercial/industrial); and
- energy recovery by anaerobic and/or refuse derived fuel processes.

Waste diverted to landfill would be limited to commercial and industrial waste, building and demolition waste (which is not capable of being recycled or re-used) and domestic waste.

To effectively manage waste diverted from landfill, the Plan states that a number of systems need to be developed to recover, manage and trade all of these resources including:

- *establishment of transfer centres that can receive and treat mixed waste from the domestic and commercial sectors;*
- *establishment of community drop-off and processing centres where members of the public can discard all types of unwanted materials;*
- *provision of specialist secondary resource sorting and reprocessing operations to serve the region including facilities for:*
  - *sorting/transfer of building and demolition waste;*
  - *recovery of materials from council recycling and collection services and commercial/industrial waste transporters;*
  - *composting green waste;*
  - *energy recovery from prestablished materials; and*
  - *specialist recovery of wood waste, metals, plastics, oils, tyres, electronic scrap, paper/cardboard, textiles etc.*

  (Western Sydney Waste Board 1997)
- *establishment of a Waste Exchange Information Service which provides a direct link between generators of waste and potential re-users; and*

- *development of pricing policies and structures which offer economic incentives in order to encourage accountability for waste generation.*

A number of these initiatives are discussed further in Section 3.4.2.

2.4 PROJECT OBJECTIVES

Long term trends considered by the Western Sydney Waste Board show that Sydney's growing population is discarding increasing levels of solid waste and in doing so is placing pressure on landfill space in Sydney. Efforts to reduce the level of waste sent to landfill have not achieved their stated goal and the reserve landfill space available for waste disposal at current landfilling rates is steadily diminishing.

This project aims to provide a viable extraction and landfilling option which would satisfy demand in the western Sydney area and would be affectively designed and managed, to enable restoration and rehabilitation for a future desirable use.

The primary objectives of the project are:

- continued extraction of a regionally significant resource;
- provision of a new landfill which would be operated in a cost effective and environmentally responsible manner;
- design of the landfill to allow progressive rehabilitation; and
- restoration of the landform to enable future reuse compatible with the objectives of the Draft Regional Environmental Plan for the Western Sydney Open Space Corridor currently being prepared by DUAP.

2.5 PROJECT DEMAND

2.5.1 Waste Generation

Waste in the region managed by the WSWB is expected to increase in the period up to 2001 at a rate relative to population growth. The WSWB estimated that population in the area would increase by 13% in the period 1991-2001 with the most significant growth occurring in Liverpool, Baulkham Hills, Blacktown, Fairfield and Penrith.

In 1996, the WSWB estimated that 483 000 tonnes of Municipal waste was generated in the Waste Board Region, with Blacktown and Parramatta contributing the greatest tonnage levels per capita in the region. By the year 2000, the total Municipal waste is expected to be in the order of 523 000 tonnes.

The largest component of waste found in domestic garbage are organics including food waste, lawn clippings and tree cuttings (72%). Paper products account for 10% of the total and plastics account for 5%. The proposed landfill would accept domestic refuse with the exception of organics and household hazardous waste.

Commercial and industrial waste contributed a further 448 000 tonnes in 1996 (WSWB 1997). Fairfield, Blacktown and Penrith contributed the highest level of commercial and industrial waste within the region. Waste generated by this sector reflects fluctuating economic conditions and volumes are therefore never stable. Similarly, the building and demolition

waste sector responds to economic conditions, particularly the demand for housing. Waste generated by this sector in 1996 was 231 815 tonnes per year.

The *EPA Waste Census March 1997, Version 2* estimated that 46% of the total commercial and industrial waste sector consists of paper/cardboard, soil rubble (<=150mm) and wood timber. Soft and hard plastics contributes 13% of the total waste sector. Soil/rubble (<=150mm) comprises 36% of the total building and demolition waste sector. Clay waste, concrete waste and wood/timber waste comprises 17%, 15% and 12% respectively. Waste Service 1993 found that while there was no component of putrescible food type waste in building and demolition waste, one fifth of waste generated by commercial and industrial activities comprised putrescible food type waste.

The proposed landfill would have access to a potential solid waste market comprising:

- 358 400 tonnes per annum of commercial and industrial waste (80% of total available);
- 231 815 tonnes per annum of building and demolition waste (100% of total available); and
- 135 240 tonnes of domestic waste (28% of total available).

(These figures are based on waste generated in 1996 (WSWB 1997)

A potential solid waste market of 725 455 tonnes per annum could be potentially sourced across all waste generating sectors for the proposed landfill. The waste catchment for the proposed landfill is likely to be similar to that identified by CMPS&F (1997) for the proposed PGH landfill at Horsley Park. The potential sources of wastes were identified to be primarily from the Western suburbs Sydney including Penrith, Liverpool, Fairfield, Blacktown, Holroyd and other surrounding suburbs. CMPS&F (1997) identified that waste could be sourced from areas further field including the northern beaches.

Estimates derived for the PGH proposed landfill at Horsley Park which is in close proximity to the site were in the order of 865 000 tonnes of potential solid waste per year, comprised of commercial and industrial waste and building and demolition waste (CMPS&F 1997). The estimate did not include any component of Municipal waste. These estimates are in excess of those predicted for the proposed landfill and are based on waste levels generated per capita. This EIS has adopted a more conservative and prudent approach adopting the levels endorsed by the *draft Regional Waste Plan for the Western Sydney Region 1997*.

2.5.2 Landfill Consumption Rates

The region provides 17 Solid Waste Class 2 (Non-putrescible and demolition solid waste landfills) and 2 Solid Waste Class 2 landfills which accept scrap tyres at locations shown in Table 2.1.

Table 2.1

SOLID WASTE LANDFILL CLASS 2 - LICENCED WASTE FACILITIES IN THE REGION

Area	Facility Category	Description	Applicant Name	Premises	Premises Address	Premises Suburb
Blacktown	Solid Waste Class 2	Non-putrescible & demolition solid waste landfill	Riverstone Waste Disposals Pty	Riverstone Waste Depot	Burfitt Rd	Riverstone
Blacktown	Solid Waste Class 2	Demolition solid waste	V&D	V&D HLEBAR	North St	Schofields
Blacktown	Solid Waste Class 2	Demolition solid waste	Autel Sales Pty	Eastern Creek Raceway	Horsley Rd	Eastern Creek
Liverpool	Solid Waste Class 2	Solid waste landfill	Brandown Pty	Brandown Pty Ltd	Elizabeth Drive	Cecil Park
Liverpool	Solid Waste Class 2	Demolition solid waste	Maron Investments Pty	Benedict Sands	Riverside Rd	Moorebank
Liverpool	Solid Waste Class 2	Demolition solid waste	Echo Dairies Pty	Echo Dairies	Newbridge Rd	Moorebank
Holroyd	Solid Waste Class 2	Non-putrescible and demolition solid waste landfill	Holroyd City	Holroyd City Council Depot	Hyland Rd	Greystanes
Penrith	Solid Waste Class 2	Non-putrescible and asbestos waste landfill	Camide Pty	Camide Pty Ltd	Torkington Rd	Londonderry
Penrith	Solid Waste Class 2	Non-putrescible and asbestos waste landfill	Kari & Ghossayn Pty	Kari & Ghossayn Pty Ltd	Clifton Ave	Kemps Creek
Penrith	Solid Waste Class 2	Non-putrescible and demolition solid waste landfill depot	Enviroguard Pty	Erskine Park Landfill & Recycling Depot	Mamre Rd	Erskine Park
Penrith	Solid Waste Class 2	Demolition solid waste	Teuma	CP Teuma	Springwood Rd	Agnes Banks
Penrith	Solid Waste Class 2	Non-putrescible & demolition solid waste landfill	Pacific Waste Management Pty	Pacific Waste Management Pty Ltd	Elizabeth Drive	Kemps Creek

Area	Facility Category	Description	Applicant Name	Premises	Premises Address	Premises Suburb
Penrith	Solid Waste Class 2	Demolition solid waste landfill	Penrith City	Nepean River Banks	River Rd	Penrith
Penrith	Solid Waste Class 2	Non-putrescible and demolition solid waste landfill	Penrith Waste Services Pty	Penrith Waste Services Pty Ltd	842 Mulgoa Rd	Mulgoa
Hawkesbury	Solid Waste Class 2	Demolition solid waste	FD Leal Pty Ltd T/A Richmond	Richmond Produce	103 Francis St	Richmond
Hawkesbury	Solid Waste Class 2	Scrap motor vehicle tyre landfill	Pincott; Elizabeth T/A Correct	Correct Tyre Disposals	End Level Crossing Rd	Vineyard
Hawkesbury	Solid Waste Class 2	Scrap motor vehicle tyre landfill	Porter	RH Porter	Ebenezer Wharf Rd	Ebenezer
Hawkesbury	Solid Waste Class 2	Demolition solid waste	Terry	Terry Allen	Cornwallis Rd	Windsor
Hawkesbury	Solid Waste Class 2	Demolition solid waste	Wouldoughby	South Windsor Landfill	George St	South Windsor

Source: WSWB 1997

The PGH proposed landfill at Horsley Park also fits into the Solid Waste Class 2 category. The Waste Services NSW, Eastern Creek Waste Depot to the north is classified as a Solid Waste Class 1 facility as it accepts putrescible waste.

The Waste Management Green Paper (1992) concluded that '*Sydney's landfill capacity would be, close to exhaustion by the end of the decade*'

This prediction is however difficult to measure especially in the context of this EIS due to the lack of available information on the lifespan of landfills listed in Table 2.1. Landfill owners are also reluctant to provide data on the proportion of waste accepted at each landfill, as this information is commercially sensitive and is closely guarded from potential competitors.

Waste Services estimated in 1995 that by the end of 1991, less than 6 years of landfill capacity would be available in the Sydney region. By mid 1995, the landfill space available had extended to satisfy a waste disposal timespan (at current filling rates) of 9 years. Since then the Waste Service's Eastern Creek Waste Management Centre is the only sizeable landfill to have established in the region.

The lack of long term waste disposal options within Sydney, focuses attention on any remaining voids within the region. Given the limited capacity still available at landfills within the region, the short lifespan left in remaining landfills for acceptance of non putrescible waste and the continued need for waste disposal to landfill in spite of conscious efforts to direct waste away from landfills (ie. recycling), potential for use of existing voids for landfilling purposes requires serious consideration.

2.6 PROJECT BENEFITS

The project has a number of significant benefits:

- It provides for an expansion of existing extraction operations on site providing a significant resource for brick making operations;
- It satisfies the demand for landfill space identified within the Sydney region owing to the limited capacity and lifespan of current landfill operations;
- It enables a viable use for Void 1 and ensures that the void does not remain as an eyesore in the surrounding landscape or that the land becomes degraded;
- It provides an opportunity to progressively rehabilitate the land by staging landfill activities and revegetating areas which have been filled, according to a comprehensive revegetation strategy; and
- It enables use of the land for purposes which are compatible with the objectives of the Draft Regional Environmental Plan for the Western Sydney Open Space corridor (currently being prepared by DUAP).

2.7 REHABILITATION NEEDS

The proposal involves rehabilitation of the site to mould the land to a landform with similar relief to the surrounding landscape. The project site can then be developed for recreation or other uses compatible with the objectives of the Draft Regional Environmental Plan for the Western Sydney Open Space Corridor (currently being prepared by DUAP). Management and staging of the waste disposal operation would be designed in a manner which enables progressive rehabilitation of the site. A landscape strategy which contains a comprehensive revegetation program with species endemic to the local area and the Cumberland Plain, would significantly contribute to the ecological and habitat value of the locality. Rehabilitation of Void 1 by landfilling would enhance the ecological sustainability of the area and provide considerable benefits to the local ecosystem, compared with potential environmental degradation which may occur if the void is left vacant and not considered for another use.

2.8 ECOLOGICALLY SUSTAINABLE DEVELOPMENT

Worldwide trends in waste management are currently targeting a significant reduction in waste disposal per capita, the efficient use of scarce resources and the avoidance of the environmental impacts associated with waste disposal. This trend is compatible with the principles of ESD discussed in greater detail in Section 17.

As stated previously, the NSW Government has set a target of reducing waste by 60% per capita by the year 2000 (using 1990 as the base year). While it is recognised that some waste would inevitably have to be disposed of to landfill, a significant proportion of waste including green waste, building and demolition wastes and items such as paper and packaging can be re-used, recycled or reprocessed.

The proposal has embraced the principles of ESD by designing the landfill in a manner which ensures that waste disposal would be conducted in an environmentally responsible way. Ongoing monitoring following closure of the landfill would ensure that environmental goals (to alleviate environmental impacts) set during the development process are still being met. It seeks to return the land within a relatively short time period, to a form which is similar to the

original Cumberland Plan topography providing opportunities for recreation or other uses by future generations and enhancing the ecological and habitat quality of the locality.

The proposal includes a transfer station and recycling facility which would direct some waste away from the landfill and so recover, recycle, reuse and reprocess waste that can be viably recycled. This process would ensure an efficient use of relatively scarce resources.

2.9 JUSTIFICATION FOR INVESTIGATION OF THE PROJECT

The proponent is considering the potential to expand extraction activities to enable continuation of brick making operations on site and at the same time assessing the potential for future uses of Void 1. These investigations are justified for the following reasons:

- Austral Bricks is an established brickmaking operation which relies on the availability of suitable raw materials on site for manufacture of bricks and pavers;
- the clay/shale resource has been identified in *Sydney Regional Environmental Plan No. 9* as a material of regional significance enabling continued extraction of the resource in this area;
- expansion of extraction operations would enable continuation of brick making activities on site over a longer timespan then is currently achievable, providing continued employment opportunities in the local area;
- extraction activities in the past have resulted in a number of voids on site which are not used for any purpose save storage of stormwater and could potentially become significantly more degraded with time;
- in the longer term there is not sufficient landfill capacity to cater for future waste disposal requirements in Sydney. Use of a pre-existing void would be preferable to encumbering land which could be put to some other use;
- effective landfill management with a well designed site rehabilitation and restoration program would provide an opportunity for developing uses compatible with the objectives of the Draft Regional Environmental Plan for the Western Sydney Open Space Corridor (under preparation by DUAP) and creating a landform reflecting the Cumberland Plain topography; and
- the ecological integrity and biodiversity of the site would be enhanced following a comprehensive landscaping and revegetation program with endemic local species.

3.1 REGIONAL AND LOCAL CONTEXT

Horsley Park is located in the western suburbs of Sydney approximately 35km west of Sydney CBD, in an area which has traditionally been predominantly rural residential developed for market gardening and horticultural purposes. Other land uses in the area include extractive industries, landfills, Prospect Reservoir and various recreational facilities.

The site is located within Fairfield Local Government Area (LGA). Land to the north of the Sydney Water Supply Pipeline which abuts the site to the north lies within Blacktown LGA.

3.2 SITE LOCATION AND HISTORY

3.2.1 Site Location

The Austral Bricks premises which is the subject of this proposal is located on the eastern side of Wallgrove Road, some 2.7 kilometres south of the F4 Western Freeway. Horsley Road forms the eastern boundary and the Sydney Water Supply Pipeline on the northern boundary provides an effective barrier between the project site and Waste Service's Eastern Creek Waste Management Centre (see Figure 3.1). An overhead transmission line is located along the southern boundary. The Austral Bricks property has an area in the order of 120 ha.

The site contains three voids from which quarry material is extracted for use in brick manufacturing operations. Two of these voids (Voids 2 and 3) are located in the eastern half of the property separated from Void 1 to the west by Eastern Creek. The Austral Bricks premises also comprises two brick manufacturing plants, two brick and paver stockpile areas, two crushing plants, an administration building, sales building and weighbridge.

The land which is the subject of this proposal extends from Eastern Creek, west to Wallgrove Road and contains Void 1. Key buildings located within the project site are shown in Figure 3.2.

3.2.2 Site History

The project site was originally used for grazing purposes and then for market gardening, which continued until 1960. Austral commenced quarrying and brickmaking activities at the site in the early 1960's.

3.3 LOCATION ALTERNATIVES

The *EIS Practice Guidelines (DUAP 1996) Landfilling* developed site selection principles for landfill proposals. As the project site is an established site with a void (Void 1) available for continued extraction and landfilling purposes, the proposal does not involve site selection to facilitate these operations. The proposal to continue extraction of a regionally significant resource and to provide capacity to satisfy future waste disposal needs, is an attractive option to Austral ensuring ongoing economic viability of existing operations. Rehabilitation of the land enhances the environmental integrity of the area and restores the land to a form reminiscent of previous Cumberland Plain topography.

The proposal is therefore site specific. However consideration of site selection principals for landfills developed by DUAP further defines the suitability of the project site for continued extraction and landfilling purposes. The five principles of site selection include:

- whether the location has been identified in any strategic waste management plan;
- permissibility of the land use;
- avoiding environmentally sensitive areas;
- compatibility with surrounding land uses; and
- site investigations to confirm suitability.

Consideration is given to each of these principles below:

Identification in Strategic Waste Management Plan

The *Draft Regional Waste Plan for the Western Sydney Region* (WSWB 1997) does not identify specific sites for landfilling purposes. Rather, it focuses on reducing or avoiding the generation of waste and managing wastes that are produced to ensure that they are *treated as resources not valueless wastes.*

Permissibility of Land Use

Sydney Regional Environmental Plan No. 9 - Extractive Industry (No. 2) (SREP No. 9(2)) lists the proposed site as a clay/shale extraction area of regional significance in Schedule 1 of the Plan. SREP No. 9(2) permits development for the purposes of extractive industry with the consent of Council.

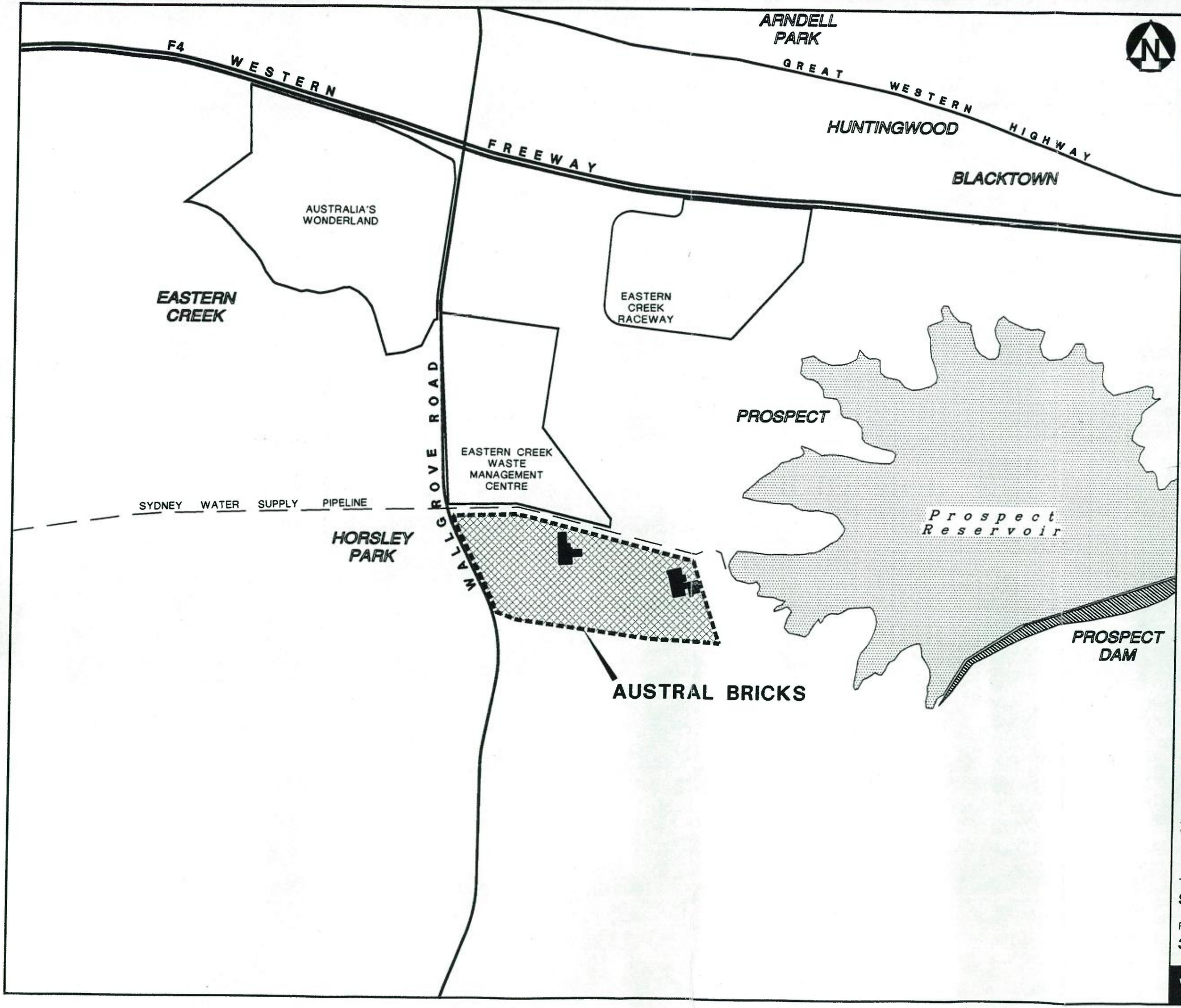
Landfilling is a permissible use within the 6(c) Recreation - Corridor zone as discussed in Section 16.

Avoiding Environmentally Sensitive Areas

The EIS Guidelines list 6 sensitive areas within the following categories:

- *sites in or within 250m of an area of significant environmental or conservation value identified under relevant legislation or environmental planning instruments;*
- *sites within an identified sensitive location within a drinking water catchment;*
- *sites within 250m of a residential zone or from a dwelling, school or hospital not associated with the facility;*
- *sites located in or within 40m of a permanent or intermittent water body;*
- *sites located within a karst region; and*
- *sites within a floodway which may be subject to washout during a major flood event.*

The project site does not impact on environmentally sensitive areas. The proposed is however located in close proximity to a dwelling located on Wallgrove Road, immediately to the south west of the project site. This dwelling predates existing extraction and brick making operations and is located some 80-90m from the proposed works. A screening berm has been provided as part of the proposal to mitigate noise and visual intrusion and to satisfy stated environmental goals. Dust suppression and odour mitigation measures have also been incorporated into site management procedures, to ensure that dust and odour levels remain within accepted criteria.



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CAD FILE NO: G.024
DATE: 20/11/97

DESIGNED: CB
DRAWN: HC
CHECKED: SKT
APPROVED: CB
STATUS: FINAL

LEGEND

- TRANSMISSION LINE
- WATER BODY
- ROADS
- SITE BOUNDARY

0 200 400 600 800 1000
metres

CLIENT
AUSTRAL BRICK COMPANY PTY LTD

PROJECT
AUSTRAL BRICK SOLID WASTE LANDFILL EIS

TITLE
SITE LOCATION

FIGURE
3.1

A3

Woodward-Clyde

EASTERN CREEK WASTE MANAGEMENT CENTRE

ROAD

Eastern Creek

FERRERS ROAD

PROSPECT

ADMINISTRATION BUILDING
BRICK MANUFACTURING PLANT

SYDNEY WATER SUPPLY PIPELINE

SITE ACCESS ROAD

SALES BUILDING

HORSLEY PARK

WALLGROVE

WEIGHBRIDGE

CRUSHING PLANT

VOID 1

BRICK MANUFACTURING PLANT

Prospect Reservoir

CHANDOS ROAD

SYDNEY/NEWCASTLE OIL AND GAS PIPELINE

REVISION: A	DESIGNED: CB
SCALE: 1:10000	DRAWN: HC
DRAWING No: A8601191/0540	CHECKED: SKT
CAD FILE NO: G.028	APPROVED: CB
DATE: 20/11/97	STATUS: FINAL

LEGEND

- TRANSMISSION LINE
- CREEKS
- WATER BODY
- ROADS
- SITE BOUNDARY
- PIPELINE
- VEGETATION
- CLAY/SHALE STOCKPILE AREAS
- BRICK STOCKPILE AREAS

0 200 400 600
metres

CLIENT
AUSTRAL BRICK COMPANY PTY LTD

PROJECT
AUSTRAL BRICK SOLID WASTE LANDFILL EIS

TITLE
SITE LAYOUT

FIGURE
3.2

A3

Woodward-Clyde

As outlined in Section 7.1.2 of this EIS, flood study cross-sections for the *Flood Study Report Eastern Creek* (Department of Water Resources 1992), were placed at some distance from the subject property. It is therefore difficult to determine with confidence the likely impact of the 1:100 year flood on the subject site.

While levels around the perimeter of Void 1 are above the calculated flood level, it is likely that some local depressions or flow paths exist between the eastern side of the pit and Eastern Creek. The proposed works would ensure that all local depressions will be built up to withstand any potential inundation during flood events.

The margin of the proposed works has been strategically located to ensure that a buffer zone would be maintained along Eastern Creek ensuring the protection of existing vegetation which lines the creek. The works would not therefore impact on sensitive areas such as Eastern Creek.

Compatibility with Surrounding Land uses

The EIS Guidelines nominate land uses surrounding the site which might require separation from landfills namely:

- residential areas;
- airports;
- surface waters;
- groundwater recharge zones; and
- environmentally sensitive areas.

As stated above the proposal incorporates comprehensive safeguard measures to alleviate any impact the proposed works may have on the adjacent residential dwelling. Section 24 of the EIS provides a summary of all safeguard measures which would be implemented to mitigate the impact of the proposed works on the environment. In the long term, restoration and rehabilitation of the site would provide significant benefit to surrounding land uses, enhancing the visual amenity and providing opportunities for development of recreational or cultural pursuits.

Site Investigation

The suitability of the project site for extraction and landfilling purposes was assessed against the following criteria:

- operational requirements;
- geological and soils;
- hydrological assessment (surface water and groundwater);
- topographic and meteorological;
- flora and fauna;
- transport issues;
- community issues; and
- cumulative issues.

Sections 4 and 6 of this EIS indicate that the project site is suitable for the proposed operations, subject to the implementation of safeguards (outlined in Section 24) to mitigate any adverse impacts on the environment.

Assessment of Site Selection Criteria

Consideration of the site selection criteria would indicate that the project site is suitable for the proposed extraction and landfilling works. Site management practices would contain any adverse impacts which might arise as a result of the proposal and on going monitoring would ensure that the project operates within accepted environmental criteria. Retention of Void 1 is unwarranted and presents an opportunity for reuse of land, which could potentially become environmentally degraded, for a use which in the longer term presents a considerable benefit to the local community.

3.4 ALTERNATIVE WASTE TREATMENT AND DISPOSAL OPTIONS

3.4.1 Waste Management and Disposal

The Draft Regional Waste Plan for the Western Sydney Region (WSWB 1997) represents a significant commitment by the NSW Government to waste management and reduction. Earlier the limited capacity of landfill operations in Sydney was discussed, along with the requirement for further landfill sites to satisfy longer term demand for waste disposal. The initiatives above, while lessening the demand for disposal sites through re-use, recycling and reprocessing initiatives, still require disposal capacity to accept the reduced volume of waste (that is the waste which can not be re-used, recycled or reprocessed).

Disposal and waste management options discussed below include:

- incineration;
- composting;
- waste transfer; and
- landfilling

Incineration

Waste incineration is widely used in well populated areas of Japan and Europe where incineration in urban areas is seen as an acceptable form of waste disposal. Only one incinerator has been established in Sydney at Zetland, processing waste from eastern Sydney Councils. Extensive community opposition to expansion of the incinerator highlights the public perception of incineration as an objectionable option, contributing to a reduction in air quality. Establishment costs are high resulting in an increase in cost to the consumer. Although incineration aims to reduce the volume of waste, the solid residue (flyash) collected in the clearing process and the ash and slag collected from the incinerator, must still be disposed of to landfill.

Composting

Open windrow composting currently produces a range of quality assured soil improvement products by aerobic decomposition (composting) at external facilities such as the Australian

Native Landscapes facility operating at the Eastern Creek Waste Management Centre. Clean green waste, parks and gardens materials and materials from food waste composting facilities, are composted to produce green waste compost.

Other composting methods include enclosure of waste in a bio-digestor for a period of active decomposition or digestion. As stated previously, 72% of waste found in domestic garbage comprises organic material. The remaining 28% must be sent to landfill. Composting of this material would have little impact on local air quality and could be an effective means of reducing the quantity of solid waste requiring disposal once waste is 'clean' and not contaminated by materials which would result in the compost being unacceptable for re-use or sale. These limitations require that contaminated organic material must still be returned to landfill along with the 28% of non organic waste contained in domestic garbage.

Waste Transfer

Transfer stations provide a waste management service in LGAs where no landfill is available. Waste is compressed, and consolidated into large vehicles and transferred without treatment to landfill sites. Transfer stations add to the overall cost of waste disposal, as haulage costs to landfill are incurred. This method however proves to be economically viable in middle suburban areas where landfills are located at some considerable distance from the waste source.

Landfill

Currently the majority of Sydney's solid waste is disposed to landfill. In addition, the residue from the processes outlined above must be disposed of to landfill. The capacity of existing landfills is limited to the short term and recent proposals to extend existing Waste Service putrescible landfills in Penrith and Sutherland, have met with extensive community opposition.

Vacant voids resulting from past extractive operations provide ideal sites for non-putrescible landfills. Implementation of appropriate environmental safeguards, both during operation and closure of the landfill, and site rehabilitation, have the potential to provide significant benefits to the local community in the long term. Proper design and management of landfills ensures that landfilling can be an environmentally acceptable and beneficial option.

3.4.2 Options Considered in Draft Regional Waste Plan

The *Draft Regional Waste Plan for the Western Sydney Region* (WSWB 1997) presents a number of waste management alternatives set out below. The majority of these alternatives remain untried and have yet to be tested to determine their viability in a NSW context.

Community Drop-Off and Processing Centres

Materials delivered to drop-off centres could be kept in separate areas (or bins), streamlining and re-aggregating like materials, which could then be used as reusable resources. The prime objective is to produce uncontaminated and sorted materials. Materials received could include garden waste, wood waste, dry recyclables (paper, cardboard, glass, plastics, liquid paperboard, metals and textiles), household hazardous goods (paints, oils, fuels, chemicals), white and brown goods, electronic scrap, building materials and light industrial and residential scrap metals.

Nine centres are proposed to be developed in the Region, geographically located to service the main residential centres.

Restabilisation and Transfer Facilities

Residual mixed (putrescible wastes) could be treated and stabilised at prestabilsation facilities prior to landfill, thus negating the need for daily cover and compaction. Four facilities are to be established to service the region, processing domestic and commercial and industrial waste. Dano drum technology would be used to pulverise, homogenise and aerobically 'compost' all mixed and putrescible 'wastes' over a 24-48 hour period, to produce fine partially 'composted' organics and a course inert oversize material stream. These functions could then either recombine in layers in the landfill or be used for specialist energy recovery operations. This process achieves a volume reduction of 30-50% without compaction and as no landfill cover is required, it saves 25-30% air space. Materials could then be transported in open top trucks for disposal at landfills.

Stabilised Landfills

These landfills would be designed to accept prestabilished residues from the transfer facilities above. Finished or filled sites would be capped off and revegetated for recreational uses. The landfill could adopt existing Solid Waste Class 2 standards which could form the basis of EPA licencing. The operation does not require imported daily cover saving 15-30% in air space.

Storage/Monofill Facilities

These facilities would be designed to store or monofill inert materials such as concrete, cleanfill, masonry, baled plastic, tyres, glass and metals in uncovered stockpiles. These facilities would adopt Inert Class 1 or 2 landfill standards and would be designed to enable ready access for re-extraction, as and when a viable reuse opportunity arises.

Dry Recyclables Materials Recovery Facility (MRF)

This facility would accept council kerbside dry recyclable collections, bulked up loads of dry recyclables from drop-off centres and would source separated materials from light commercial and industrial uses. It is proposed that Waste Service's MRF at Chullora, Cleanway's Co-mingled MRF at Blacktown and Waste Service's MRF at Jack's Gully, would service the region. The benefit of MRF facilities is the output of homogenous materials prepared for selling or trading to industry.

Commercial and Industrial Materials Recovery Facility

Mixed or partially separated construction and industrial materials would be passed through a sorting/picking facility, to recover recyclable materials or separate partially hazardous materials, for more specialised treatment and disposal. It is considered that this facility could be set up in the Waste Service's MRF at Chullora.

3.5 CONCLUSION

In the absence of tried and tested and proven economically viable waste management alternatives to landfill in NSW, the proposed landfill which incorporates detailed environmental safeguards and recycling facilities is considered the best option for waste management in this location. The proposal is not inconsistent with existing waste management techniques and any alternatives identified in the *Draft Regional Waste Plan for the Western Sydney Region.*

4.1 PROJECT OUTLINE

The key operational elements of the project include excavation, extraction and landfilling activities. A rehabilitation strategy designed for the site would allow progressive rehabilitation at all stages during the life of the project and the creation of a final landform with significant benefits for future generations in the immediate and wider area.

Overburden in the order of 3.7 million m^3 would be initially extracted and placed in stockpiles for use as landfill cover material and for site rehabilitation. Any suitable clay/shale extracted would be used by Austral in existing brick making operations on site.

At the same time, all necessary landfilling infrastructure would be constructed on site and landfilling with Class 2 Solid Waste would occur in a progressive manner, once excavation works have been terminated in a specific area. The landfill would be designed as a saturating, entombment landfill and would be referred to as a containment landfill. Cover would be applied continuously to reduce infiltration and lower the moisture content of the waste. Installation of surface and groundwater drainage media and a liner at the base of the void would contain stormwater and leachate generation to levels which would have no adverse impact on the surrounding hydrological and hydrogeological regime. Section 7 elaborates on this issue further.

4.2 SITE DEVELOPMENT WORKS

Excavation, extraction and landfilling activities would require specific site development works. Excavation and extraction works would be carried out using infrastructure currently available on site along with haul roads to be constructed in the future to facilitate expansion of extraction activities.

Use of the site for landfilling purposes requires site development works which would contain activities within a well defined area separated from brick manufacturing and sales and administrative functions, associated with the brickworks.

Chain wire fencing would be constructed around the perimeter of the waste management centre/landfill area, with access to the site controlled by fencing and 2m high chain wire gates. A dedicated access road would be constructed south of the existing entrance on Wallgrove Road, to provide a clear entry to the landfill for visitors, contractors, commercial waste hauling companies and other transporters of waste. Wallgrove Road would be widened to provide turning lanes at this point into the site and would be well signposted.

The landfill entrance would have better sight distances along Wallgrove Road than the existing main entrance. Turning lanes would ensure that the flow of traffic would not be interrupted by trucks turning into the property.

The main access road from the Wallgrove Road entrance would be sealed to a Waste Transfer Station which would be located on a handstand area. Vehicles entering and exiting the site would pass through a weighbridge station along this access road. An office would also be located immediately to the west of the weighbridge. The Waste Transfer Station would be relocated to the eastern portion of the site as landfilling activities move to the west (see Figure 4.1).

The vehicular access road to the disposal area within the landfill would be unsealed and constructed to a standard required to accommodate haul trucks from the Waste Transfer Station and customer trucks. The road would be continuously reconstructed, as filling progressively moves within the landfill area to provide ready access for customer trucks. A sealed road around the perimeter of the site would be used for emergency vehicle purposes only.

A waste recycling depot and sealed car park located adjacent to the offices and weighbridge would provide a convenient resident drop off facility for recyclable products. Other site development works include a truck washdown facility.

Extraction and landfilling activities would be screened from passing traffic on Wallgrove Road by a screening berm located along the western margin of the proposed works area (see Figure 4.1). A screening berm along the southern boundary of the site would screen the works from adjoining properties. Landscaping around the weighbridge office drop off recycling area, car park and truck washdown area would soften the visual impact of these buildings. Extensive landscaping between the screening berm and Wallgrove Road coupled with the retention of the open woodland vegetation in this area would provide a clean and well kempt image to passing vehicular traffic. The screening berm would be turfed.

4.3 WASTE CHARACTERISTICS

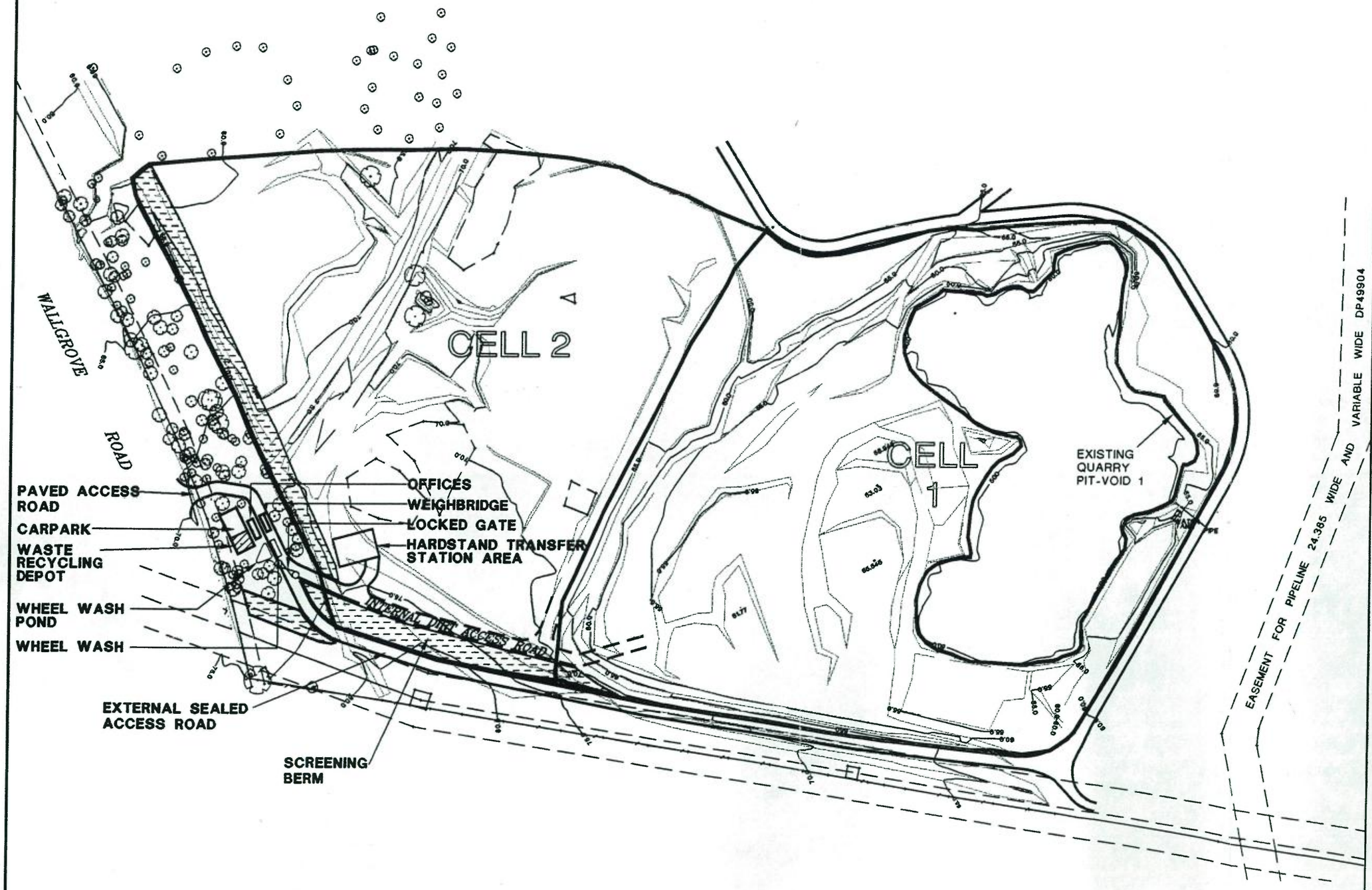
The proposed landfill would be licenced as a Solid Waste Landfill Class 2. The NSW Environmental Protection Authority (EPA) *Environmental Guidelines: Solid Waste Landfills* (1996) specify that the landfill would be permitted to receive all solid waste with the exception of putrescible waste and other wastes approved by the EPA. Solid waste is defined as waste which is non-hazardous, solid and degradable (EPA, 1996).

The landfill would also be licenced to receive inert waste. Inert waste is defined as waste which does not undergo environmentally significant physical, chemical or biological changes and has no potentially hazardous content once landfilled (EPA, 1996).

4.3.1 Permitted Wastes

The types of wastes which would be accepted at the landfill are listed as follows:

- virgin excavated natural material;
- building and demolition wastes such as bricks, concrete, glass, plastics, metal and timber;
- miscellaneous commercial and industrial wastes which do not have hazardous characteristics;
- stabilised solid waste;
- non-leaching contaminated soils;
- small loads of tainted and non-segregated paper wastes;
- wood waste such as wooden crates, pallets and timber; and
- green waste such as trees, branches and miscellaneous garden waste.



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CAD FILE NO: G.027
APPROVED: CB
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STATUS: FINAL
SOURCE:
WILLIAM L. BACKHOUSE Pty. Limited

LEGEND

SCREENING BERM

0 20 40 60 80 100
metres

CLIENT
AUSTRAL BRICK COMPANY PTY LTD

PROJECT
AUSTRAL BRICK SOLID WASTE LANDFILL EIS

TITLE
PROPOSED SITE LAYOUT

FIGURE
4.1
A3

Woodward-Clyde

4.3.2 Excluded Wastes

The types of wastes which would not be accepted at the landfill are presented below:

- putrescible wastes such as food or animal matter;
- unstable or untreated biosolids;
- hazardous wastes which have the ability to cause harm as a result of their flammability, corrosivity, reactivity, toxicity and potential to cause infection;
- highly contaminated materials; and
- liquid wastes.

Procedures which would be put in place to prevent the disposal of unacceptable wastes to the landfill are detailed in Section 4.2.2 of the Draft LEMP (Appendix B).

4.4 OPERATION OF PROJECT

4.4.1 Waste Receival and Handling

The weighbridge building located on the landfill access road 50m from the entrance, would record vehicle movements to and from the site (see Figure 4.1). Two weighbridges adjacent to this building would weight incoming traffic and outgoing traffic. Vehicles transporting waste to the site would proceed to the incoming weighbridge where the loaded weight of the vehicle, the registration number and the type of vehicle would be recorded. The weighbridge operator would visually inspect all open loads using an elevated mirror and any vehicles observed to be containing waste of a type which is not acceptable at the site, would be turned away.

From the weighbridge, large trucks would proceed to the active tipping face of the landfill where the tipping supervisor would direct vehicle movements and waste tipping into the void. Once discharged, the supervisor would visually inspect the load and contents, prior to any compaction and covering of the waste. Any waste which is considered unacceptable, would be rejected.

The Waste Transfer Station would be constructed so as to minimise the number of vehicles travelling to the active face of the landfill. Small trucks, vans and cars which require hand unloading would be directed to this facility. Within the transfer station, wastes would be compacted into a waste pit by a wheeled loader and then loaded into a prime mover and hauled to the active face of the landfill.

The proposal also includes a waste recycling depot with separate storage areas for materials such as glass, metal, plastics, batteries, waste oil and paper. The depot would be established as a resident drop-off facility and any recyclable materials which are separated from incoming loads of waste, would also be deposited there. Recyclable materials would be removed for processing by recycling contractors when the storage areas approach capacity. Access and use of the recycling facility would be free of cost. The Waste Transfer Station would be used for stockpiling large recyclable items such as white goods.

Wood and green waste would be separated from other types of waste. Wood waste consists of items such as wooden crates, pallets and timber, and green waste is comprised of trees,

branches and miscellaneous garden waste. Wood waste would be shredded and mulched for use on-site or for sale to public/private contractors and government departments. Green waste would be chipped and composted. The composted material would be used on-site or sold to commercial landscapers.

4.4.2 Waste Emplacement

Waste material would be deposited in the landfill using the area fill method, which involves progressively filling the site in layers at the base of the void. This method of landfilling entails the following activities:

- depositing waste at the active face of the landfill which would be kept to a maximum width of 20 m and a length of 50 m. This would allow sufficient space for incoming waste while limiting the area of landfill exposed to the weather;
- compacting waste into cells with layers of approximately 600 mm. Waste would be compacted by pushing and rolling it toward the landfill face, which ensures maximum compaction; and
- filling each cell to a height of approximately 1.8 m of compacted waste and applying cover material.

4.4.3 Waste Management Strategy

The overall proposed landfill surface area covers some 25 hectares. The surface area of the existing quarry void covers some 6.5 hectares as shown in Figure 4.2.

Waste material would be placed using the area fill method of landfill. Area fill involves progressively filling the site in layers in the base of the quarry. The site has been divided into two cells (14.3 ha and 10.9 ha each). Filling would generally take place from east to west with the final cap being placed progressively, as final levels are achieved.

The conceptual design identifies cells that are filled in approximately 1.8m lifts of compacted waste, with 0.15m of cover material applied daily. Where a lift of material would not be progressed within a one month period, a 0.3m thick interim cover layer of shale or other suitable material would be applied compacted at optimum moisture content, to create a low-permeability barrier. This interim cover would largely prevent infiltration of surface water and would be graded at a slope of 1:50, to a dirty water collection pond for appropriate management.

When active landfilling is recommenced over a cell previously capped with intermediate cover to stimulate clean stormwater runoff, cover material in excess of 0.15m would be recovered for reuse elsewhere or would, at least, be ripped to ensure that the moisture levels in the site are able to develop consistently, without perched leachate levels developing.

Figure 4.3 and 4.4 provide a conceptual plan of the progressive filling within the landfill, while Figure 4.5 provides schematic sections of filling in progress. Figure 4.6 shows the anticipated final contours.

The volume of available airspace has been assessed as 6 842 000 m^3 using the ENTEC Environmental and Mining modelling program. The 6 842 000 m^3 total airspace comprises 3 703 000 m^3 of overburden to be excavated for brickmaking and cover purposes, and 3 139 000 m^3 of existing airspace and overtopping potential. It has been assumed in the

E286500

E286800

287100

261°23'15"
200.125

4°30'25"
195.87

356°07'35"
416.245

116°07'35"
384.645

RL69.405

1255800 N

RL59.309

TOP OF BANK

ROCK OUTCROP

WALLGROVE ROAD

STOCKPILE

ACCESS ROAD

VOID 1

BANK

TOE

CL

FENCE

TOWER FOOTING

RL73.64

OLD POST AND WIRE FENCE

EASEMENT FOR TRANSMISSION LINE IN J259850 30.48 WIDE

EASEMENT FOR PIPELINE 24.384 WIDE & VARIABLE WIDE DP569004

1255500

1255500 N

E286500

E286800

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CAD FILE NO:	G.026	APPROVED:	CB
DATE:	20/11/97	STATUS:	FINAL

SOURCE:
WILLIAM L. BACKHOUSE Pty. Limited

LEGEND

SCREENING BERM

0 20 40 60 80 100
metres

CLIENT
AUSTRAL BRICK COMPANY PTY LTD

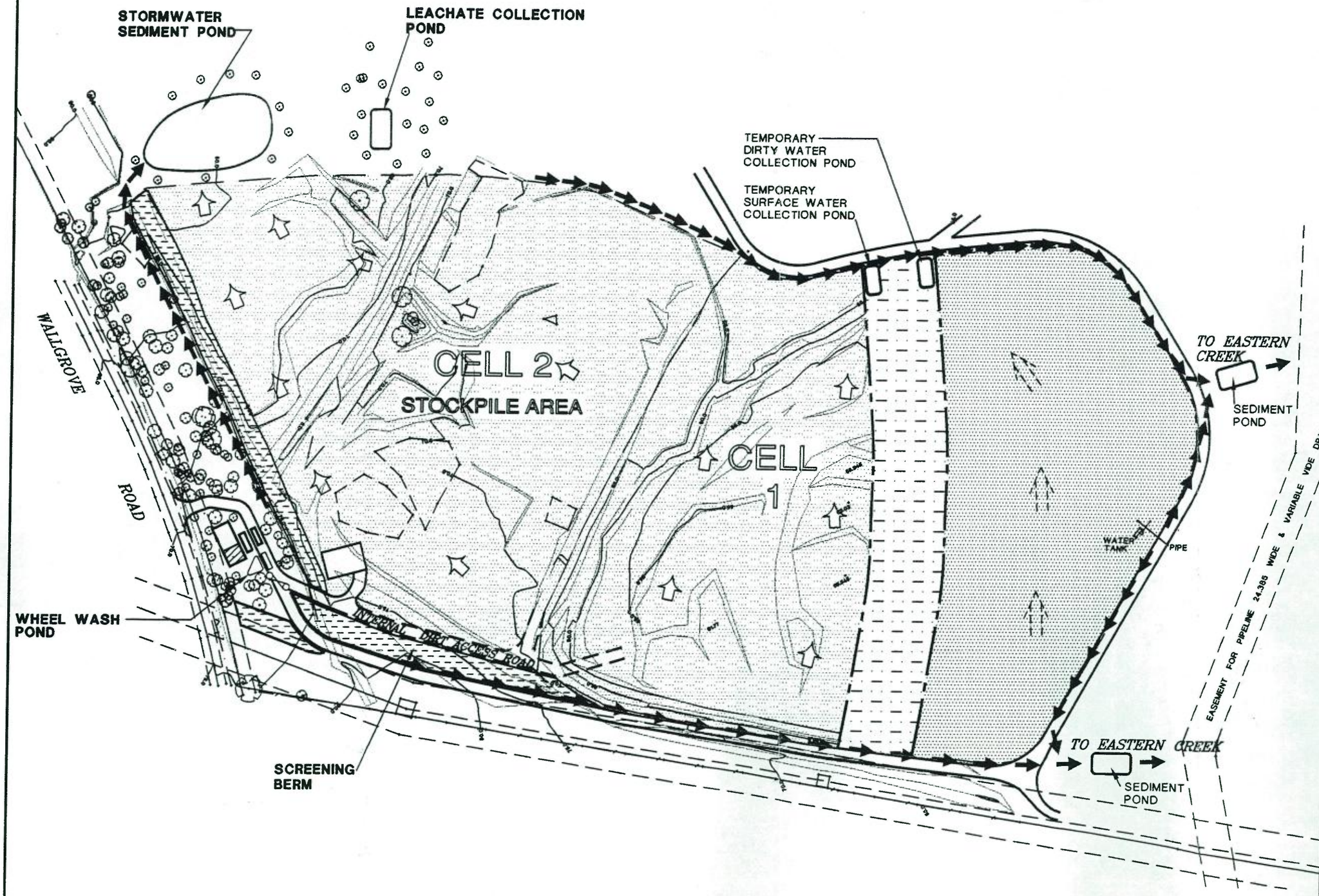
PROJECT
AUSTRAL BRICK SOLID WASTE LANDFILL EIS

TITLE
CURRENT QUARRY PROFILE

FIGURE
4.2

A3

Woodward-Clyde



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LEGEND

- SURFACE WATER DIVERSION DRAIN
- DIRTY WATER FLOW PATH
- SURFACE WATER FLOW PATH
- ACTIVE LANDFILL AREA
- LANDFILL BASE PREPARATION AREA
- EXTRACTION AREA
- SCREENING BERM

0 20 40 60 80 100
metres

CLIENT
AUSTRAL BRICK COMPANY PTY LTD

PROJECT
AUSTRAL BRICK SOLID WASTE LANDFILL EIS

TITLE
CONCEPTUAL PLAN - CELL 1 ACTIVE

FIGURE
4.3

A3

Woodward-Clyde

STORMWATER SEDIMENT POND

LEACHATE COLLECTION POND

TEMPORARY SURFACE WATER COLLECTION POND

TEMPORARY DIRTY WATER COLLECTION POND

TEMPORARY STORMWATER SEDIMENT POND

CELL 2

CELL 1

STOCKPILE AREA

HARDSTAND TRANSFER STATION AREA

WALLGROVE ROAD

INTERNAL DIRT ACCESS ROAD

WHEEL WASH POND

SCREENING BERM

TO EASTERN CREEK

SEDIMENT POND

TO EASTERN CREEK

SEDIMENT POND

EASEMENT FOR TRANSMISSION LINE IN J259850 30.48 WIDE

EASEMENT FOR PIPELINE 24.385 W & VARIABLE WIDE DP49904

65.0

70.0

75.0

80.0

LEGEND

- SURFACE WATER DIVERSION DRAIN
- DIRTY WATER FLOW PATH
- SURFACE WATER FLOW PATH
- ACTIVE LANDFILL AREA
- LANDFILL BASE PREPARATION AREA
- EXTRACTION AREA
- SCREENING BERM
- FINISHED SURFACE
- 80.0 FINISHED SURFACE LEVEL CONTOURS

0 20 40 60 80 100

metres

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CAD FILE NO:	G.030	APPROVED:	CB
DATE:	20/11/97	STATUS:	FINAL

SOURCE:

WILLIAM L. BACKHOUSE Pty. Limited

CLIENT

AUSTRAL BRICK COMPANY PTY LTD

PROJECT

AUSTRAL BRICK SOLID WASTE LANDFILL EIS

TITLE

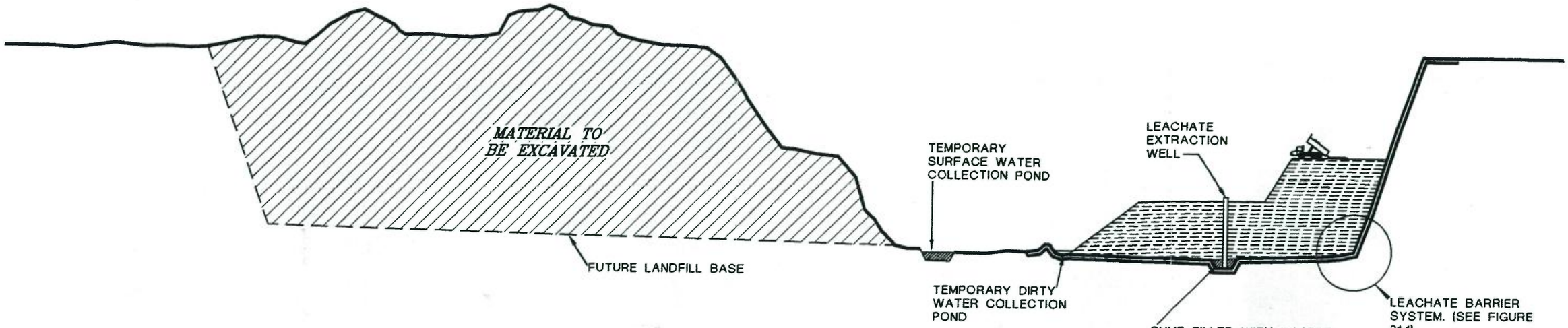
CONCEPTUAL PLAN
CELL 2 - ACTIVE
CELL 1 - COMPLETED

FIGURE

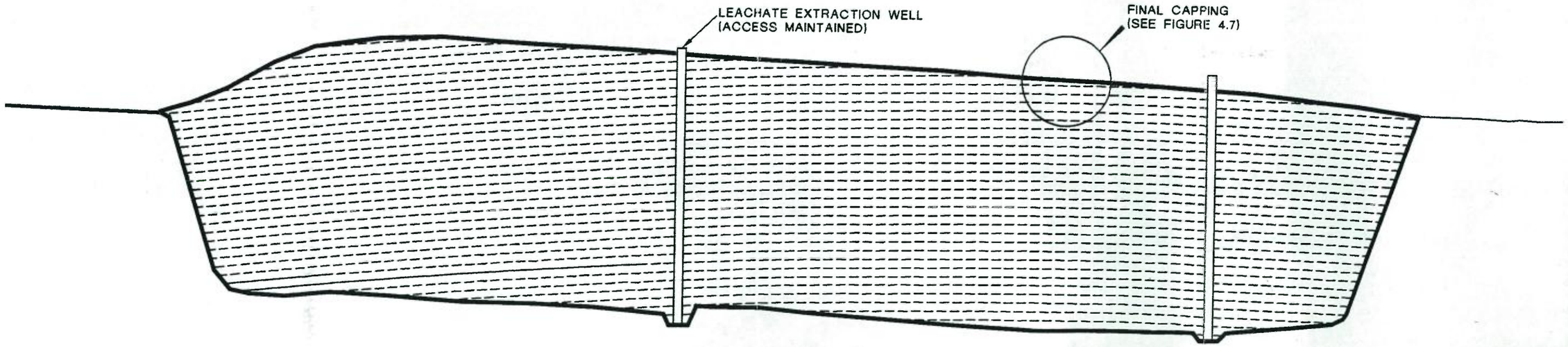
4.4

A3

Woodward-Clyde



DURING FILLING
NOT TO SCALE



FILLING COMPLETED
NOT TO SCALE

Woodward-Clyde

CLIENT
AUSTRAL BRICK COMPANY PTY LTD

PROJECT
AUSTRAL BRICK SOLID WASTE LANDFILL EIS

REVISION: A
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CAD FILE NO: G.031
APPROVED: CB
DATE: 20/11/97
STATUS: FINAL

TITLE
SCHEMATIC LANDFILL CROSS SECTION

FIGURE
4.5

A3

STORMWATER SEDIMENT POND

LEACHATE COLLECTION POND

65.0

70.0

75.0

80.0

WALLGROVE ROAD

CELLS 1 & 2 COMPLETED

TO EASTERN CREEK

SEDIMENT POND

TO EASTERN CREEK

SEDIMENT POND

EASEMENT FOR PIPELINE 24.385 WIDE & VARIABLE WIDE DP499844

N

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DATE:	20/11/97	STATUS:	FINAL

SOURCE:

WILLIAM L. BACKHOUSE Pty. Limited

LEGEND

- SURFACE WATER DIVERSION DRAIN
- SURFACE WATER FLOW PATH
- REVEGETATED FINISHED SURFACE LEVEL

0 20 40 60 80 100

metres

CLIENT

AUSTRAL BRICK COMPANY PTY LTD

PROJECT

AUSTRAL BRICK SOLID WASTE LANDFILL EIS

TITLE

FINAL CONTOURS

FIGURE

4.6

A3

Woodward-Clyde

calculations of the cumulative volume of fill, that the proportion of cover (including final capping and soil) is approximately 19%.

An ISG (Integrated Survey Grid) grid was laid out across the site by a registered surveyor. This grid would permit the identification of burial locations, for any wastes which require this level of documentation.

4.4.4 Cover Material

Application of Cover Material

Application of cover material to the active face of the landfill is required to control odours, fires, pest and vermin populations, and infiltration by rain. The material used for covering waste would be sourced from stockpiles of overburden extracted from the void, and from incoming demolition/construction and excavation materials brought to the site as waste. The types of cover layers which would be used during the proposed landfilling works are as follows:

- Daily cover - which is applied to all exposed waste surfaces at the end of each working day. The depth of daily cover over the active face of the landfill would be at least 150 mm.
- Intermediate cover - which is applied where a filled area has not reached the final landform level, but due to staging of the filling would remain inactive for a period greater than one month. This intermediate cover should be greater than 300 mm in depth.
- Final cover - which is applied at the completion of landfilling activities and typically would consist of a 900 mm thick compacted sealing layer.

Source of Cover and Engineering Material

There would be two primary sources of cover material available for the landfill. The first material for cover, in terms of preference would be the quarry overburden that would be stockpiled on inactive cells and would be the most readily available source.

A stockpile of at least 1 000 tonnes (approximately 625 m^3) of excavated material (not topsoil) would be maintained on-site for use as emergency cover throughout the operational life of the project.

A second source of cover/engineering material would be demolition/construction and excavation materials brought to the depot as waste. As a general rule, these materials would be expected to comprise approximately 30 percent of the waste stream. These wastes would be admitted for a reduced charge (which does not include the Section 72 Contribution required by the *Waste Minimisation and Management Act*, 1995 for disposal of waste), when required, to encourage their disposal at the depot.

The environmental advantage for using demolition and mixed excavation materials to meet the daily cover and on-site engineering requirements for the landfill include:

- maximising the landfill resource and extending the life of the landfill by not accepting unnecessary clean fill;
- protecting clean fill resources which have beneficial uses outside of landfill; and

- reducing the quantity of wastes received, thereby promoting the State government's 60% reduction target for solid waste landfills.

These materials would be accepted as cover material throughout the life of the landfill.

4.4.5 Waste Compaction

Optimal compaction of waste would be undertaken to ensure that the existing landfill space is put to its best use. The degree of compaction of the deposited material would play an important role in conserving air space, generating increased revenues and minimising subsequent settlements.

All deposited refuse would be contained in the working area and the face kept to a maximum of 50 metres in length.

The NSW EPA established a compaction goal of 850 kg/m^3 for large landfills. The landfill would aim to achieve this compaction level, through the use of appropriate equipment and good operating practices.

Equipment to be used would include a compactor, bulldozer and loader. Other ancillary equipment would include a grader, water cart, fuel truck and tip truck. It is envisaged that a prime mover with trailer would be used for transporting waste from the transfer station to the working area of the landfill (see Table 4.1).

Whenever practical, the compaction equipment would be operated by pushing and rolling in towards the landfill face, rather than pushing down the face. Pushing down the face would tend to spread the refuse away from the face, resulting in less compaction.

Settlement or subsidence of the finished landform as a result of surcharge loading within the fill itself, may result in the landform taking on a significantly different topographical appearance. Settlement is the result of primary consolidation due to compaction and surcharges, as well as secondary consolidation (creep) and the decomposition of refuse.

The design of the finished landfill surface would incorporate these forms of settlement. Based on previous experience, overfilling by approximately 15 % would be required to compensate for consolidation and to achieve the designed finish surface levels. Typically, the majority of the settlement would occur in the first three or four years following the completion of the individual cells.

Routine settlement monitoring would be included to allow better determination of the volume of overfilling required for the site.

Volumetric surveys would be undertaken to measure the consumption of airspace throughout the life of the landfill. The results of the survey would be reported to the EPA bi-annually.

4.4.6 Site Management, Supervision and Control

Site management procedures would set out a clear chain of command and responsibilities for on-site operations. The Landfill Manager would provide overall direction for on-site management and would be supported by a Operations Manager, responsible for day to day on-site requirements. A weighbridge operator/gatehouse supervisor and tipping supervisor would manage all aspects of acceptance, on-site movement and deposition of waste materials.

4.4.7 Equipment

The types of plant and heavy equipment which would be used for the excavation, extraction and landfilling activities are listed in Table 4.1.

Table 4.1
PLANT AND HEAVY EQUIPMENT[1]

PLANT AND HEAVY EQUIPMENT	NUMBER OF ITEMS
Typical Construction Equipment[2]:	
Caterpillar D9N bulldozer	1
Caterpillar 815B soil compactor	1
Caterpillar 330 hydraulic excavator	1
Caterpillar D20D articulated truck	1
12 tonne water truck[1]	1
Fuel Truck[1]	1
Excavation and Extraction Activities	
Caterpillar D9N bulldozer	1
Caterpillar 631E scrapers	3
Caterpillar 988F wheeled loader	1
12 tonne water truck[1]	1
Fuel truck[1]	1
Landfilling Activities	
Caterpillar 826C compactor	2
Caterpillar D9N bulldozer	1
Caterpillar 980F wheeled loader	1
Mack prime mover and trailer	1
Caterpillar 12G motor grader	1
Caterpillar D20D articulated truck	1
12 tonne water truck[1]	1
Fuel truck[1]	1

[1] Plant and heavy equipment would be used for a number of activities on site. Hence one fuel track would be used during the excavation, construction and landfilling phases of the project.

[2] Caterpillar equipment selected are indicative of the type of equipment which would be used on site. Table 4.1 does not restrict operations to selection of this brand only.

4.4.8 Hours of Operation

Excavation, Extraction and Construction Activities

Excavation, extraction and construction activities would be undertaken between the hours of 6.00 am to 6.00 pm Monday to Friday, and 6.00 am to 4.00 pm on Saturdays. No excavation, extraction or construction works would be carried out on Sundays or public holidays.

Landfilling

The landfill would operate every day except Good Friday and Christmas Day. The hours of operation would be compatible with the adjoining Eastern Creek Waste Management Centre and would be as follows:

- Monday to Friday 6.00 am to 5:00 pm
- Saturday 6.00 am to 4:00 pm
- Sunday and Public Holidays 8.00 am to 4:00 pm

The compaction of waste and application of cover material would take place within the normal operating hours of the landfill and would continue for 1 to 1.5 hours after the advertised closing time each day.

4.4.9 Workforce Requirements

Excavation and Extraction Activities

Excavation and extraction activities would be undertaken by six personnel under Austral supervision including a bulldozer driver, loader driver, three scraper drivers and one Supervisor. A number of these employees would also be responsible for driving the fuel and water trucks and road grader.

Construction of the Landfill

Construction of the landfill and associated infrastructure such as the weighbridge, transfer station and the site office would be undertaken by a workforce in the order of six people.

Landfilling

Operation of the landfill would require a workforce of approximately fifteen people. The personnel required are listed as follows:

- operations supervisor (1);
- landfill manager (1);
- weighbridge operator/gatehouse supervisor (1);
- operators of heavy equipment (5);
- tipping supervisor (1);

- transfer station supervisor (1);
- maintenance and repair of heavy equipment (1);
- landscape and site maintenance (1);
- accountant (1);
- administration staff (1); and
- site security contractor (1) (One person would be responsible for on-site security at any one time).

These personnel would also be responsible for driving the fuel and water trucks, and directing incoming vehicles. Employees would be multi-skilled and be capable of assuming various roles on the site.

Other personnel who would be employed on a less regular basis include recycling contractors who would be required to remove the recycling bins when they are full and environmental consultants employed to undertake environmental monitoring.

4.5 STAGING OF PROJECT

A number of factors would determine the phasing of the project including the rate of extraction and the market for waste disposal to landfill. At a minimum the rate of extraction of material should be at an equivalent rate to landfilling.

4.6 FINAL FORM

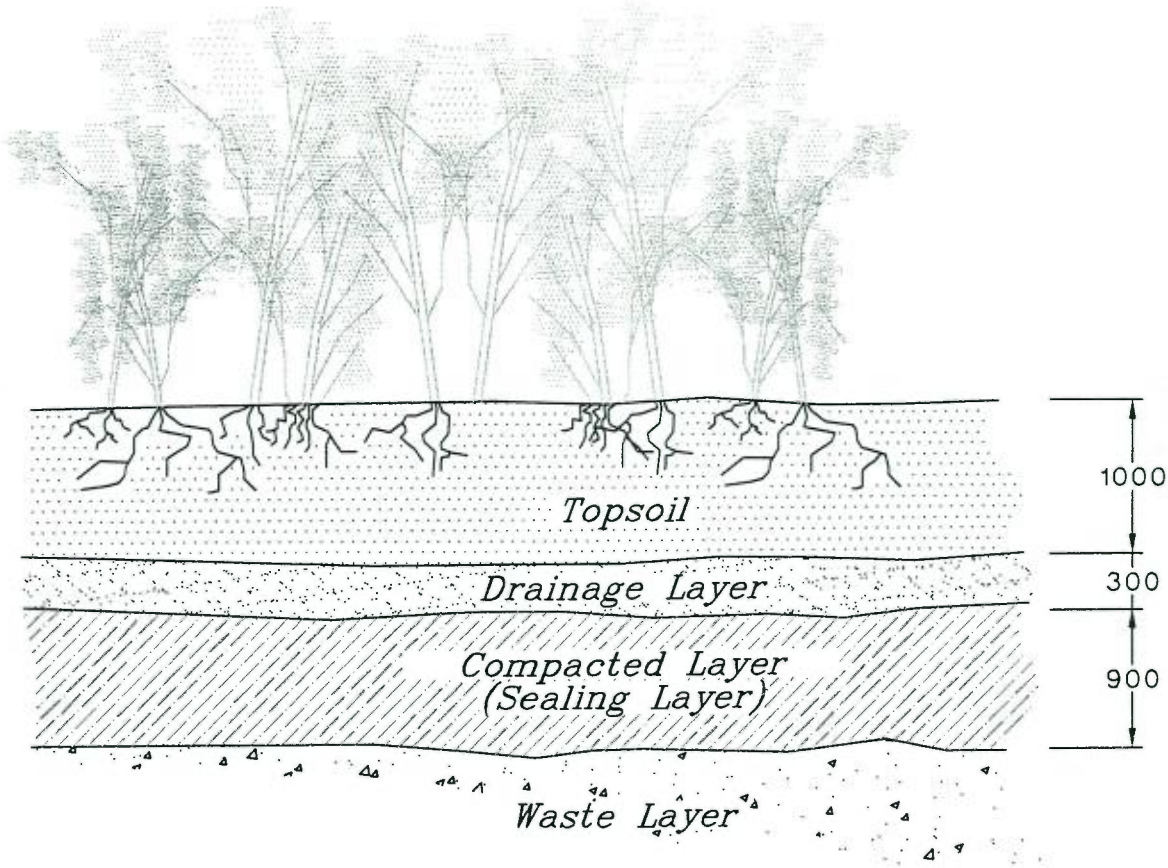
4.6.1 Landform

At the completion of landfilling activities, a final capping layer would be placed over the surface of the waste material to enable the site to be developed for uses compatible with the objectives of the Draft Regional Environmental Plan for the Western Sydney Open Space Corridor (currently being prepared by DUAP).

The capping layer would consist of a 900 mm layer of compacted material to minimise rainfall infiltration into the landfill mass, a 300 mm drainage layer comprised of suitable material and a 1000 mm layer of topsoil/mulch, to promote vegetation growth and minimise odours from any fugitive gas emissions (see Figure 4.7). The final cover would also provide a biologically active filter for suppression of odours and would be shaped to have a similar slope and relief to the surrounding landscape. The maximum height of the finished surface would be approximately 85 m AHD and would generally slope in a north easterly direction.

4.6.2 Vegetation

Development of a detailed revegetation program for the site addressing both temporary and permanent revegetation options would be undertaken early in the site development process and would involve consultation with the Department of Land and Water Conservation (DLWC).



FINAL CAPPING

NOT TO SCALE

Woodward-Clyde	CLIENT: AUSTRAL BRICK COMPANY PTY LTD PROJECT: AUSTRAL BRICK SOLID WASTE LANDFILL EIS	REVISION: A SCALE: N.T.S. DRAWING No: A8601191/0540 CAD FILE NO: G.021 DATE: 20/11/97	DESIGNED: SP DRAWN: HC CHECKED: SKT APPROVED: CB STATUS: FINAL	TITLE: FINAL LANDFORM FIGURE: 4.7 A4

Temporary revegetation would be undertaken with annual species which are fast growing, provide a highly effective ground cover, and have a short growing season of say 6 to 8 months.

Permanent revegetation of the site would involve spreading of a 1 000mm layer of topsoil over the disturbed area and immediate stabilisation of disturbed areas using annual species such as *Echinochloa Rumentacea* - Japanese Millet, Regal Ryegrass and pasture grasses which are fast growing and provide a highly effective ground cover. Couch or Kikuyu turf would be placed in areas where the erosion hazard is particularly high.

Rehabilitation of the site would include revegetation with species of *Pultenaea microphylla* and other local endemic species determined in consultation with DLWC. Rehabilitation would take place progressively until the final surface level has been completed. As each nominated cell is completed, rehabilitation works would commence on that cell.

Areas where grassland or vegetated areas are disturbed or where overburden stockpiles are removed, would be shaped appropriately and then sown with a cover of perennial grass. Areas containing site facilities associated with the depot would be left as hardstand if possible or would be reshaped and vegetated with a perennial grass. All remaining buildings and plant would be removed prior to disposal of the site.

Rehabilitation of the final capped area would begin within 30 days of the completion of landfill operations and intensive revegetation would continue for between 12 and 18 months, in a manner to be determined in final design.

Disturbed areas would be progressively rehabilitated to minimise land areas exposed to erosion at any one time. Section 4.8 *Site Capping and Revegetation* of the Draft Landfill Environmental Management Plan (LEMP) in Appendix B provides details of strategies to be employed for site capping and rehabilitation.

4.7 WATER MANAGEMENT

The objectives of water management strategies are to:

- prevent surface waters at or beyond the boundary of the landfill becoming polluted by the landfill development;
- prevent surface water flowing into the excavation and landfill areas;
- prevent contamination of groundwater;
- prevent groundwater seeping into the void;
- minimise the generation of leachate; and
- prevent the washout of waste or contaminated water from the landfill.

4.7.1 Surface Water Management

A surface water management system consisting of a network of diversion drains and collection ponds would be used to prevent surface water entering the extraction and landfill areas. The diversion drains in Figure 4.3 would intercept water flowing toward the void and either direct it to a permanent stormwater sediment pond to be located in the north western corner of the site or to Eastern Creek (in instances where surface water does not come in

contact with waste or stockpiles of material). The diversion drains and stormwater sediment pond would be designed to cope with a 1 in 10 year Average Recurrent Interval (ARI), 24 hour duration storm.

Runoff derived from within the extraction areas would be directed to a temporary surface water collection pond at the base of the void, and then pumped to the permanent stormwater sediment pond. Surface water collected from the landfill areas would be stored in a temporary dirty water collection pond and then pumped to the leachate collection pond located on the outer rim of the void (Figure 4.3). The temporary collection ponds would be designed according to DLWC's criteria for sediment basin design for small sites (<15 ha contributing catchment).

The quality of surface water would be controlled by erecting silt fences at locations where soil erosion may occur and by removing sediment from the diversion drains and collection ponds. Surface water management issues are discussed further in Sections 7 and 24, of this report and Section 2 of the Draft LEMP (see Appendix B).

The rehabilitated landfill surface would be properly designed and constructed to reduce surface water infiltration to the landfill mass, by increasing runoff and evapotranspiration from the rehabilitated surface. Runoff would be encouraged by including a low permeability layer within the final core sequence and by forming a moderately sloped topography on the rehabilitated surface, thereby providing a surface drainage route.

4.7.2 Surface Water Treatment and Disposal

Sediment would settle out over time in the stormwater sediment pond. The pond would be cleared out on a regular basis to ensure operational efficiency. Water from the stormwater sediment pond would be used for dust suppression purposes or would over time evaporate.

4.7.3 Groundwater Management

A liner would be installed at the base of the void to contain leachate within the landfill and prevent contamination of groundwater. A system of groundwater monitoring wells would be installed to monitor the effectiveness of the liner in preventing contamination of groundwaters. Details of the groundwater management and monitoring strategies are provided in Sections 7 and 24 and Section 2 of the Draft LEMP (see Appendix B).

4.7.4 Water Use

Water would be required for staff amenities, dust suppression and irrigation of areas being vegetated.

The proposed operations would result in a small increase in the number of employees working at the site which would result in an increase in demand for potable water. The brickworks are currently serviced by a reticulated water supply and this would also provide an adequate supply to the staff amenity buildings, associated with the landfill.

Dust suppression would be required during dry weather on unsealed internal access roads and on the active excavation and landfill areas. Water contained in the stormwater sediment pond would be used for dust suppression. This would be supplemented by the reticulated water supply where necessary.

Areas being vegetated would require frequent watering during the first few months of planting and after this time would only require watering during extremely dry conditions. Water contained in the stormwater sediment pond would be used for this purpose.

4.8 LEACHATE MANAGEMENT

4.8.1 Objectives

The objectives of leachate management strategies are to:

- identify potential leachate generation;
- minimise the generation of leachate;
- minimise the contamination of ground and surface water by leachate; and
- collect leachate and treat it on-site.

4.8.2 Generation and Collection

Leachate is defined as all water which comes into contact with waste material. Potential sources of leachate are as follows:

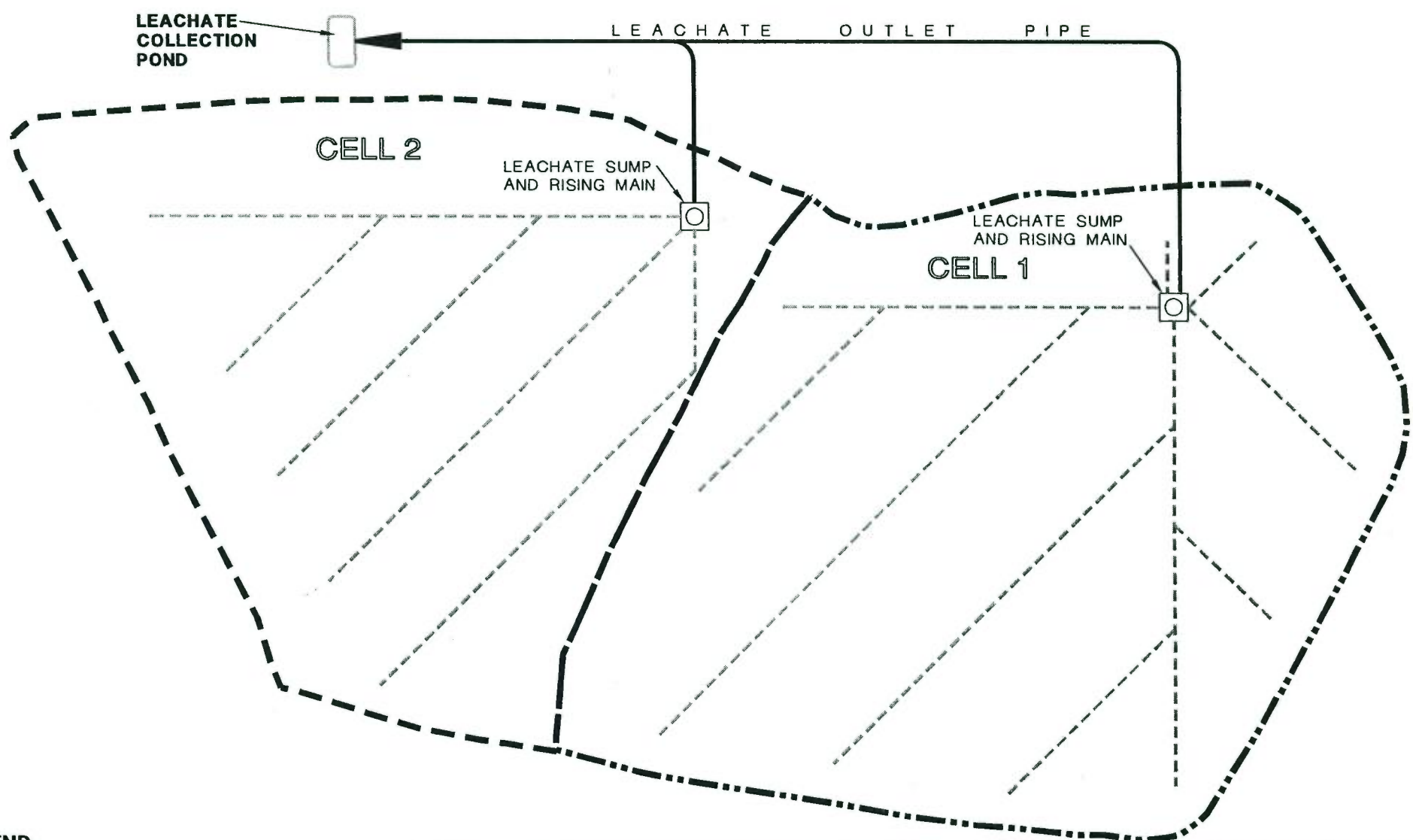
- water already contained in the waste during placement;
- precipitation falling directly onto the site during landfilling operations;
- stormwater runoff from adjacent areas percolating into the waste; and
- precipitation falling directly onto the site and percolating into the waste after landfilling is complete.

The rate of leachate generation is dependent on a number of factors such as precipitation, evaporation, rates of surface runoff, soil characteristics, temperature and make up of the waste. With the implementation of management measures which minimise the infiltration of precipitation, and the nature of the waste material, the rate of leachate generation by the landfilled waste is predicted to be low.

Leachate would be contained within the landfill by a liner system which would be installed over the base of the void. The liner would prevent leachate contaminating ground and surface waters. A leachate collection system would also be installed to intercept leachate generated by the landfilled waste.

A separate leachate collection system would be installed in Cells 1 and 2. Both collection systems would consist of a network of pipes, and a leachate sump and rising main. The pipes would be installed in a leachate collection layer in trenches at the base of the landfill. The base of the landfill would be graded so as to direct leachate toward the pipes which would transport leachate to the sumps and rising mains. From the sumps, leachate would be pumped via a leachate outlet pipe to the surface and stored in a leachate collection pond located on the outer rim of the landfill (Figure 4.8). The pond would have a capacity of 100 m^3 and would be constructed of a low permeability material to guard against percolation.

As landfilling progresses, the height of the rising mains would need to be adjusted as the depth of the landfill increases.



LEGEND

- LEACHATE COLLECTION PIPE
- CELL 1 BOUNDARY
- CELL 2 BOUNDARY

0 20 40 60 80 100

metres

Woodward-Clyde

CLIENT
AUSTRAL BRICK COMPANY PTY LTD

PROJECT
AUSTRAL BRICK SOLID WASTE LANDFILL EIS,

REVISION: **A**
SCALE: **AS SHOWN**
DRAWING No: **A8601191/0540**
CAD FILE NO: **G.023**
DATE: 20/11/97
DESIGNED: **CB**
DRAWN: **HC**
CHECKED: SKT
APPROVED: CB
STATUS: **FINAL**

TITLE
LEACHATE COLLECTION SYSTEM LAYOUT

FIGURE
4.8

A4

4.8.3 Leachate Characterisation

A leachate monitoring program would be implemented so as to chemically characterise the leachate and to ensure the appropriate treatment and disposal methods are being used. It is not expected that leachate would contain excessive pollutant concentrations due to the non-putrescible and non-hazardous nature of the waste to be accepted at the landfill.

Leachate monitoring would include:

- monitoring the height of leachate in the riser. These measurements would be made on a monthly frequency and would be used to assess the adequacy of the treatment/disposal system; and
- sampling leachate from the riser and testing it for a range of organic and inorganic analytes. Leachate would be sampled quarterly and the analytical results would be used to determine if adequate treatment techniques are being used.

4.8.4 Treatment and Disposal

Leachate collected in the leachate collection pond may, depending on its quality, be used to respray the landfill surface. Alternatively, leachate may be disposed of to sewer under licence from Sydney Water. It is likely that a proportion of leachate stored in the pond would evaporate over time.

4.8.5 Post Closure Monitoring and Maintenance

Austral would continue monitoring, and performing post closure maintenance of completed areas, until such time that there is scientific evidence that the landfill wastes have stabilised and do not have the potential to pollute. The Certificate of Completion would take the form of a report that summarises:

- hydrological monitoring data;
- leachate monitoring data;
- landfill gas monitoring data;
- surface monitoring data;
- water and sediment control evaluation report;
- physical inspection report;
- revegetation analysis report;
- defined future use analysis; and
- environmental regulation compliance statement.

5.1 FORMAL PROCEDURES FOR CONSULTATION

5.1.1 New South Wales Formal Procedures

This EIS has been prepared in accordance with Part 4 of the EP&A Act and its regulation (as amended). Part 4 of the EP&A Act ensures that the potential environmental effect of a proposal is properly assessed and considered in the decision making process.

In preparing this EIS, the requirements of the Director-General of DUAP were sought as required by Clause 52 of the Regulation. Each of the matters raised by the Director-General of Urban Affairs and Planning for consideration in the EIS are outlined in Table 5.1 together with the relevant section of the EIS which addresses that matter. An unabridged copy of the Director-General's requirements dated 30 September 1997 can be found in Appendix C.

Table 5.1
NSW DEPARTMENT OF URBAN AFFAIRS AND PLANNING DIRECTOR-GENERAL'S REQUIREMENTS

Matter	Reference in EIS
Consistency with objectives and provisions of Sydney REP No. 9 - Extractive Industry	Section 16
Consistency with objectives and provisions of Sydney REP No. 20 - Hawkesbury Nepean River	Section 16
Demonstration that the project is consistent with the objectives of the regional open space zone, 6(c) Recreation Corridor under Fairfield LEP, 1994	Section 16
Impact of additional traffic volumes on Wallgrove Road	Section 10
Impact on Eastern Creek	Section 7
Assessment of the likelihood of the site supporting threatened species, populations, ecological communities, or their habitats	Section 11
Statutory authority consultation	Section 5

In addition to the above, Clause 51 of the Regulation to the EP&A Act lists the matters which shall be included in the contents of an EIS. These matters together with the relevant sections of the EIS which give consideration to the issues, are summarised in Table 5.2.

Table 5.2
STATUTORY REQUIREMENTS FOR EIS (INCLUDING EP&A REGULATION CLAUSE 51 MATTERS)

Matter	Reference in EIS
Summary of EIS	Executive Summary
Objectives of activity	Section 2
Alternatives	Section 3
Consequences of not proceeding	Section 25
Justification of activity	Section 25
Description of activity	Section 4
Description of environment	Sections 6 to 16
Analysis of impacts	Sections 6 to 16 and 18 to 22
Safeguard measures	Section 24
ESD principles	Section 17
Summary of safeguards	Section 24
Approvals required	Section 1

5.2 CONSULTATION WITH STATUTORY AUTHORITIES

5.2.1 Planning Focus Meeting

A planning focus meeting was held at the Administration Offices of Austral Bricks, Horsley Park on 14 August 1997 in order to introduce members of the study team to the statutory and other relevant authorities, and to provide an outline of the Solid Waste Landfill EIS. The following authorities attended the meeting:

- DUAP;
- Fairfield City Council;
- Blacktown City Council;
- NSW EPA;
- NSW Department of Mineral Resources;
- WSWB;
- Sydney Water;
- NSW Roads and Traffic Authority; and
- Southern Western Sydney Public Health Unit.

5.2.2 Statutory and Other Relevant Authority Replies

During preparation of the EIS all relevant authorities were contacted advising them of the project and requesting written confirmation of any comments or concerns with regard to the proposed works. A list of statutory authorities contacted and replies received from each statutory authority are in Appendix D. A summary of the comments/requirements of the authorities is presented below.

Table 5.3
STATUTORY AND OTHER RELEVANT AUTHORITIES COMMENTS AND REQUIREMENTS

Authority	Comments/Requirements	Reference in EIS
NSW Department of Urban Affairs and Planning	• Consider context of the site.	Sections 6 to 16
	• Land is located in Prospect Corridor and DUAP is the acquisition authority for corridor lands.	Section 16
	• Need to consider the impact of the proposal on the water quality of Eastern Creek.	Section 7
	• Need to retain vegetation along Eastern Creek.	Section 11
	• On completion of landfilling activities, the final landform should be stable, attractive and enable the growth of vegetation.	Section 4
	• The EIS should justify the need for the proposed landfill.	Section 25
Fairfield City Council	• Need to address odour control and means of dealing with odour emissions in EIS.	Section 8
	• Strategies to monitor and manage landfill gas should be addressed in the EIS.	Section 23
	• Longterm stockpiles should be stabilised with vegetation. Would help reduce the visual impact.	Sections 4
	• Diversion of surface water from fill areas and other surface water management strategies should be addressed in the EIS.	Sections 4,6 and 7
	• The impact of the proposal on the rural residential interface should be assessed.	Section 15

Authority	Comments/Requirements	Reference in EIS
	• The final landform should be detailed in the EIS. It should reflect the surrounding topography.	Section 4
	• Assess the cumulative impact of the proposal.	Section 22
	• Detail means of ensuring the landfill only receives the waste it is licenced to receive. How would the proponent deal with unacceptable waste?	Section 4
	• Indicated that the local community objected to the overall timeframe of landfilling at the nearby PGH site. Timeframe on this site would be longer.	Noted
	• Consider implications of potential rezoning of land parcel on western side of Wallgrove Rd for industrial purposes.	Section 21
Blacktown City Council	• An LEMP is a critical component of the project.	Appendix B
	• The LEMP and EIS should detail the timing of activities and the agencies responsible for undertaking specific activities.	Section 4 and Appendix B
	• The anticipated duration of landfilling should be detailed in the EIS.	Section 4
	• Environmental controls relating to water and air quality should be included in the EIS.	Sections 7 and 8
	• Examine impact on regional water and air quality.	Sections 7 and 8
NSW Environment Protection Authority	• Solid waste guidelines apply to the proposal.	Section 4
	• A Draft LEMP must be prepared as part of the EIS.	Appendix B
	• Any new waste management technologies would be reviewed by the EPA.	Noted
	• No problem with using cells to compartmentalise waste as long as environmental monitoring is undertaken.	Noted and Section 23

Authority	Comments/Requirements	Reference in EIS
NSW Department of Mineral Resources	• The site is located in a regionally significant area.	Section 16
	• Marketing of bricks is currently based on the colour of brick preferred by consumers. This could change in the future. There is a need to determine whether Void 1 contains resources which are suitable for brick manufacturing operations. Concerned that the proposed landfill does not sterilise a future resource.	Section 6
	• Exploration drilling should be conducted prior to extending Void 1.	N/A (part of Detailed Design)
	• Provide details of what resources are there, what can be extracted and justification for any sterilisation of future resources.	Section 6
Western Sydney Waste Board	• The Waste Minimisation and Management Act states that efforts should be made to reduce the consumption of resources and the disposal of waste to landfills.	Section 2
	• There are a number of landfills in this region.	Section 2
	• Class 2 landfills should be in the business of waste management.	Section 2
	• A Draft LEMP must be prepared as part of the EIS.	Appendix B
	• Materials in the waste stream are potential resources.	Section 2
	• New waste management strategies aim to divert 60% of waste from landfill. Also aim to reduce the quantity and promote the reuse of waste. This would result in the landfill having a longer lifespan.	Section 2
	• Class 2 landfills contain waste which degrades slowly. May be 150 years or more. Need to examine the ecological sustainable issue.	Section 17
	• Examine the Waste Minimisation and Management Act 1995 as it relates to management of waste.	Section 2
	• Waste Boards set the policy for the region while the EPA ensures appropriate environmental controls.	Section 2

Authority	Comments/Requirements	Reference in EIS
	• The Draft Regional Waste Plan for the Sydney Region states that the materials now in the waste stream are a valuable resource that should be used to gain higher value. For instance demolition and commercial material should be resourced so it can be reused rather than just placed in a landfill.	Section 2
	• Need to look at reuse of waste.	Section 3
Sydney Water	• No impact on Sydney Water Supply Pipeline is anticipated.	Section 15
	• Environmental control measures should be adopted to ensure there is no impact on Prospect Reservoir or on groundwater quality.	Section 7
NSW Roads and Traffic Authority	• The likely traffic movements generated by the proposed development should be addressed in the EIS.	Section 10
	• The necessity of making improvements to existing road and intersection conditions (in terms of traffic and pedestrian safety and efficiency) in the immediate vicinity of the development should be addressed in the EIS.	Section 10
	• Need to examine options for entrance and sight distances on Wallgrove Rd.	Section 10
	• The form of intersection should be discussed - would it be signal or sign controlled?	Section 10
	• A traffic management plan should be developed particularly if there would be truck movements in the period from 10 pm to 6 am. Where possible residential areas should be avoided, particularly during this time period.	Section 10
	• The proposed access driveway treatment and on-site parking layout for staff, visitor and heavy vehicles should be addressed.	Section 10
	• The EIS should justify the need for a separate access road to the landfill.	
	• The Orbital road is not likely to be constructed as soon as previously anticipated. However the proposal has not been abandoned.	Section 10

Authority	Comments/Requirements	Reference in EIS
South Western Sydney Public Health Unit	• The proposed landfill should not affect the provision of water for drinking purposes.	Section 7
	• The disposal of on site, project generated sewage should be addressed.	Section 21
	• Health and safety issues relating to the construction and operation of the proposed landfill should be addressed.	Section 19

6.1 TOPOGRAPHY

The subject site generally reflects topography of the Minchinbury/Horsley Park area which is characterised by rolling terrain with low to moderate relief. The property is dominated by a hill at the south-western edge of the study area, and Void 1 with an elevation of around 92 mAHD. From the hill top the ground surface generally slopes to the north-west and to the east, with typical ground slopes of between 4° and 8°.

An earth bund, running parallel to Wallgrove Road, separates the active quarry area from a landscaped buffer zone, approximately 60 m wide.

Void 1 is divided into two zones; the lower platform in the eastern portion from where material has been extracted for the brickworks, and the upper platform in the western portion which is being stripped in preparation for mining activities. The upper platform is at an elevation of approximately 70 mAHD. The western corner of the lower platform is at a lower elevation of some 55mAHD.

The north-western corner of the pit is currently inundated to an elevation of approximately 51 mAHD (as surveyed in late July, 1997). This water is predominantly stormwater which has accumulated at the lowest point within the quarry area.

Void 1 also contains a number of stockpiles.

6.2 GEOLOGY

6.2.1 Regional Geology

The study area is situated near the central portion of the Sydney Basin, which is a broad geological province formed essentially by Permian and Triassic sedimentation. The general stratigraphic succession at this location comprises the Triassic Hawkesbury Sandstone, overlain by the Wianamatta Group, also of Triassic Age. The Wianamatta Group comprises, in ascending order, the Ashfield Shale, the Minchinbury Sandstone and the Bringelly Shale, with the latter forming the ground surface across the relatively flat terrain in the region. The elevation of the base of the Wianamatta Group in the region is given as around -80mAHD (Department of Minerals and Energy, 1991). The following table provides a breakdown of the general stratigraphy of the Wianamatta Group.

UNIT	THICKNESS (m)
Bringelly Shale	≈ 70 to 100
Minchinbury Sandstone	≈ 3
Ashfield Shale	≈ 50

The Bringelly Shale, the uppermost member of the Wianamatta Group, comprises, in decreasing abundance, claystone (often carbonaceous), siltstone, laminate, tuff and coal (Herbert, 1975). The Bringelly Shale is also considered to be more plastic than the Ashfield Shale, and it displays greater lithological variation than the underlying formations. Weathering of the Bringelly Shale produces grey and red silty clays, with abundant siderite nodules.

6.2.2 Regional Geological Structure

The Penrith Geological Sheet (Department of Minerals and Energy, 1991) indicates that the study area is located approximately 2 km south-west of a regional synclinal structure referred to as the Penrith Basin (which has a trend of 150° at a point nearest the site). The study area is also close to a regional lineament (having a trend of 008°) which coincides with Eastern Creek, adjacent to its eastern boundary.

6.2.3 Site Geology

Based on investigation drilling and observation of the existing quarry faces of Void 1 carried out as part of this study, the site geology reflects the general nature of the Bringelly Shale, as described in Section 6.2.1, above. From the ground surface down, the stratigraphy at the site is described as:

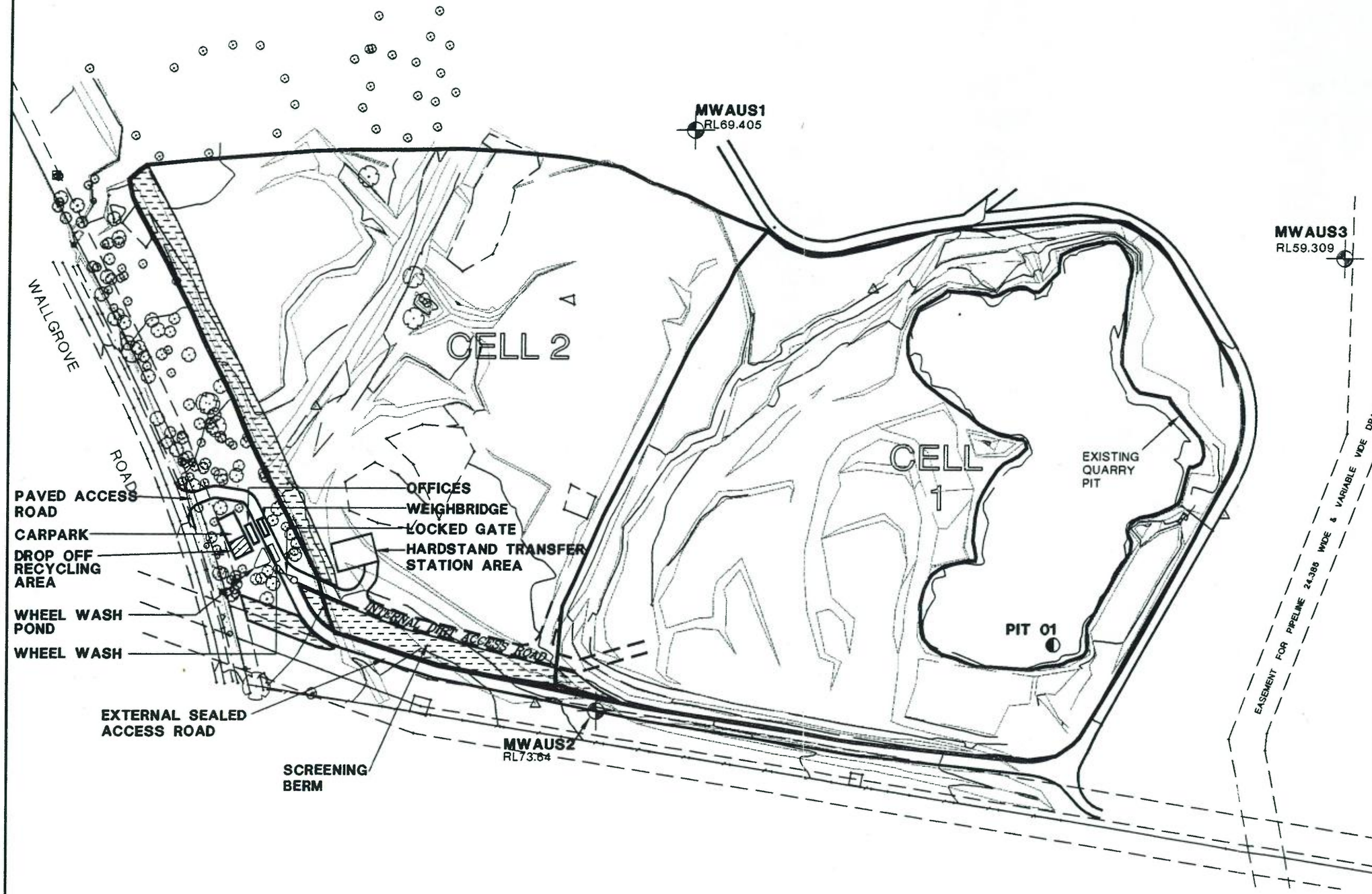
- topsoil, comprising silty clay with high organic content, including vegetation, rootlets and other organic components. The topsoil is typically between 0.0m and 0.2m thick.
- residual soil, comprising dark grey to grey and mottled red-grey clay, which is derived from insitu weathering of the Bringelly Shale. Based on tactile assessment of tube samples and insitu tests (Standard Penetration Tests (SPT)) the clay was typically assessed to have a firm to very stiff consistency (SPT results indicated N values between 16 and 41) and generally to be of low to medium plasticity; and
- the residual clay typically becomes harder with depth and progresses through extremely weathered to distinctly weathered and fresh shale. Various layers of claystone and siltstone/sandstone are exposed in the quarry walls of Void 1. However, the predominant lithology comprises a light grey claystone with occasional carbonaceous claystone layers.

At borehole locations MWAUS1 and MWAUS3 (shown in Figure 6.1), fill material was encountered to depths of 1.2m and 5.5m below the ground surface, respectively. The fill typically comprised clay and shale, with some sand, gravel, plastic and brick fragments. The fill was assessed to be moderately to well compacted, and is probably re-worked site soils.

During the site inspection carried out as part of this study, no evidence of major structural features were observed. Moderately to widely spaced sub-vertical joint planes were evident on remnant sandstone and siltstone faces, along the eastern boundary of the study area. The bedding planes within the shale formation visible in the quarry faces, indicated near horizontal structure, with a slight overall dip (in the order of 1° or less) towards the north-east.

6.2.4 Geological Resource

The Wianamatta Group is the main source of structural ceramic material in the Sydney region, as can be seen by the number of brick works in the area. Because of its higher plasticity and lithological variation, the Bringelly Shale is considered a good material for brick making as it is more suited to modern day extraction methods for brick production, and has the potential to produce a variety of colours after firing. Both the Ashfield Shale and the Bringelly Shale are also considered potential sources of raw materials for production of lightweight concrete aggregate (although the Ashfield Shale, and particularly the lower portion of it, is considered a superior resource in this respect).



REVISION:	A	DESIGNED:	CB
SCALE:	1:3000	DRAWN:	HC
DRAWING No:	A8601191/0540	CHECKED:	SKT
CAD FILE NO:	Q.025	APPROVED:	CB
DATE:	20/11/97	STATUS:	FINAL

SOURCE:
WILLIAM L. BACKHOUSE Pty. Limited

LEGEND

- SCREENING BERM
- MONITORING WELL LOCATIONS
- MWAUS1 — SURFACE WATER SAMPLING LOCATIONS

NOTE:
SURFACE WATER SAMPLE CREEK 1 WAS COLLECTED FROM EASTERN CREEK APPROXIMATELY 20m SOUTH OF MWAUS3

0 20 40 60 80 100
metres

CLIENT
AUSTRAL BRICK COMPANY PTY LTD

PROJECT
AUSTRAL BRICK SOLID WASTE LANDFILL EIS

TITLE
SURFACE WATER SAMPLE AND MONITORING WELL LOCATIONS

FIGURE
6.1

A3

Woodward-Clyde

Material currently extracted from Void 1 is between 60 and 80m above the base of the Bringelly Shale, and this zone is reported (Herbert, 1979) to have the highest potential for significant mineable reserves for brick making, within this formation.

6.3 SOILS

6.3.1 Soils and Weathering

Much of the study area has already been disturbed by activities associated with the brickworks. The Penrith Soils Landscape Map shows that the site is within the Blacktown soils landscape, which, in the undisturbed state, is recorded as having hard-setting, mottled duplex soils (red and brown podsols) on crests. Heavier, more plastic red-brown earths would be expected in lower lying, moist areas. These soils are the result of insitu weathering of the Bringelly Shale, and their presence on site was confirmed by inspection of exposures within the existing quarry, and during drilling carried out as part of this study.

Topsoil present in undisturbed areas is described as a brown silty clay loam with high organic content. The layer of topsoil is relatively shallow with depths varying up to 0.2m. Wherever possible, topsoil would be stripped and stockpiled for future land restoration. Testing carried out at the PGH Brickworks site at Horsley Park CMPS&F (1997), indicated that the clayey residual soil is unlikely to be suitable for topdressing during land restoration. However, it would be suitable for daily or intermediate cover for the proposed landfilling operations.

Exposed claystone, siltstone and laminate in Void 1 tend to weather very rapidly, producing a scree of fine lamellae which covers lithological details and accumulates at the base of exposed slopes. This weathering, or breakdown of the parent shale, is a result of slaking and fretting of the shale surface, due to moisture loss after the face is exposed.

6.3.2 Erosion Potential

The undisturbed topsoils are generally in a stable condition and relatively resistant to erosion as a consequence of their hard-setting nature and high organic content. Compacted residual soils also typically have a low erosion potential, particularly on shallow slopes (less than 5%). As indicated above, the majority of the exposed Bringelly Shale lithologies tend to weather rapidly and (together with exposed insitu residual clay and silty clay) erode relatively easily.

6.4 GEOTECHNICAL ISSUES

The geotechnical issues associated with the proposal are as follows:

- cliff face stability during the extraction process;
- construction of a new access road;
- slope stability of inert waste used to fill the void after ore extraction; and
- site restoration, specifically the construction of an appropriate low permeability cover for the inert waste and the long-term integrity of the cover.

The quarry faces cut into the Bringelly Shale materials are expected to remain stable (both existing faces and those exposed during future quarry activities), at least for the duration of landfilling activities. The existing faces, particularly along the eastern boundary, have been exposed for some 37 years and no evidence of face collapse or other significant slope failure

has been recorded by site personnel. Given the generally near horizontal dip of the bedding planes within the shale, and the absence of major unfavourably oriented geological structure (faults or shear zones), the risk of significant failure of the exposed faces is relatively low. However, as indicated in Section 6.3.1, the faces weather rapidly which increases the risk of minor slumps and spalling. Ongoing monitoring of the exposed quarry faces would be carried out as part of the Draft LEMP (Appendix B), to ensure their proper and safe management.

The residual soils at the site are expected to produce suitable sub-grade conditions to allow normal haul road design and construction. The proposal would incorporate drainage measures to control surface runoff and collect and treat stormwater, which has the potential to contain elevated suspended sediment.

Operational procedures for the proposed landfill would include guidelines relating to maximum fill batter angles, maximum lift height and compaction of the fill. Regular monitoring and review of landfill operations in relation to the above criteria, should ensure that any risk of fill slope failure would be minimised.

A cover (or landfill cap) would be engineered as part of the final site restoration which would incorporate current EPA guidelines for capping layers.

The design and maintenance of an effective landfill cover is a considered part of this proposal as it would minimise leachate generation from inert waste, thereby minimising the cost of managing the leachate in the medium and longer-term. Settlement of the landfill material is expected, over time and has been addressed in the detailed restoration and landfill cap design, to ensure ongoing integrity of the capping layer.

6.5 SOIL CONTAMINATION

Subsurface investigations conducted as part of this study, and research on current and historical work practices at the quarry, have revealed no evidence of soil contamination within the study area.

6.6 STERILISATION OF RESOURCES

As indicated in Section 6.2.3, the Wianamatta Group is a major resource for structural ceramic material and for the production of lightweight aggregate, particularly in the lower portions of the Ashfield Shale. The restoration of Void 1 and its extension by landfilling, would effectively preclude further surface extraction of insitu materials from this area.

Extraction activities are currently within a geological zone which has the greatest potential to encounter good quality brick making materials within the Bringelly Shale. Deeper extraction is therefore unlikely to economically produce additional significant raw materials for the brickworks. Although the Ashfield Shale has some potential to produce lightweight aggregate, the considerable depth to this material (80m or more), precludes its consideration as a viable resource.

6.7 IMPACTS OF PROPOSAL

The following aspects of the proposal are likely to impact on the landform, geology and soils:

- the construction of a new access road which would alter the existing topography within a relatively narrow corridor along the southern edge of the site (although much of this area has already been disturbed by extraction activities);
- the proposed extension of Void 1, to the west; and
- the progressive filling of Void 1, and creation of a final landform which is likely to be at a slightly higher elevation than the land immediately surrounding the current pit.

6.8 SAFEGUARDS

Implementation of the following safeguards would mitigate adverse impacts of the Proposal:

6.8.1 Landform

The impacts associated with road construction, void extension and rehabilitation are primarily visual, and are described in Section 14. However, new ground surfaces and profiles would be designed to be compatible with the surrounding landform. Following completion of the project, all exposed areas would be rehabilitated and revegetated according to a landscape strategy to be prepared during detailed design.

6.8.2 Erosion and Sediment Control

Erosion and potential sediment transport from disturbed areas of the site, particularly during the construction and operation of the haul road would be minimised by implementing recognised control strategies developed in consultation with DLWC in the pre-construction phase. Design standards and methods for erosion control should be based on advice from DLWC's Soil Conservation Service and relevant Government agencies. The following safeguard measures would be adopted to control erosion.

Clearing

Providing a vegetative cover is the most effective method of minimising erosion and sedimentation. Initial clearing would be limited to areas that need to be actively used for construction and areas required for storage of materials and site machinery.

Buffer Zones

As far as possible, buffer zones should be established between the areas of disturbance and the natural drainage lines. The buffer zones are effective in protecting the drainage lines from construction related impacts.

Drainage and Flooding

Drainage works would form an integral part of landfill design and would be designed to divert water flows originating from undisturbed areas away from those areas disturbed during construction. Runoff down batter slopes would be minimised to preclude excessive erosion and localised failures of soil batters.

Erosion Controls

Temporary erosion and sediment control structures such as staked straw bales and sediment fences would be used to restrict and retain sediment movements, to within the construction site. Diversion banks and drains would be integrated into the drainage system.

Sediment Controls

Sedimentation controls would be designed to contain runoff from heavy rain periods. Runoff from areas of the site which have been stripped of vegetation cover, either for cover material, unsealed haul road construction or from stockpiles, would be directed by overland flow to the main stormwater sediment pond. Runoff from areas to be excavated would be directed to a temporary sediment collection pond at the base of the landfill from where water would be pumped to the stormwater sediment pond or re-used on site. Runoff from the active landfill area would be directed to a temporary dirty water collection pond. Both of these measures are shown in Figure 4.3). Due to the difficulty in capturing fine grained particles once they are in streams, emphasis would be placed on providing controls as close as possible to areas of soil disturbance, and with sufficient surface area to maximise particle settlement.

Stockpiles

Topsoils would be stripped and stockpiled for future land restoration and daily or intermediate cover for the proposed landfill. The materials would then be progressively respread during land restoration activities. Surface waters from disturbed areas or areas used for stockpiling purposes would be directed to the stormwater sediment pond (see Figure 4.3).

Revegetation

Temporary revegetation would provide short term stabilisation of disturbed areas during the construction period. Progressive permanent revegetation would be undertaken to stabilise completed works and allow the development of adopted landscaping themes. This could be carried out by hydroseeding, top soil replacement, and/or the use of commercially available geotextiles to promote seed germination and provide temporary soil protection.

Movement of Material Off Site

A truck washdown area provided close to the exit to the site would allow the wheels and chassis of vehicles to be washed down with a high pressure low volume water hose. This measure would ensure that soils and coarse materials would be removed from the vehicle and not deposited on Wallgrove Road. Washdown water from the wheel washing facilities would be pumped out and discharged to the wheelwash pond immediately adjacent to the brick washdown area. A coarse mesh basket in the collection pit would collect any large refuse, which could then be disposed of in a waste receptacle adjacent to the washdown area.

Maintenance

Regular maintenance of all erosion, sedimentation and pollution control devices would be undertaken to ensure their continuing effective and efficient operation.

The adoption of erosion and sedimentation control measures as described above, combined with close liaison with the DLWC to ensure implementation of the most suitable measures,

and also to monitor the effectiveness of those measures, would minimise the occurrence of any erosion and sedimentation impacts as a result of the project.

A summary of safeguard measures which would form an integral part of the proposal is presented in Chapter 24.

6.8.3 Other Geotechnical Issues

Other safeguards to mitigate potential concerns relating to the geotechnical issues would be included in the Draft LEMP in Appendix B and the operational procedures for the landfill. These measures include:

- limiting the lift thickness of waste to 1.8m which would maximise the compaction of the waste (thereby maximising the strength properties of the landfill material) and minimise the risk of intermediate fill slope failure. Any uncovered temporary batters in fill material should not be constructed steeper than 2 (horizontal):1 (vertical), otherwise specific geotechnical advice should be sought;
- regular monitoring and inspection of exposed quarry faces to identify any areas of preferential weathering or structural weakness, which may increase the risk of slope failure. Implementation of remedial measures such as shotcreting, rock bolts, meshing or excavation if problem areas are identified; and
- following statutory guidelines for specific design features (EPA guidelines for the design of landfill liners and caps) and appropriate materials and construction specifications, combined with construction supervision.

6.9 CONCLUSION

The geological setting of the study area is within the Bringelly Shale a formation of the Wianamatta Group. The properties and characteristics of this geology are well documented, and the subsurface investigations carried out as part of this study, confirm the site conditions are generally typical of other sites in the vicinity.

The proposal involves processes and techniques common to the industry. By using familiar and proven construction and operating guidelines and safeguards, no adverse impacts are expected with respect to landform, geology, soils and geotechnical issues. Some sterilisation of potential resources would occur by constructing the landfill. However, the practical and economical viability of realising those resources, either now or in the future, is extremely unlikely.

7.1 HYDROLOGY

7.1.1 Catchments and Drainage

The northerly flowing Eastern Creek which marks the eastern boundary of the proposed development is the most prominent natural feature of the Austral property. A smaller drainage depression lies on the undeveloped western corner of the site.

Eastern Creek drains the portion of western Sydney generally bounded by Cecil Park to the south, Plumpton to the west, Lalor Park to the east and Vineyard to the north. From its source to the north of Cecil Park, Eastern Creek flows northwards through Horsley Park, Doonside, Schofields and Riverstone. It then joins South Creek near Vineyard, which in turn enters the Hawkesbury River just downstream of Windsor. The Eastern Creek catchment has an area of approximately 120 km^2.

The portion of the Eastern Creek catchment area in the vicinity of the study area is roughly defined by the Sydney Water Supply Canal to the east, Wallgrove Road to the west, Southdown Road to the south and by the Warragamba-Prospect Water Supply Pipeline to the north. In total, it covers an area of approximately 4.5 km^2. Cross-roads, agricultural developments and numerous dams represent obstacles to the free flow of run-off. Eastern Creek forms the eastern boundary of the property and follows a corridor mostly lined with trees, probably remnants of the original open woodland of the Cumberland Plain.

The catchment area of the small water course which crosses the north-western corner of the property, approximately defined by Wallgrove Road to the east and Wallworth Road to the west, covers an area of about 1 km^2. Within the property's boundaries, the catchment is restricted by the bunds along Wallgrove Road.

Quarry and factory works have altered the natural drainage pattern on site, with the pits and Eastern Creek being the major recipients of the available run-off. The latter is the main discharge point for surface water run-off from the property.

Future development works would necessitate the re-arrangement of the present drainage regime on site to some extent, but the current run-off levels from the site would most likely remain the same. The Water Management Plan, as part of the environmental management planning for the project covering future operations, would address this matter in greater details.

7.1.2 Flooding

A flood study of the Eastern Creek catchment was undertaken by the Department of Water Resources (now the DLWC) in a report titled *Flood Study Report Eastern Creek* dated 25 July 1992.

The aim of the study was to estimate the 100 year Average Recurrence Interval (ARI) discharges, velocities and levels for Eastern Creek from Garfield Road to the Warragamba-Prospect water supply pipeline, Bungarribee Creek to 600 metres upstream of Doonside Road, Breakfast Creek to Sunnyholt Road and Bells Creek to just downstream of Richmond Road.

The nearest flood study cross-section to the study area is E 0.00 which is located immediately downstream of the Warragamba Prospect water supply pipeline on Eastern Creek. This is about 900 metres from Void 1. The calculated 1:100 year ARI flood level at this location is 54.5 mAHD. It is likely that the 1:100 year flood level of Austral's property would be slightly higher.

The survey information available only covers the study area and hence it is not possible to confirm, with any confidence, the likely impact of the 1:100 year flood on the study site. In general, the levels around the perimeter of the pit are above the calculated flood level of 54.5 mAHD, however, there may be some local depressions or flow paths between the eastern side of the pit and Eastern Creek that could result in flood waters entering the pit.

The possible impact of the Warragamba-Prospect water supply pipeline on the upstream flood levels was not addressed in the study. The impact of the pipeline may have some influence on the flood levels on the study area.

Not withstanding the above, the western portion of the site along Wallgrove Road could be considered "flood free" due to its higher elevation.

7.1.3 Water Quality

Eastern creek is not a classified waterway under the Clean Waters Act and is not, therefore, subject to specific water quality criteria for industrial discharges. However, any discharges from the site, other than uncontaminated stormwater, are subject to a licence issued by the EPA under the Pollution Control Act, 1970. The conditions of this licence reflect the existing water quality in Eastern Creek, as well as the agricultural water uses and aquatic systems in South Creek and, ultimately, in the lower Hawkesbury River.

Two surface water samples were collected from Void 1 and from Eastern Creek, half way through its length within the property. The sampling sites are shown in Figure 6.1 and are summarised in the following Table 7.1. The water samples have a similar anionic and cationic composition to the groundwater, although the surface waters have a significantly lower salinity, a higher proportion of sulphate and a lower proportion of chloride. Since the quarry has been excavated below the level of the water table, it is considered that the water in Void 1 is comprised of runoff, incident rainfall and groundwater.

The water in Void 1 is of a quality suitable for use for many purposes such as dust suppression and tree and grass watering and is currently discharged to Eastern Creek under licence from the EPA. Water from Void 1 will most likely be discharged to Eastern Creek or, alternatively, to sewer under licence from Sydney Water, when the pit is emptied prior to commencement of the landfilling operation.

7.2 HYDROGEOLOGY

7.2.1 General

Hydrogeological investigations have been undertaken by Woodward-Clyde to provide some background data prior to the start of landfilling. A detailed description of these investigations is provided in Appendix E and the findings summarised below.

The previous chapter described the general geological setting of the Horsley Park area. As mentioned, the quarry has previously excavated into material from the Bringelly Shale formation. Due to the depositional environment into which the sediments of the Wianamatta Group were laid, the Bringelly Shale is comprised of an alternation of different lithologies.

These range from massive sandstones to finely laminated shales, with each different material usually having limited thickness, generally not more than four or five metres.

Table 7.1

SURFACEWATER FIELD AND LABORATORY RESULTS

Analysis	Units	LOR	Creek 1	Pit 01
Field				
pH			7.45	8.03
Electrical Conductivity	µS/cm		1045	1208
Dissolved Oxygen	mg/L		7.5	7.12
Dissolved Oxygen	%		80	75
Redox Potential	mV		140	135
Laboratory				
Total Dissolved Solids	mg/L	1	758	856
Calcium	mg/L	1	12	11
Magnesium	mg/L	1	20	18
Sodium	mg/L	1	214	211
Potassium	mg/L	1	5	5
Bicarbonate as $CaCO_3$	mg/L	1	134	139
Sulphate	mg/L	1	62	61
Chloride	mg/L	1	272	259
Iron	mg/L	0.1	0.2	0.1
Arsenic	mg/L	0.01	<0.01	<0.01
Copper	mg/L	0.001	0.011	0.09
Manganese	mg/L	0.001	0.018	0.058
Lead	mg/L	0.001	<0.001	<0.001
Zinc	mg/L	0.001	0.017	0.035
Mercury	mg/L	0.0001	<0.0001	<0.0001
Fluoride	mg/L	0.1	0.5	0.8
Ammonia as N	mg/L	0.01	<0.01	<0.01
Nitrate as N	mg/L	0.01	0.03	0.18
Nitrite and Nitrate as N	mg/L	0.01	0.03	0.19
Total Kjeldhal Nitrogen as N	mg/L	0.1	0.5	0.65
Total Nitrogen as N	mg/L	0.1	0.5	0.8
Phosphorus as P -Total	mg/L	0.01	0.08	0.09
Total Organic Carbon	mg/L	1	15	18
Phenols	mg/L	0.2	<0.2	<0.2
Total Petroleum Hydrocarbons				
C6-C9 Fraction	µg/L	20	<20	<20
C10-C14 Fraction	µg/L	50	<50	<50
C15-C28 Fraction	µg/L	100	<100	<100
C29-C36 Fraction	µg/L	50	<50	<50
Halogenated Organics (AOX)	µg/L		88	80

1. LOR is Level of Reporting

The Wianamatta Group, to which the Bringelly Shale belongs, has not been affected by severe tectonic disturbances. As a result, the majority of structural defects are represented by fractures and joints, generally tight and infilled by secondary depositional products. Characteristically, most fractures and joints do not cross the lithological boundaries, ie., a fracture in a sandstone horizon, for instance, would not continue into the underlying, or overlying, laminite horizon. Major faults are rare and are mostly found against the uplifted blocks surrounding the Sydney Basin.

The individual lithological units of the Bringelly Shale do not have a primary hydraulic conductivity, due to their degree of cementation and weathering, that tends to produce clayey secondary products. The formation's hydrogeological parameters depend entirely upon fractures, joints and interbed partings. To the extent that these defects are interconnected, they provide secondary hydraulic conductivity and groundwater storage. In these circumstances, the rock mass will occasionally behave as an aquifer, delivering useful, albeit small, quantities of water. However, throughout the Sydney Basin, the Bringelly Shale displays a characteristically low hydraulic conductivity, that results in negligible groundwater yields to bores drilled into this formation.

7.2.2 Monitoring Wells

In order to evaluate the hydrogeological conditions of the rock mass underlying the quarry area, three groundwater monitoring wells, MWAUS-1, MWAUS-2 and MWAUS-3, were drilled and constructed around the periphery of Void 1 (see Figure 6.1).

Table 7.2 below presents a summary of the statistics of the monitoring wells.

Table 7.2

MAIN STATISTICS OF MONITORING WELLS

Item		MWAUS-1	MWAUS-2	MWAUS-3
Quarry Depth	mAHD	~45	~45	~45
Surface level at Wellhead	mAHD	69.41	73.64	59.31
Well Base	mAHD	37.21	38.64	38.21
Screened Interval	mAHD	50.61-38.71	52.04-40.14	48.61-39.71
Static Water Level (26.8.97)	mAHD	56.42	43.14	52.10

mAHD = metres Australian Height Datum

7.2.3 Groundwater levels

No definite conclusion can be drawn from the available levels at the time of measurement, because large differences in elevation are evident. These are considered to be a reflection of the variations in hydraulic conductivity of the rockmass at the three monitoring wells. The more permeable rockmass around MWAUS -1 displays the most rapid water level recovery and the highest elevation of the water level. The least permeable rockmass encountered around MWAUS -2 displays the lowest water level. It is expected that, in time, the water level in MWAUS -2 will reach an elevation comparable with the other bores.

The present indications suggest that a groundwater gradient exists inward from the area surrounding Void 1. This local effect is superimposed on to a regional water table which follows the slope towards Eastern Creek. Longer monitoring records will confirm this preliminary assessment.

7.2.4 Hydraulic Conductivity

The hydraulic conductivity is a hydrogeological parameter related to the ease with which groundwater flows through a rockmass under certain conditions. It is measured by performing a variety of tests in specifically constructed wells. Details of the tests performed are given in Appendix E. A summary of the results is presented in Table 7.3 below.

Table 7.3

HYDRAULIC CONDUCTIVITY, K, SUMMARY

Well	Date	Interval tested m AHD	K m/sec	Type of test
MWAUS-1	12.8.97	51.91-37.21	$3.1x10^{-6}$	Recovery
MWAUS-2	26.8.97	31.3-35.0	$1.8x10^{-8**}$	Recovery
MWAUS-3	11.8.97	50.11-3.21	$1.9x10^{-8}$	Recovery

** Preliminary value, as this well is recovering at a very slow rate.

The Bringelly Shale formation is known throughout the Sydney Basin to have low hydraulic conductivity, a characteristic that has favoured the establishment of several landfills in the area. The hydraulic conductivity values measured at the subject site are low and indicate that the movement of groundwater in and around the quarry is limited. The groundwater is under semiconfined to confined conditions, under the clay surface layers derived from the weathering of the Bringelly Shale formation units. Under these conditions, direct recharge to the rockmass aquifer via infiltration of surface waters is limited, a fact that is also confirmed by the chemistry of the groundwater, as discussed below.

7.2.5 Groundwater Quality

Water samples were collected from the three monitoring wells, from Void 1 and from Eastern Creek. These samples were analysed for a range of parameters and constituents based on the list of groundwater indicator parameters required under the EPA's *Environmental Guidelines: Solid Waste Landfills, 1996*, but expanded to include additional analytes.

Table 7.4 presents the field measurements and laboratory results.

The results show that the groundwater is typical of the groundwater in the Bringelly Shale formation in the Western Sydney area. The Bringelly Shale was deposited in a near-marine and lacustrine environment and the water entrapped in the sediments was saline. Due to the low permeability of the sediments, flushing of the connate waters by recharge waters since deposition has occurred only in part and, preferentially, along more permeable conduits associated with structural defects and weaknesses. As a results, the salinity of the groundwater in this formation can be variable and unevenly distributed.

Table 7.4

GROUNDWATER FIELD AND LABORATORY RESULTS

Analysis	Units	LOR	MWAUS - 1	MWAUS - 2	MWAUS - 3
Field					
pH			7.84	7.01	6.8
Electrical Conductivity	µS/cm		11050	17090	15650
Dissolved Oxygen	mg/L		4.05	2.05	4.8
Dissolved Oxygen	%		43.3	21.3	50
Redox Potential	mV		334	0	290
Laboratory					
Total Dissolved Solids	mg/L	1	6560	10300	9970
Calcium	mg/L	1	71	140	104
Magnesium	mg/L	1	186	73	430
Sodium	mg/L	1	212	3900	3130
Potassium	mg/L	1	25	44	17
Bicarbonate as $CaCO_3$	mg/L	1	1320	346	824
Sulphate	mg/L	1	55	12	404
Chloride	mg/L	1	2980	6290	5400
Iron	mg/L	0.1	<0.1	<1.0	0.4
Arsenic	mg/L	0.01	<0.01	0.01	<00.1
Copper	mg/L	0.001	0.008	0.004	0.010
Manganese	mg/L	0.001	0.013	0.192	0.485
Lead	mg/L	0.001	<0.001	<0.001	0.019
Zinc	mg/L	0.001	0.026	0.027	0.059
Mercury	mg/L	0.0001	<0.0001	<0.0001	<0.0001
Fluoride	mg/L	0.1	0.2	<0.1	0.3
Ammonia as N	mg/L	0.01	1.98	8.59	0.83
Nitrate as N	mg/L	0.01	0.04	0.06	0.04
Nitrite and Nitrate as N	mg/L	0.01	0.05		0.04
Total Kjeldhal Nitrogen as N	mg/L	0.1	2.5	9.8	1.1
Total Nitrogen as N	mg/L	0.1	2.6		1.1
Phosphorus as P -Total	mg/L	0.01	0.05	0.43	0.19
Total Organic Carbon	mg/L	1	14	22	12
Phenols	mg/L	0.2	<0.2	<0.2	<0.2
Total Petroleum Hydrocarbons					
C6-C9 Fraction	µg/L	20	<20	<20	<20
C10-C14 Fraction	µg/L	50	<50	<50	<50
C15-C28 Fraction	µg/L	100	200	<100	748
C29-C36 Fraction	µg/L	50	<50	<50	76
Halogenated Organics (AOX)	µg/L		235	180	265

These conditions have been encountered at the subject site. The groundwater has a composition similar to seawater, with higher salinity found where the rockmass permeability is lowest. The concentrations of metals and other constituents are generally low and within background levels for the Western Sydney area. Traces of heavier fractious hydrocarbons have been recorded in the wells, but not in the creek and pit water. The concentration of Total Petroleum Hydrocarbons (TPH) in the wells is low and it is possible that it derives from the carbonaceous component of the Bringelly Shale, as experienced at other sites in the western Sydney area.

The Absorbable Organic Halogens (AOX) test is carried out as an inexpensive and preliminary indicator of organic contamination. The analytical results from the bores indicate generally low to medium AOX values, but the higher values may have been affected by the presence of colloidal material or particulate in the sample.

In consideration of the type of activities carried out at and around the site, of the low rockmass hydraulic conductivity, of the depth of the bores and of the low AOX levels in the creek and pit waters (80-88 µg/L), it is most probable that the groundwater values encountered are background values applicable to the area. In addition, the upgradient (MWAUS-1) and the downgradient (MWAUS-3) wells have similar AOX concentration, which further excludes the Void 1 as the possible source of the AOX.

7.2.6 Hydrogeological Summary

The hydrogeological assessment of the subject site shows that the quarry is located in the Bringelly Shale rockmass, that it is characterised by low hydraulic conductivity and semiconfined to confined conditions under the surface clays. These characteristics and the original nature of the sediments are responsible for poor recharge to the rockmass, for the persistence of high salinities around the site and for their uneven distribution.

The overall hydraulic gradient could not be determined with accuracy at the time of the study as the groundwater levels were still recovering from the drilling and purging and sampling carried out. However, it appears that a regional gradient from west to east towards Eastern Creek exists under the site, following the natural surface topography. Groundwater is located some metres below the creek level, indicating that, potentially, recharge could occur through the creek bed. Superimposed on the regional gradient, there is a depression in the water table coinciding with the quarry void. The water table depression results in an inward gradient towards Void 1, limiting the opportunity for migration of the pit water away from the site.

7.3 IMPACTS ON PROPOSAL

The hydrological and hydrogeological conditions of the site are unlikely to have any significant impacts on the proposed landfill.

Surface Water

Bunding, contouring and other controls will control run-off and minimise the risk of flood waters entering the site. The subject property is located at the headwaters of Eastern Creek and the catchment above the site is small and fractioned by existing developments.

Groundwater

The hydrogeological regime described earlier is not an actively dynamic regime. The pond water analysis results suggest that the majority of the water is accumulated run-off, and that groundwater inflows into the pit are minimal and largely diluted. After dewatering for landfilling, inflows are expected to remain low, even under a steeper gradient at the quarry face. Inflows into the pit will be disposed of via the leachate collection system, and collected in stormwater sediment ponds and, finally, re-used over the waste. The high groundwater salinity will not have a significant impact on the proposal, as the leachate will eventually also attain high salinity.

7.4 IMPACTS FROM PROPOSAL

Surface Water

The management of surface waters around the proposed landfill will prevent any run-off from the site's working areas entering Eastern Creek.

Incident rainfall will result in some stormwater run-off from different areas, such as:

- clay and shale stockpiles,
- disturbed areas stripped of vegetation,
- brickmaking and associated activities,
- active quarry areas,
- active landfill areas, and
- occasional leachate generation from landfill areas.

The potential for turbid or contaminated run-off to reach Eastern Creek and to leave the site would be minimised by surface water control measures already in place and by additional drainage controls proposed under the Draft LEMP.

No adverse impact is expected from site activities on the surrounding surface waters.

Groundwater

The establishment of the landfill has the potential to impact on the groundwater underlying the site. The impacts would be mainly from the generation of leachate within the waste mass which could escape from the site. However, natural and man-made impediments will ensure leachate is managed on site.

Natural limitations are the low permeability of the rockmass and the low economic value of the groundwater, as its saline nature precludes use for domestic or commercial purposes. Man-made impediments are the engineering of the landfill to enhance the low permeability of the formation, the installation of a liner, and a leachate collection system to further limit the potential for escape of leachate to the groundwater by the maintenance of an inward gradient during the life of the landfill.

In addition, leachate generation will be kept to a minimum by the management practices of the facility, including limiting the amount of refuse exposed, daily covering of waste and the final landscaping of the completed landfill.

Upon cessation of pumping from the leachate collection system, the groundwater underlying the site would recover to pre-development regional levels. The recovery would be slow, in the order of many years, due to the low hydraulic conductivity of the rockmass and the limited opportunity for recharge and infiltration provided by the clay capping of the waste and the natural surface clays surrounding it.

Once the water level in the refuse has risen to a level above the regional water table, then a reversal of the hydraulic gradient would occur and the potential for escape of leachate into the surrounding groundwater would exist. However, it is most probable that, at that time, the evolution of leachate processes would be such that the leachate would be of a better quality than the natural groundwater, because the landfill would not accept putrescible waste.

The proposed development would have no adverse impact on the surrounding groundwater environment.

7.5 SAFEGUARDS

The impact of the proposed landfill on the surrounding hydrological and hydrogeological environment would be well managed by safeguards to be implemented as detailed in the LEMP. In brief, safeguards will address the following points:

Flood Control

The current surface levels of the study site are generally above the calculated 1:100 year ARI flood level. There may be some minor depressions between the pit and Eastern Creek, however, which may allow flood waters to enter the pit during the 1:100 year storm event.

As part of the development works, all depressions or possible flow paths would be filled to a level 0.5 metres above the 1:100 year flood level which would effectively prevent flood waters from entering the pit/landfill areas.

Drainage

Most of the site is already protected by an earth bund which prevents the entry of surface water from surrounding properties and also controls run-off from the property. Diversion drains on the property would convey surface waters from disturbed areas or areas around stockpiles to a stormwater sediment pond, for use within the landfill. Runoff from areas to be excavated would be directed to a temporary sediment collection pond at the base of the landfill and then pumped to the stormwater sediment pond. A temporary dirty water collection pond would collect water from the active landfill area.

Modifications to the site's internal drainage would need to provide for the collection of turbid run-off from stockpiles and disturbed areas in adequately sized settlement ponds, prior to re-use within the site or discharge to natural drainage. More permanent areas should be grassed in order to limit run-off and sediment transport.

Surface Water

Surface water quality monitoring would be required as part of the operating licence, according to the conditions set by the regulatory authorities. Section 2.7 of the Draft LEMP in Appendix B provides details of environmental objectives and management strategy for surface water monitoring.

Groundwater

During the operation of the landfill and for some years after completion, an inward hydraulic gradient would be maintained by the works drainage and leachate collection system. Escape of leachate from the site would be prevented. Groundwater levels and hydrochemistry conditions would be monitored at a network of purpose built monitoring wells and monitoring reports would be submitted to the relevant regulatory authorities as required.

On completion of landfilling, groundwater monitoring would be maintained for a post-closure period as determined by the licence conditions. Section 2.4 of the Draft LEMP in Appendix B provides details on the proposed groundwater monitoring program.

Leachate

Leachate testing would be carried out to provide Austral with a basis for beneficially using the leachate or ensuring that leachate which cannot be otherwise used, is stored in a leachate pond. Section 2.8 of the Draft LEMP in Appendix B provides details of the leachate monitoring program.

7.6 CONCLUSIONS

The quarry area is currently being managed so as to limit surface water impacts on the surrounding environment and within the quarry itself. Under the approval conditions for the proposed landfill, improvements to the present system would be required due to the change in the operation of the site. Details of such improvements are set out in the Draft LEMP in Appendix B.

The hydrogeological regime under the site is one common to the Western Sydney area. The Bringelly Shale formation displays low hydraulic conductivity and contains groundwater that is saline. Interaction between surface waters and groundwater is limited by the surface clays, which act as a confining layer on the rockmass underlying the area.

By the maintenance of an inward hydraulic gradient for the duration of the landfilling operation and for some time after closure, leachate would be prevented from escaping from the site. Eventually, water levels within the landfill would recover to a level higher than the surrounding groundwater, thus reversing the hydraulic gradient. At that time, it is expected that the leachate would have matured to a liquid, having characteristics that would be indistinguishable from the natural groundwater. These characteristics would be the result of a number of known natural attenuation processes, such as advection, diffusion and dispersion.

8.1 LOCAL CLIMATE

The subject site is located on the Western Cumberland Plain in an area which is generally warmer and drier than the coastal areas of Sydney. It lies in a rain shadow area caused by the higher coastal plateau trapping the moist southeast winds.

Climatic data were obtained from the Bureau of Meteorology for their nearest meteorological station located at Prospect Dam (some three kilometres east of the Austral Bricks site). These data are presented in Table 8.1 and summarised below.

- Temperature

  Seasonal temperature variations range from mean daily maximum and minimum temperature of 28°C and 16 °C respectively in summer to a mean daily maximum and minimum temperature of 16°C and 6°C respectively in winter (July).

- Rainfall

  The annual average rainfall at Prospect Dam recorded over 110 years is 879 mm. The average rainfall varies seasonally. Rainfall is highest from January to March, with a mean monthly maximum of 99 mm in March. It is lowest from August to October, with a mean monthly minimum of 48 mm in September. The mean number of rain days is 111.5 days.

- Evaporation

  The mean daily pan evaporation is highest in summer, with a maximum of 6.2 mm in December, and a minimum of 1.8 mm in June.

- Wind

  The wind data obtained from Prospect Dam indicate that the strongest winds occur during late winter and early spring (August to October), however, these figures are based on twice daily recordings of wind speed (9 am and 3 pm) only.

  More detailed wind speed and wind direction information relevant to the site has been obtained from an automatic weather station (AWS) owned by Waste Service NSW, which is located some 500 m to the north of the subject site at the Eastern Creek Waste Management Centre (WMC). The location of the AWS relative to the Austral Bricks site is shown in Figure 8.1. Seasonal wind roses for the year February 1996 to January 1997 are shown in Figure 8.2, based on 15 minute averages of wind speed and direction.

  During winter, winds in the area occur most frequently from the southwest and the northwest quadrants. Light winds are common, with a significant proportion (31%) of calms (less than 0.5 m/s) recorded.

  Summer winds are predominantly from the east-southeast to southwest, and the proportion of calm days drops to 15%. There is also an observable occurrence of winds from the northeast quadrant as a result of the summer seabreeze effects, although these winds are not as frequent or as strong as they are closer to the coast.

  During spring and autumn, winds are more widely distributed between the prevailing southwest to northwest winds of winter and the south to northeast winds of summer, due to the transition of the seasons.

OLD WALLGROVE ROAD

Reedy Creek

AUTEL LANDFILL

EASTERN CREEK RACEWAY

Eastern Creek

FERRERS ROAD

PROSPECT

WALLGROVE ROAD

EASTERN CREEK WASTE MANAGEMENT CENTRE

Prospect Reservoir

SYDNEY WATER SUPPLY PIPELINE

SYDNEY WATER SUPPLY PIPELINE

SITE ACCESS ROAD

SALES BUILDING

HORSLEY PARK

WEIGHBRIDGE

CRUSHING PLANT

VOID 1

BURLEY ROAD

WALWORTH ROAD

CHANDOS ROAD

ARUNDEL ROAD

SYDNEY/NEWCASTLE OIL & GAS PIPELINE

REDMAYNE ROAD

FERRERS ROAD

REVISION:	A	DESIGNED:	ST
SCALE:	1:25000	DRAWN:	HC
DRAWING No:	A8601191/0540	CHECKED:	SKT
CAD FILE NO:	G.049	APPROVED:	CS
DATE:	20/11/97	STATUS:	FINAL

LEGEND

- TRANSMISSION LINE
- CREEKS
- WATER BODY
- ROADS
- SITE BOUNDARY
- PIPELINE
- METEOROLOGICAL STATION
- DUST GAUGE

0 200 400 600

metres

CLIENT

AUSTRAL BRICK COMPANY PTY LTD

PROJECT

AUSTRAL BRICK SOLID WASTE LANDFILL EIS

TITLE

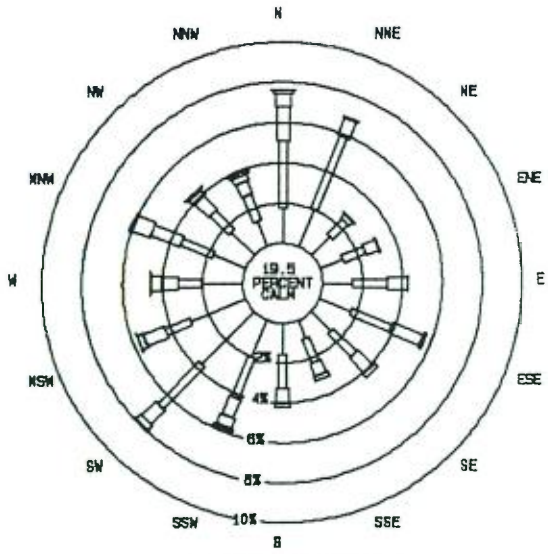
MONITORING STATIONS

FIGURE

8.1

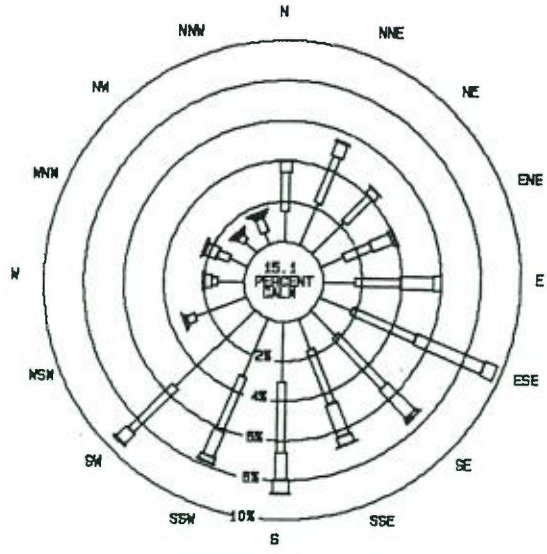
A3

Woodward-Clyde



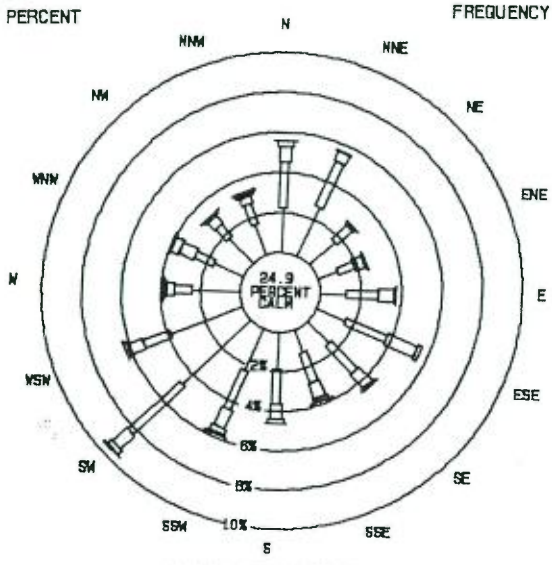
DISTRIBUTION OF WINDS
FREQUENCY OF OCCURRENCE IN PERCENT

Spring



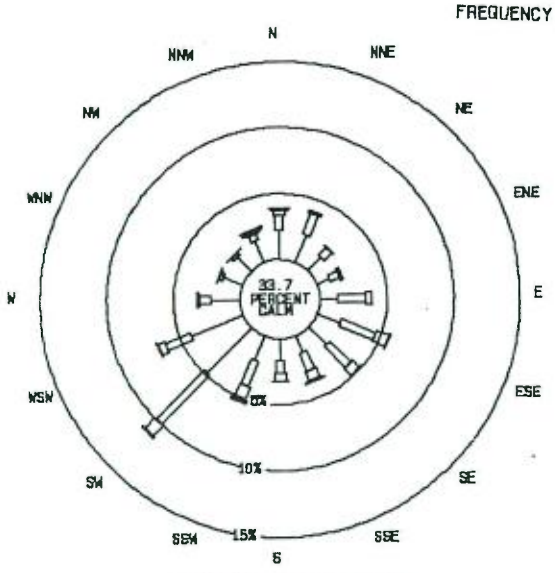
DISTRIBUTION OF WINDS
FREQUENCY OF OCCURRENCE IN PERCENT

Summer



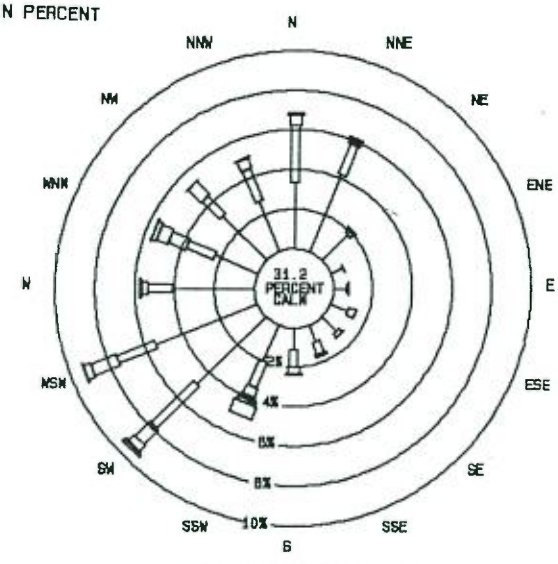
DISTRIBUTION OF WINDS
FREQUENCY OF OCCURRENCE IN PERCENT

Annual



DISTRIBUTION OF WINDS
FREQUENCY OF OCCURRENCE IN PERCENT

Autumn



DISTRIBUTION OF WINDS
FREQUENCY OF OCCURRENCE IN PERCENT

Winter

Woodward-Clyde

CLIENT
AUSTRAL BRICK COMPANY PTY LIMITED

PROJECT
AUSTRAL BRICK SOLID WASTE LANDFILL EIS

REVISION: **A**	DESIGNED: **CB**
SCALE: **AS SHOWN**	DRAWN: **HC**
DRAWING No: **A8601191/0540**	CHECKED: SLT
CAD FILE NO: **G.033**	APPROVED: CB
DATE: 20/11/97	STATUS: **FINAL**

TITLE
WIND ROSES FOR 1996

FIGURE
8.2

A4

Table 8.1

PROSPECT DAM CLIMATOLOGICAL SUMMARY

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual	Years of Record
Mean Daily Maximum Temp (°C)	28.0	27.6	26.1	23.6	20.1	17.1	16.6	18.3	20.7	23.2	24.9	27.2	22.8	26
Highest Temperature (°C)	42.8	42.5	36.8	37.1	29.4	24.5	25.0	29.0	35.0	39.0	41.2	41.2	42.8	26
Mean Daily Minimum Temp (°C)	17.6	17.7	16.0	13.0	10.1	7.4	6.1	6.8	9.1	12.1	14.2	16.4	12.2	26
Lowest Temperature (°C)	11.0	11.5	7.9	5.0	1.3	0.4	0.0	0.1	2.6	5.0	7.2	7.8	0.0	26
Mean 9am Temperature (°C)	21.1	20.7	19.8	16.5	13.2	10.3	9.2	10.6	13.8	16.9	18.2	20.4	15.9	26
Mean 3pm Temperature (°C)	26.8	26.3	24.9	22.5	19.2	16.4	16.0	17.4	19.5	21.7	23.5	25.8	21.7	26
Mean 9am Relative Humidity (%)	76	80	77	77	80	79	76	71	66	66	70	70	74.1	20
Mean 3pm Relative Humidity (%)	51	53	54	51	55	56	50	45	43	47	48	48	50.1	20
Mean 9am Cloud Cover (oktas)	4.8	4.8	4.5	3.6	3.9	3.7	3.2	3.0	3.3	4.0	4.4	4.5	4.3	26
Mean 3pm Cloud cover (oktas)	4.6	4.9	4.8	4.1	4.3	4.1	3.8	3.8	3.8	4.3	4.7	4.6	4.0	22
Mean Number of Clear Days	5.6	4.3	5.4	7.2	7.6	8.4	10.3	11.3	10.5	7.9	6.2	5.4	90.1	28
Mean Number of Cloudy Days	10.7	10.4	10.1	7.3	8.4	7.6	5.9	5.6	6.1	8.7	9.1	9.1	99.0	28
Mean Number of Days of Strong Wind	0.4	0.2	0.2	0.4	0.4	0.7	0.5	1.7	1.6	1.2	0.7	0.3	8.5	26
Mean Number of Days of Gales	nil	nil	0.1	nil	nil	nil	nil	nil	0.1	0.3	0.1	nil	0.7	26
Mean Daily Pan Evaporation (mm)	5.8	5.1	4.1	3.1	2.0	1.8	1.9	2.7	3.8	4.6	5.3	6.2	3.9	17
Mean Monthly Rainfall (mm)	95.6	91.8	98.8	75.6	73.4	77.3	59.1	51.8	48.2	58.6	71.8	76.9	879.1	110
Highest Monthly Rainfall (mm)	426.7	519.1	380.7	363.5	556.0	531.3	323.7	458.5	186.3	269.0	391.3	338.1		110
Lowest Monthly Rainfall (mm)	3.9	2.8	5.1	3.4	1.8	1.0	0.0	0.0	0.0	0.0	0.8	2.2		110
Mean Number of Rain Days	10.5	10.5	10.7	9.3	9.0	9.4	7.5	8.0	8.5	9.2	9.2	9.7	111.5	110

Source: Bureau of Meteorology 1997

1. Oktas - a measure of the cloud cover in the sky measured by visual observation. One okta represents 1/8 cloud cover.

8.2 FACTORS AFFECTING AIR QUALITY

Air pollution is not a single entity, but comprises several types of pollutants, which may have separate sources and effects. In the case of the proposed quarrying and landfilling operations, the principal discharges to air associated with the project which have significant potential for off-site effects, are dust and particulate matter.

The landfill would only be accepting non-putrescible waste. Thus, as long as the screening procedures for incoming waste are followed correctly, odorous emissions of products of aerobic or anaerobic degradation (such as methane, hydrogen sulphide and mercaptans) from the landfill itself would be insignificant.

The products of fuel combustion would also be emitted from vehicle exhausts, however, these discharges would be minor.

8.2.1 Suspended Particulate

Suspended particulate matter is dust or aerosol that stays suspended in the atmosphere for significant periods. Its exact definition depends on the monitoring procedure adopted. In general terms suspended particulate matter has a diameter up to about 50 µm. There is, however, no sharp dividing line between suspended particulate and deposited particulate, with the larger particles dropping out more rapidly as they move from the source.

Inhalable particulate or thoracic particulate refers to that portion of total suspended particulate (TSP) that can penetrate the upper respiratory tract and deposit in the fine airways of the lung. Very fine particles (<1 µm) tend to behave as a gas and may be expelled before deposition occurs. However, particles in the 1-10 µm size range (PM_{10}) can penetrate and deposit on the airways causing adverse health effects, especially when present with other pollutant species, such as sulphur dioxide.

Major natural sources of background particulate levels include forest fires, pollen and wind-blown dust from exposed areas. Background levels vary widely depending on location, meteorology and proximity of major point or area sources. Man made sources include stationary and mobile combustion sources, road dust, agriculture, mining, major fires and emissions from industrial processes.

8.2.2 Deposited Particulate Matter

The dust deposition rate is measured as the amount of dust deposited on a horizontal surface as a result of gravitational settling. The units for this parameter are grams per square metre per month (g/m^2/month). Dust deposition is a measure of the effects of dust on amenity, rather than health effects.

8.3 AIR QUALITY GUIDELINES

8.3.1 Suspended Particulate Matter

The EPA adopts, as ambient air quality goals, National Health and Medical Research Council (NHMRC) guidelines supplemented by World Health Organisation (WHO) long term goals

and United States Environment Protection Agency (US EPA) Air Quality Standards. The NSW EPA ambient air quality criteria for TSP are shown below in Table 8.2.

Table 8.2

RELEVANT AMBIENT AIR QUALITY GOALS FOR NSW

Pollutant	Goal $\mu g/m^3$ (1 atm, 0°C)[1]	Averaging Period	Agency
Total Suspended Particulates	90	12 months	NHMRC
PM_{10}	50	12 months	US EPA
(Particulate Matter <10 μm^2)	150	24 hours	US EPA

Source: NSW EPA

1. Corrected to 1 atmosphere pressure and 0°C

8.3.2 Deposited Particulate Matter

To protect against loss of amenity from new developments, the NSW EPA (1990) has set goals for the maximum acceptable increase of dust fallout levels over existing mean annual levels as detailed in Table 8.3.

Table 8.3

CRITERIA FOR DUST DEPOSITION

Existing Dust Level (g/m^2/month)	Maximum Acceptable Increase over existing Dust Level (g/m^2/month)	
	Residential Suburban Areas	Commercial and Industrial Areas
2	2	2
3	1	2
4	0	1

Note: If any existing dust level is greater than 4 g/m^2/month, then no increase in dust fallout is acceptable as a result of any dust emitting works.

8.4 EXISTING AIR QUALITY

Particle levels are influenced by a wide range of activities and are contributed to by a range of other atmospheric pollutants. A number of other dust producing activities exist in the vicinity of the project site, including other brickworks and the Eastern Creek Waste Management Centre. Aside from the nearby brickworks and landfill, the area surrounding Austral bricks is predominantly rural-residential, focusing on market gardens and open grazing.

8.4.1 Suspended Particulates

There are no suspended particulate monitoring data available for the Austral Bricks site or immediate surroundings. The nearest EPA suspended particulate monitoring site is located in Blacktown, on Flushcombe Road. This area has been more extensively developed than the

Austral Bricks site, hence EPA monitoring data from a comparable site located at the University of Western Sydney in Richmond, have also been examined. Both of these sites record ambient PM_{10} concentrations based on 24-hour average concentrations on every sixth day.

The PM_{10} monitoring results published by the EPA for these two sites are shown in Figure 8.3. There is a significant lag between the monitoring period and the results becoming publicly available, hence the most recent two years of data shown are from July 1994 to June 1996.

Prior to September 1995 the measured PM_{10} levels showed significant variation. Figure 8.3 shows that from September 1995, the results have become much more consistent, at around 15 - 20 $\mu g/m^3$ as a monthly average, and 20 - 25 $\mu g/m^3$ as a monthly maximum. There is no significant difference between the two sites.

Typical ambient background PM_{10} concentrations in the vicinity of the proposed development would be similar to the levels measured at Blacktown and Richmond. Particulate concentrations in the near vicinity of existing landfills and brickpits may be potentially higher on occasion, due to the potential for uncontrolled fugitive emissions from existing stockpile areas and unpaved haul roads from existing activities. However, a significant proportion of these emissions would be coarse particulate matter which would not contribute to local PM_{10} levels and would quickly drop out of the air.

8.4.2 Deposited Particulate

Waste Service operate two dust deposition monitors at the Eastern Creek Waste Management Centre. One of these gauges is located at the southern boundary of the Waste Management Centre (refer Figure 8.1) some 200 m north-northeast of Void 1. Deposited dust levels measured by Waste Service at this site since November 1995 are shown in Figure 8.4.

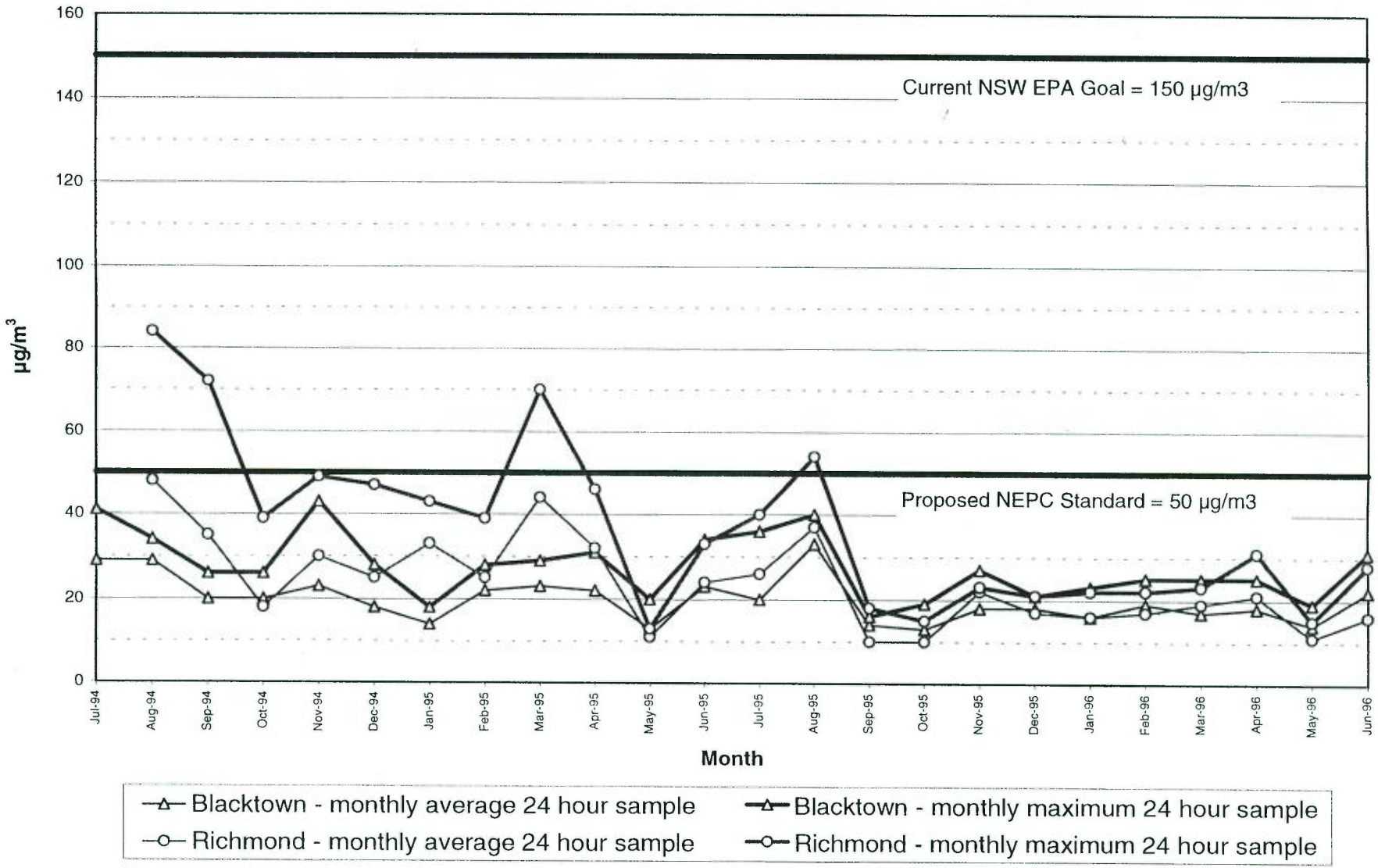
Dust deposition levels recorded over the last 12 months range from 1 g/m^2/month to just over 4 g/m^2/month. The average dust deposition for the period November 1995 to June 1997 was approximately 2.2 g/m^2/month.

Dust deposition monitoring has also been undertaken at the boundary of the nearby PGH Brick works site located approximately 2.5 km to the west of the Austral site. These results have been reported in CMPS&F (1997) and indicate a general background level of dust deposition of approximately 1.7 g/m^2/month

These levels are within the annual criteria and indicate that existing dust deposition levels in the vicinity of these project sites are unlikely to be giving rise to nuisance effects on the project site. The existing annual average TSP concentrations are estimated at approximately 40 $\mu g/m^3$ to 50 $\mu g/m^3$.

8.4.3 Odour

The proposed landfill will only be accepting non-putrescible waste as stated previously. Odorous emissions resulting from the aerobic or anaerobic decomposition of landfill matters will be insignificant. There is a public perception of odours associated with landfills in general, however, offensive odours are typically associated with putrescible landfills or landfills involving composting operations.



Woodward-Clyde

CLIENT
AUSTRAL BRICK COMPANY PTY LIMITED

PROJECT
AUSTRAL BRICK SOLID WASTE LANDFILL EIS

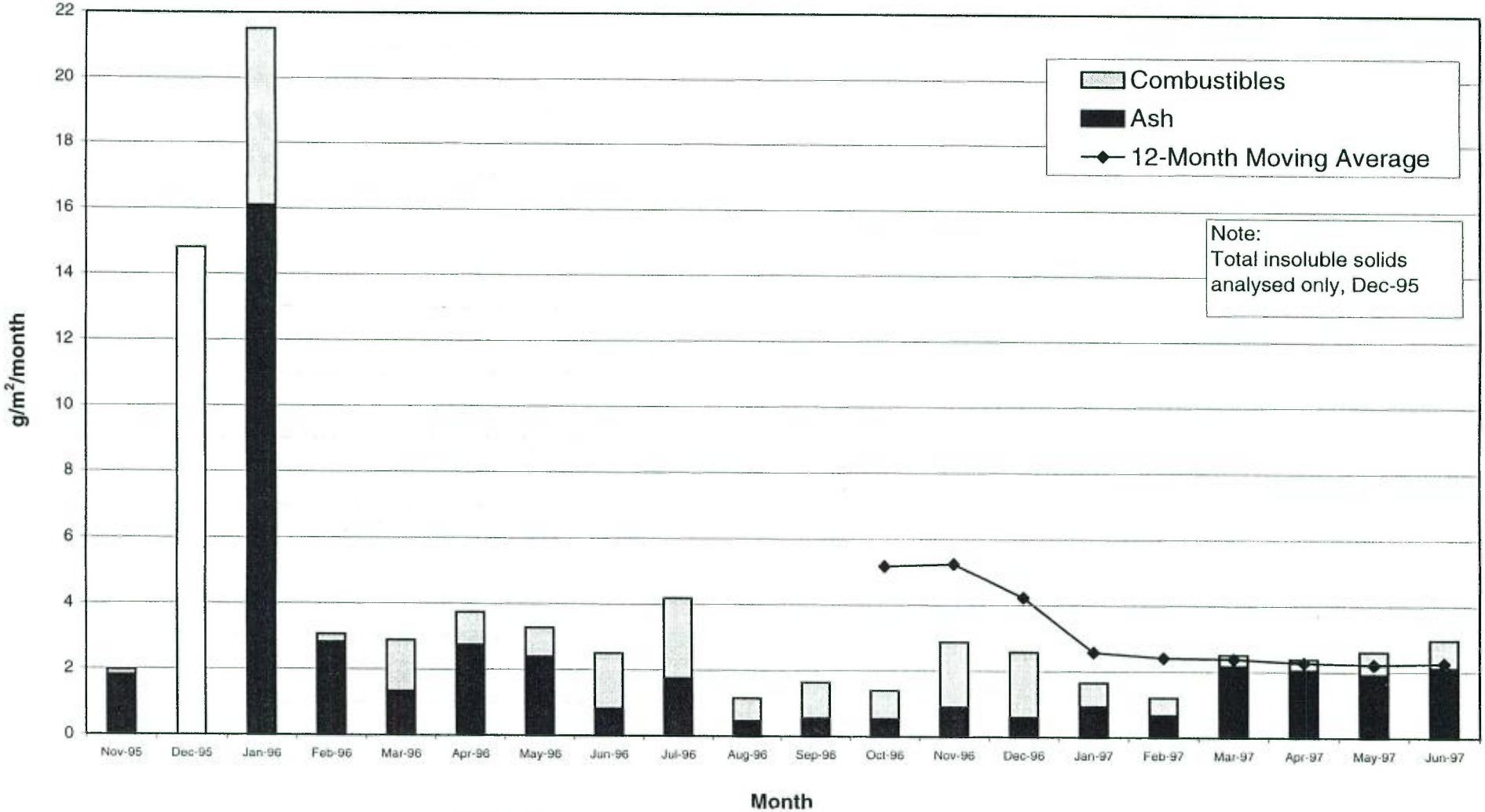
REVISION: **A**
SCALE: **AS SHOWN**
DRAWING No: **AS601191/0540**
CAD FILE NO: **G.035**
DATE: 20/11/97

DESIGNED: **CB**
DRAWN: **HC**
CHECKED: SLT
APPROVED: CB
STATUS: **FINAL**

TITLE
SUSPENDED PARTICULATE LEVELS

FIGURE
8.3

A4



Woodward-Clyde

CLIENT
AUSTRAL BRICK COMPANY PTY LIMITED

PROJECT
AUSTRAL BRICK SOLID WASTE LANDFILL EIS

REVISION: A	DESIGNED: JT
SCALE: AS SHOWN	DRAWN: HC
DRAWING No: A8601191/0540	CHECKED: SKT
CAD FILE NO: G.034	APPROVED: CB
DATE: 20/11/97	STATUS: FINAL

TITLE
EASTERN CREEK DUST DEPOSITION LEVELS

FIGURE
8.4

A4

Following site inspections by Woodward-Clyde personnel, existing odours have been observed in the vicinity of the proposed landfill, as a result of other activities in the Eastern Creek area. Existing operations/activities which may potentially emit odorous emissions include the Eastern Creek Waste Management Centre and market gardens (particularly when fertilised), such that these activities will contribute to the existing and future air quality environment.

8.5 EMISSION SOURCES

The potential sources of particulate emissions associated with the proposed activities are:

- wind erosion from material stockpiles;
- on-site traffic on unsealed roads;
- loading and unloading of stockpiles;
- tipping at the active face of the landfill;
- compacting of waste and application of cover material; and
- particulate exhaust emissions from vehicles on-site.

8.6 PROPOSED MITIGATION AND MANAGEMENT

Mitigation measures required to be implemented to ensure than an acceptable level of dust control is achieved include:

- Installation of on-site wind speed/wind direction gauges with an alarm to indicate excessive wind speeds. Dust generating operations to be reduced or temporarily cease during very windy conditions (typically if average wind speed over 10 minutes exceeds 10 m/s);
- Suppression of dust on internal roadways and other exposed areas by use of water trucks;
- Minimisation of vehicle numbers into tipping areas;
- Use of polymer based binder and/or water sprays over product stockpiles and other bare surfaces when not in use;
- Covering of materials transported on-site or before transport off-site;
- Installation of a truck washdown area;
- Rehabilitation of worked sites as soon as practicable; and
- Establishment of grass cover on any extensive bare areas not being utilised for long periods.

The above mitigation measures are considered best management practices for dust suppression, and the most effective way that dust emissions can be controlled to acceptable levels.

It is recommended dust deposition gauges in accordance with Australian Standard AS3580.10.1-1991 be established at the boundary of the landfill as part of the Environmental Management Plan to monitor dust levels and check compliance.

8.7 POTENTIAL IMPACTS

Implementation of best management practices for dust suppression and proper maintenance of the dust control procedures set down should ensure that fugitive dust emissions from the proposed landfilling activities would be kept to a minimum and that the proposed development would not adversely affect air quality outside the site boundary. There should be no impact from dust on potentially sensitive users (such as Prospect Reservoir and the nearby sporting complex).

The dust monitoring undertaken at the boundaries of the existing Eastern Creek Waste Management Centre and the PGH Brickworks indicate that existing air quality criteria are not being exceeded as result of the existing activities.

The nearest residential dwelling at the Austral site is located at the southwest corner of the site, approximately 200 m to the south southwest of Void 1. Nearby residences are also located in the rural-residential areas to the west and south of the site. These sensitive receptors are downwind of the Austral Bricks site when winds are from the north-northeast to east-northeast. The windroses shown in Figure 8.2 indicate that the frequency of such winds is less than 15% for the year.

In addition, an air dispersion modelling study was undertaken for the PGH Brickworks site (CMPS&F, 1997). The modelling study was for a similar operation and demonstrated that the EPA guidelines for long term dust deposition and TSP would not be exceeded at the nearest residences, which are within 200 m to 500 m south and southeast of the site, where winds from the north to the west, occur for approximately 20 % of the time.

It is reasonable to infer from this modelling study that the ground level concentrations as a result of emissions from the proposed operations at the project site are likely to be similar or less than those at the PGH Brickworks site and hence the landfilling activities at the Austral site would not adversely affect the amenity of nearby residences.

The landfill would only be accepting non-putrescible waste and as such the landfill would not generate any significant amount of landfill gas. Thus, as long as the screening procedures for incoming waste are followed correctly, odorous emissions of products of aerobic or anaerobic degradation (such as hydrogen sulphide and mercaptans) from the landfill itself should be insignificant. Maintenance of sections over the completed cells and incorporation of compacted material in interim cover to stimulate bio infiltration of gases will ensure minimal impact from odour emission. The Draft LEMP in Appendix B provides details of corrective actions that would be taken if odour should present as a nuisance. These actions may involve installation of temporary gas extraction wells to permit flaring of the gases, increasing the depth of cover or use of other more cohesive materials.

Odorous emission from the nearby Eastern Creek Waste Management Centre may occur as a result of the putrescible landfill particularly during periods of warmer weather. The impact of these emissions on the Austral site may be significant enough to mask any slight emissions which may arise as a result of the proposed activity.

9.1 INTRODUCTION

Measurement of environmental noise involves statistical descriptors and parameters because the sound level is varying all the time due to a number of factors including variations in source sound levels and locations, wind and distant source effects, and so on. The three main descriptors used by the EPA are as follows:

L_1 The sound level exceeded for 1% of the time in the measurement period. For a measurement period of 15 minutes, this is the sound level exceeded for 9 seconds.

L_{10} The sound level exceeded for 10% of the time in the measurement period. For a measurement period of 15 minutes, this is the sound level exceeded for 90 seconds.

L_{90} The sound level exceeded for 90% of the time in the measurement period. For a measurement period of 15 minutes, this is the sound level exceeded for 13 minutes and 30 seconds.

9.2 EXISTING ENVIRONMENT

The subject site lies within a Recreation Corridor zone. The regional significance of the subject site is recognised by its inclusion in Schedule 1 of Sydney Regional Environmental Plan 9, Amendment 2. The nearest residences lie to the south-west along Wallgrove Road, to the south along Chandos Road in the Recreation Corridor zone, and in the non-residential area to the south-west. The Eastern Creek Waste Management Centre lies immediately to the north.

9.3 BACKGROUND NOISE LEVEL

Ambient noise levels were measured by Woodward-Clyde at four locations around the Austral site. A description of each measurement location is in Table 9.1 and the locations are indicated in Figure 9.1. The measurements were made in accordance with Australian Standard AS1055 (Standards Australia, 1997a) and the NSW EPA's Noise Control Guidelines (EPA, 1994). Noise levels were measured all week both by day and night.

Table 9.1

DESCRIPTION OF AMBIENT NOISE MEASUREMENT LOCATIONS

Location	Description
Austral 1[1]	684-698 Wallgrove Road, Horsley Park.
Austral 2	168-174 Chandos Road, Horsley Park.
Austral 3	108-124 Chandos Road, Horsley Park.
Austral 4	383 Horsley Road, Horsley Park

[1] No valid data obtained.

The L90 and L10 levels measured at each location between the hours of 7:00am and 6:00pm are presented graphically for each day of the measurement period in Figures 9.1.1 to 9.1.8, 9.2.1 to 9.2.8 and 9.3.1 to 9.3.8, in Appendix F. A complete data set for each location has not been included, because of the volume of data, but is available on request.

Noise levels were measured using four Acoustic Research Laboratories EL-215 Portable Statistical Noise Logger (Serial Numbers 19440, 194471, 193401, 194539) which were calibrated with a Rion NC-73 calibrator (Serial Number 10334201) prior to commencing each measurement and calibration was confirmed to be within ± 1dBA at the completion of each measurement. The Rion NC-73 calibrator was last laboratory calibrated on 2 October 1996.

9.3.1 Data Analysis

Rainfall, and wind speeds greater than 5 metres per second, invalidate environmental sound level measurements. Weather conditions measured at the neighbouring Eastern Creek Waste Management Centre during the noise measurement period were fine with four, 15 minute average wind speeds exceeding the 5 metre per second threshold throughout the noise measurement period. Light rainfall (1.4 mm) was recorded on Thursday 7 August. (Meteorological data courtesy of Waste Service NSW).

The measured noise levels were analysed to assign a background noise level to each location. The A-weighted noise level which is exceeded for 90% of the time interval considered (the $L_{A90,\,T}$) is commonly taken to be an approximation of the background noise level (Standards Australia, 1997a). For noise levels measured unattended in consecutive 15 minute measurement periods, EPA policy is to assign the background level to the lowest repeatable $L_{A90,\,15\ minute}$ value within the time interval considered (EPA, undated, Background Noise Measurement - Interim Policy).

The noise levels have been processed to assign the background level to the tenth percentile $L_{A90,\,15\ minute}$ values from the data collected between 7am and 6pm during the measurement period. In other words, the background level has been assigned to the $L_{A90,\,15minute}$ sound pressure level (dBA) which was exceeded by 90% of the $L_{A90,\,15\ minute}$ values measured consecutively between 7am and 6pm over the measurement period. The EPA have indicated verbally that this is an acceptable method for assigning a background level.

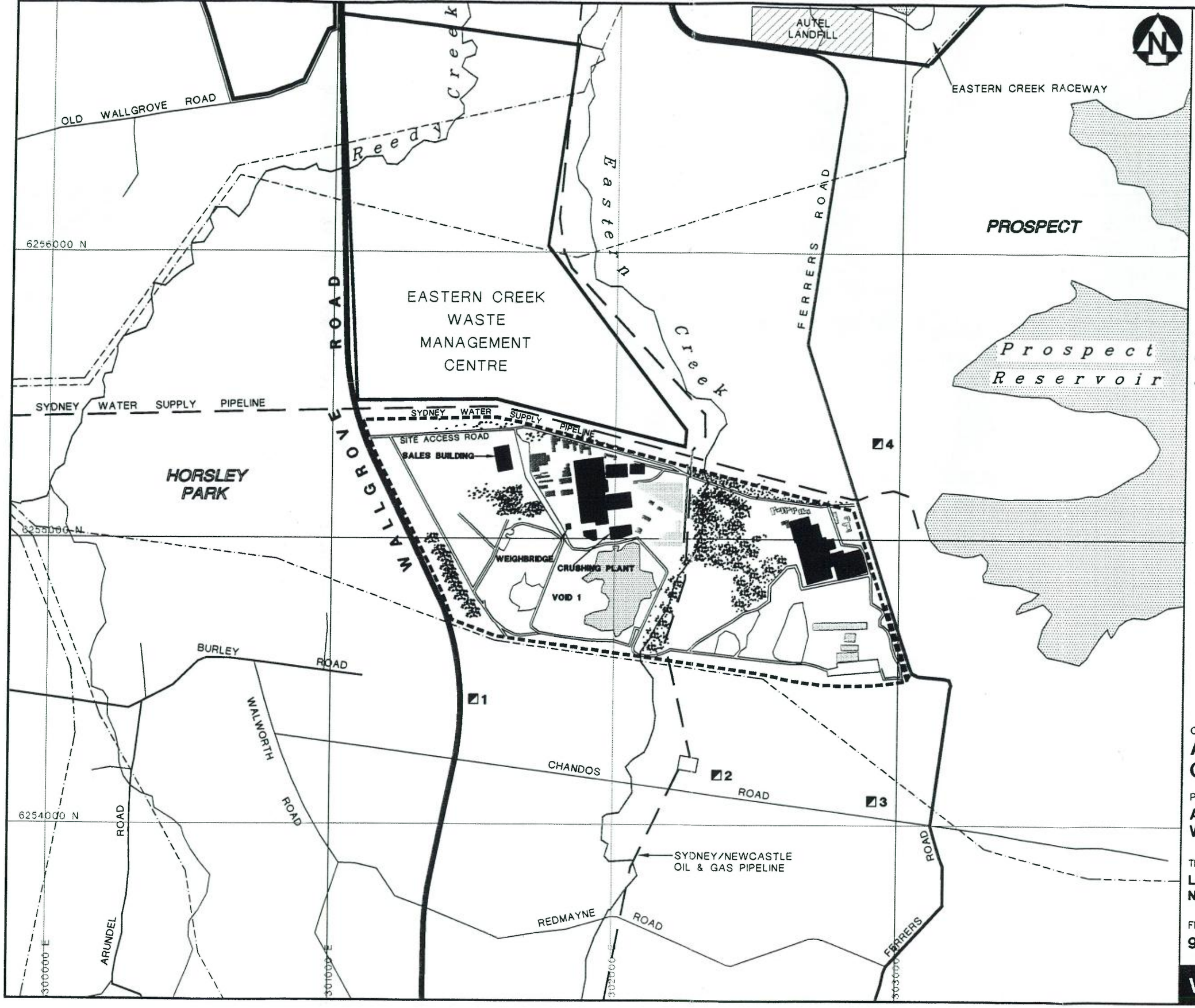
No valid data were obtained at Location Austral 1 during the measurement period due to equipment malfunction. ERM Mitchell McCotter measured ambient noise levels at 684-698 Wallgrove Road in 1996 and assigned a background level to the location of 53 dBA (ERM Mitchell McCotter, 1996). For the purposes of this study, the measurement recorded at this location is considered adequate to provide an indication of background noise levels in this location. Assigned background levels are presented in Table 9.2. These assigned background levels are then plotted against $L_{90,\,15\ minute}$ levels measured at locations 2, 3 and 4 in Figures 9.1.1 to 9.1.8, 9.2.1 to 9.2.8 and 9.3.1 to 9.3.8 in Appendix F.

Table 9.2

ASSIGNED BACKGROUND NOISE LEVELS (dBA)

Location	Assigned background noise levels (dBA)
Austral 1	53[1]
Austral 2	36
Austral 3	40
Austral 4	47

[1] from ERM Mitchell McCotter, 1996.



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DATE: 20 Nov 97 | STATUS: FINAL

LEGEND

- TRANSMISSION LINE
- CREEKS
- WATER BODY
- ROADS
- SITE BOUNDARY
- PIPELINE
- 1 AMBIENT NOISE MEASUREMENT LOCATION

0 200 400 600
metres

CLIENT
AUSTRAL BRICK COMPANY PTY LTD

PROJECT
AUSTRAL BRICK SOLID WASTE LANDFILL EIS

TITLE
LOCATION OF AMBIENT NOISE MEASUREMENTS

FIGURE
9.1

A3

Woodward-Clyde

9.4 NOISE IMPACT CRITERIA

The EPA have specified limits for noise emissions from existing activities at the site as follows:

The LA10, T noise levels for mobile plant, emanating form the premises must not exceed:

- *55 dBA during the daytime (Monday to Saturday 7 am to 10 pm, and on Sundays and Public Holidays 8 am to 10 pm);*
- *45 dBA at other times.*

The LA10, T sound pressure levels must be measured or computed at the most affected residence, over any period between 10 and 15 minutes using (where measured) "FAST" response on the sound level meter.

5 dBA must be added to the measured or computed level if the noise is substantially tonal or impulsive in character.

2. *The LA10, T noise levels for plant (excluding mobile plant) emanating from the premises must not exceed:*
   - *50 dBA during the daytime (as defined above);*
   - *40 dBA at other times.*

   The LA10, T sound pressure levels must be measured or computed at the most affected area within 30 metres of the most affected residence, over any period between 10 and 15 minutes using (where measured) "FAST" response on the sound level meter.

   5 dBA must be added to the measured or computed level if the noise is substantially tonal or impulsive in character.

In addition, Austral are to implement a Noise Reduction Program with the objective to reduce the noise generated by mobile plant during the non-daytime operations of the premises to a noise level goal of 40 dBA.

These noise limits are the appropriate criteria for assessing the proposed quarry extension and landfilling.

The proposed quarry extension and landfilling activities would be generally contained within the hours defined as daytime by the EPA i.e. Daytime is 7:00am to 10:00pm Monday to Saturday, and 8:00am to 10:00 pm Sunday and Public Holidays. The EPA's noise level limits for daytime operation of mobile plant are plotted against measured ambient L_{90} and L_{10} levels between the hours of 7:00am and 6:00 pm in Figures 9.1.1 to 9.1.8, 9.2.1 to 9.2.8 and 9.3.1 to 9.3.8 in Appendix F.

9.5 NOISE LEVEL PREDICTION

Average maximum (L_{10}) noise levels as a result of the proposed works were predicted using the Environmental Noise Model (ENM). ENM is approved for use in Australia by the Australian Environment Council. A full technical description is in Tonin (1985). ENM simulates outdoor sound propagation and predicts noise levels from known noise sources for close and distant locations. The Model calculates attenuation due to noise source enclosure and other noise control measures, for distance from the source to the receiver, for the noise source size, type and directivity, for barriers and natural topographic features and for sound absorption in the air (Tonin, 1997). Sound power levels, in dBA, for individual noise sources are input to the model together with ground elevations. The program first generates cross-sections of ground elevations from each source to the map limits, for eighteen rays around the source spaced apart by 10 degree angle steps. It then calculates sound pressure levels at regular, user-specified, distances along each ray. The resulting total sound pressure level for all sources is then calculated in a regular grid and isopleths (or contours) drawn joining equal values of sound pressure levels. Source sound power level, source location and height above ground, ground type, and meteorological conditions, which all influence the propagation of sound from the source to receiver, are specified by the model user.

9.5.1 Sources

Maximum sound power levels for equipment items to be used were calculated from the equation:

$$Lw = 99 + 10 \log (kW)$$

where Lw = sound power level (dB)

kW = engine power (kilowatts) (Woods, 1992).

Estimated octave band sound power levels for diesel engine-powered equipment were calculated by subtracting from the maximum overall Lw the adjustments from Woods (1992) in Table 9.4.

Table 9.4

ADJUSTMENTS USED TO ESTIMATE A-WEIGHTED AND OCTAVE-BAND SOUND POWER LEVELS, LW (dB).

Frequency, Hz	31	63	125	250	500	1000	2000	4000	8000	A-weighted
Adjustment	-	11	6	3	8	10	13	19	25	5

Actual operating equipment does not operate at full power continuously. Woods (1992) subtracts the following values from calculated maximal values to obtain work-shift-long equivalent Leq levels:

3-4 dB Backhoes, rollers

5-6 dB Dozers, graders, haulers, loaders, scrapers

7-8 dB Air compressors, concrete batch plants, mobile cranes, trucks.

Leq levels for operating plant are typically approximately 3 dBA less than L_{10} levels (Tony Hewitt pers comm). Maximum sound power levels for equipment to be used, part-power

corrections and conversion to A-weighted, L_{10} levels, and sound power levels used in the ENM modelling are presented in Table 9.5.

Table 9.5

MAXIMUM SOUND POWER LEVELS, CORRECTIONS FOR PART-POWER OPERATION AND CONVERSION TO A-WEIGHTED L_{10} SOUND POWER LEVELS.

Activity	Item	Engine Power (kW)	Maximum Sound Power Level, Lw (dB)	Maximum Sound Power Level, Lw (dBA)	Part-Power Correction	Leq to L10 Conversion	L10 Sound Power Level (dBA)
Landfilling	Compactor	235	123	118	-5	+3	116
	Bulldozer	276	123	118	-5	+3	116
	Wheeled Loader	205	122	117	-5	+3	115
	Motor Grader	101	119	114	-5	+3	112
	Tip Truck	134	120	115	-7	+3	111
	Fuel Truck						
	Water Truck						
Quarrying	Scraper	336	124	119	-5	+3	117
	Bulldozer	276	123	118	-5	+3	116
	Loader	298	124	119	-5	+3	117

9.5.2 Topography

Ground elevations input to ENM were from the following sources:

- the area around the Austral site was digitised from the Horsley Park U8252 1:10 000 orthophoto map (contour interval of 4 metres);
- the proposed landfill area and quarry extension were digitised from a survey by Backhouse Surveyors on 1 August 1997 (contour interval 1 metre); and
- an existing earthern bund wall along Austral's southern boundary, installed after publication of the Horsley Park U8252 orthophoto map. Elevations were drawn from information provided by Austral Bricks.

9.5.3 Model Scenarios

Two scenarios have been modelled. The first scenario simulates the commencement of landfilling and quarrying into the extension area by placing a noise source representing landfilling activities, and a noise source representing quarrying activities, within the existing landform of the site i.e. landfilling commences on the base of the existing quarry at an elevation of 50 metres AHD, and quarrying commences at the base of the extension at 65 metres AHD. The second scenario simulates landfilling into the quarry extension area once

quarrying is completed and landfill cell one is completed as per Figure 4.4 by placing the noise source representing quarrying activities at the base of landfill cell two (50 metres AHD).

In any one fifteen minute interval, the L_{10} is the noise level in dBA which is exceeded for ten percent of the time i.e. one and one-half minutes (or 90 seconds). Landfill and quarry equipment typically operates at full power for a few seconds, then at reduced power, and rarely do two items of equipment operate at full power together. Items of equipment operate at a distance from each other, so that even if they are operating at full power together, the noise level at a noise receiver would be determined by the closer item of plant.

L_{10} noise levels beyond the site as a result of activities at the site have therefore been predicted by assuming that the item of plant with the greatest sound power level for each of the landfilling and quarrying activities, is operating at full power in the centre of the landfill and quarry areas respectively.

9.5.4 Meteorological Conditions.

Noise levels have been predicted for neutral conditions. i.e. 20° Celsius and 70% relative humidity. Recent Commissions of Inquiry for the proposed Bayswater No. 3 and Bengalla mines found that predictions of noise levels under adverse meteorological conditions could not be accurately made and therefore predictions, and approvals, should be based on predictions for neutral conditions.

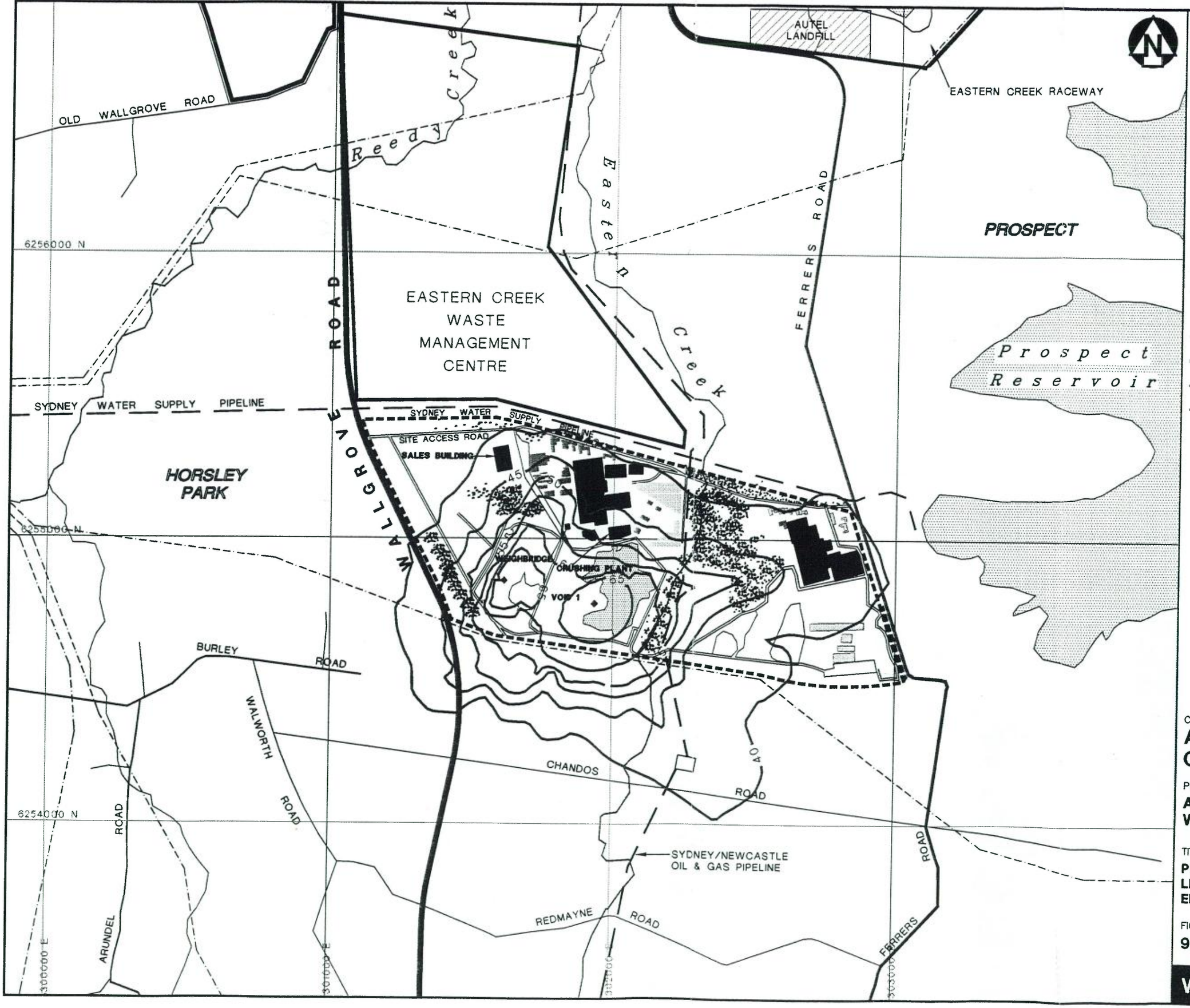
9.5.5 Predicted Sound Pressure Levels

Figures 9.2 and 9.3 present the predicted sound pressure level contours for the two scenarios modelled. In Figures 9.2 and 9.3 it can be seen that the 45 dBA and 55 dBA noise level contours are well removed from any residences.

In figure 9.2 (Scenario 1) it can be seen that the 40 dBA noise goal for non-daytime operation of mobile equipment is in the vicinity of residences along Chandos Road and the residence at 684-698 Wallgrove Road. In Figure 9.3 (Scenario 2) it can be seen that the 40 dBA noise goal for non-daytime operation of mobile equipment is in the vicinity of the residence at 684-698 Wallgrove Road only.

For scenario one, the 40 dBA contour would extend further without the noise barrier effect of the screening banks along Wallgrove Road and the southern property boundary, and the quarry wall. For scenario two, the 40 dBA contour would extend further without the noise barrier effect of the screening banks along Wallgrove Road and the southern property boundary, and the wall of landfill Cell one.

Clearly, as the quarry is filled and the landfill cells approach, and are built up above, the surrounding ground level to create the final landform, the noise barrier effect of the quarry walls and the screening bank would be reduced. In order to maintain noise levels below the noise level criteria at residences beyond the site, it would be necessary to manage landfilling activities in a manner which ensures that screening banks are built up above ground level on the west, south and east perimeter of the site to maintain effective noise barriers to the planned finish heights. The screening banks would be built up as the project progresses to maintain the top of the banks an estimated five metres above the level on which machinery is operating. Screening banks would be comprised of stockpiles of material to be used for final cover and



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LEGEND

- TRANSMISSION LINE
- CREEKS
- WATER BODY
- ROADS
- SITE BOUNDARY
- PIPELINE
- 40 SOUND PRESSURE LEVEL CONTOURS (dBA)

0 200 400 600 metres

CLIENT
AUSTRAL BRICK COMPANY PTY LTD

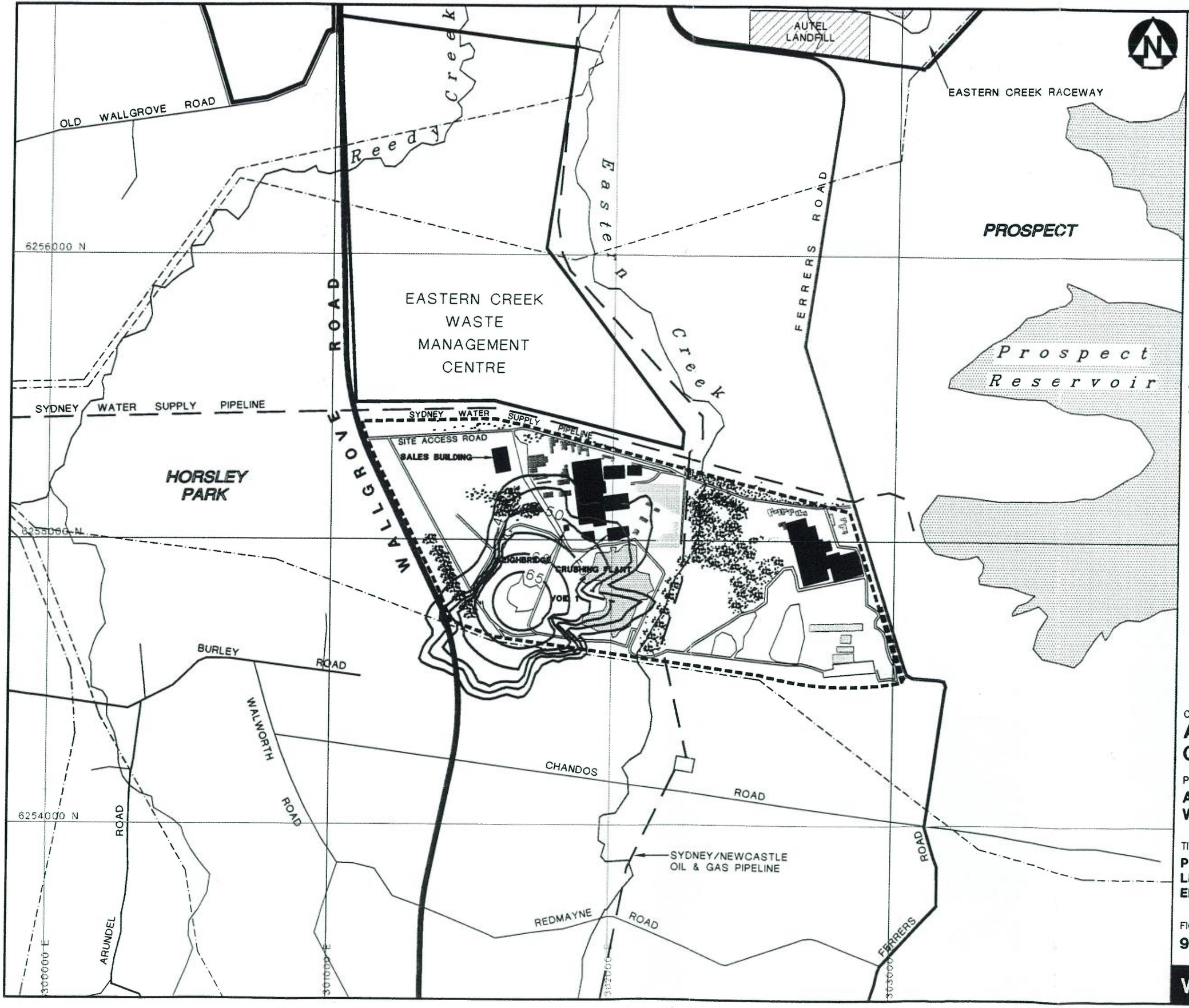
PROJECT
AUSTRAL BRICK SOLID WASTE LANDFILL EIS

TITLE
PREDICTED SOUND PRESSURE LEVEL CONTOURS (dBA) FOR ENM SCENARIO 1 (SEE TEXT)

FIGURE
9.2

A3

Woodward-Clyde



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DATE:	20 Nov 97	STATUS:	FINAL

LEGEND

- TRANSMISSION LINE
- CREEKS
- WATER BODY
- ROADS
- SITE BOUNDARY
- PIPELINE
- 40 SOUND PRESSURE LEVEL CONTOURS (dBA)

0 200 400 600
metres

CLIENT
AUSTRAL BRICK COMPANY PTY LTD

PROJECT
AUSTRAL BRICK SOLID WASTE LANDFILL EIS

TITLE
PREDICTED SOUND PRESSURE LEVEL CONTOURS (dBA) FOR ENM SCENARIO 2 (SEE TEXT)

FIGURE
9.3

A3

Woodward-Clyde

landform development on completion of landfilling activities in each cell. These measures would ensure that noise emanating from excavation and landfilling activities would be contained within each working cell.

9.5.6 Noise Impact

The noise modeling predicts that the EPA's noise limits for the existing activities could be met by activities associated with the proposed quarry extension and landfilling.

Austral's Noise Reduction Program requires that measurement or computation, for the purpose of monitoring must take place after the implementation of the Noise Reduction Program to ensure compliance with the 40 dBA noise level. This requirement should also apply to this proposed quarry extension and landfilling as a safeguard to ensure that the appropriate noise criteria are being met.

9.5.7 Conclusion

Noise impacts can be maintained within the limits specified by the EPA for existing activities. Monitoring can be undertaken to ensure compliance with the EPA limits. Should the noise level give rise to serious complaint, noise level monitoring would be undertaken by a recognised acoustic consultant to monitor the noise level as compared to EPA criteria. Screening banks would need to be built up along the east, west and south Austral boundaries ahead of landfilling and creation of the final landform, to maintain an estimated five metres difference between the top of the bank and the level on which machinery is operating. The provisions of the Noise Control Act 1975 and Regulations, and the powers assigned to Council officers under the Local Government Act 1983, are safeguards to ensure that residents and businesses can take action to mitigate unacceptable noise levels.

10.1 EXISTING TRANSPORT NETWORK

The Austral Brickworks complex has entrances to both Wallgrove Road and Ferrers Road. The portion of the site under consideration is accessed via Wallgrove Road. The property is conveniently located close to the F4 Western Freeway which provides access to the adjacent urban areas of Penrith, Fairfield, Parramatta, Blacktown and Sydney City.

Liverpool and the south-western suburbs of Sydney are accessed via Wallgrove Road and Elizabeth Drive while Wallgrove Road and Ferrers Road provide access to Fairfield, Bankstown and other areas south-west of the site.

It is anticipated that Wallgrove Road would ultimately form part of the proposed Western Sydney Orbital Route. The Orbital would be located on the eastern side and parallel with Wallgrove Road and would connect with the F4 Western Freeway at a major road interchange to be constructed. To facilitate the interchange between the Orbital and the F4, it is likely that the section of Wallgrove Road north of the entrance to Australia's Wonderland would be terminated. The Orbital would provide rapid access to areas north and south of the Sydney metropolitan area. The Roads and Traffic Authority (RTA) representative at the PFM organised as part of this proposal, advised that the proposed Western Sydney Orbital Route is unlikely to be constructed in the short term or within the timeframe previously proposed for construction. However, the proposal has not been abandoned by the NSW State Government. As a result, access to the project site would be considered in the context of the existing road network.

Wallgrove Road, north of the Old Wallgrove Road intersection, has a sealed width of approximately 15m with two traffic lanes in each direction. South of this intersection, Wallgrove Road has a sealed width of approximately 8 m with one traffic lane in each direction. Wallgrove Road has a speed limit of 80 km/h.

Wallgrove Road, Ferrers Road and Elizabeth Drive are all classified roads maintained by the RTA and are designated as arterial roads within the road hierarchy.

10.2 EXISTING TRAFFIC AND ROAD CONDITIONS

10.2.1 Traffic Conditions

Traffic survey results for roads near the subject site and roads likely to be used in the transportation of waste to the site were obtained from the RTA. Traffic survey results are shown in Table 10.1.

Table 10.1
TRAFFIC SURVEY DATA

Location	Survey Year	AADT
F4 Western Freeway - at Horsley Road Underpass	1993	73 010
Wallgrove Road - south of F4 Western Freeway	1993	31 570
Wallgrove Road - north of Elizabeth Drive	1993	13 980
Elizabeth Drive - west of Wallgrove Road	1993	15 910
Elizabeth Drive - east of Wallgrove Road	1993	21 890
Ferrers Road - east of Wallgrove Road	1993	17 660

Note: AADT - Average Annual Daily Traffic (axle pairs)

Source: RTA

In order to obtain an estimate of traffic flows in 1997 on roads in the vicinity of the site, a 1% annual growth rate, based on a projected population growth rate of approximately 1% per annum for both the Blacktown and Fairfield areas and the Sydney Region as a whole was adopted (DUAP 1995). These estimates are presented in Table 10.2.

Table 10.2
ESTIMATED TRAFFIC FLOWS FOR 1997

LOCATION	PROJECTED AADT 1997
F4 Western Freeway - at Horsley Road Underpass	75 930
Wallgrove Road - south of F4 Western Freeway	32 830
Wallgrove Road - north of Elizabeth Drive	14 540
Elizabeth Drive - west of Wallgrove Road	16 550
Elizabeth Drive - east of Wallgrove Road	22 766
Ferrers Road - east of Wallgrove Road	18 370

Note: AADT - Average Annual Daily Traffic (axle pairs)

10.2.2 Road Conditions

Roads surrounding the site are generally in good repair with sealed carriageways. Wallgrove Road has a sealed carriageway and a gravel shoulder with no kerb and gutter. The traffic lanes are approximately 3.5 m wide.

The existing entrance driveway to Austral's administration and sales offices is sealed and vehicle speed is restricted to 30 km/hr. Other roads within the site are unsealed. There are no merge lanes on Wallgrove Road or Ferrers Road at the entrance to the site and no give way or stop signs, where the driveway opens to Wallgrove Road.

10.3 TRAFFIC GENERATED BY THE PROPOSAL

The proposed extraction and landfilling activities would generate additional traffic volumes from:

- construction of the landfill and infrastructure (such as the weighbridge, Waste Transfer Station, site office and new access road) associated with the operation of the landfill;
- transport of solid waste to the site for landfilling; and
- a slight increase in staff movements associated with the landfill operations.

Excavation activities would be carried out by existing site personnel using heavy equipment located on site. No additional traffic is expected to be generated by excavation works.

10.3.1 Construction of the Landfill and Associated Infrastructure

Additional traffic movements generated during construction of the landfill and associated infrastructure would result from the mobilisation and demobilisation of heavy equipment, the delivery of construction materials and workers commuting to and from the site. These would involve an additional 6 vehicles or 12 trips per day.

10.3.2 Transport of Solid Waste

Solid waste would be transported to the site in a range of vehicles with differing load capacities. Based on a solid waste receival rate of 300 000 tonnes per annum, Table 10.3 lists the types of vehicles likely to be used for waste transportation and provides an estimate of the number of trips required.

Table 10.3
TRANSPORT OF SOLID WASTE TO THE SITE

VEHICLE TYPE	AVERAGE LOAD (TONNES)	LOAD TRANSPORTED (TONNES/YEAR)	VEHICLES PER DAY[1] (ONE WAY)
Ro-Ro Bins	7.0	60 000	24
Skips	1.5	15 000	28
Front Lifts	8.0	30 000	10
Small Tippers	10.0	75 000	21
Large Tippers	20.0	120 000	17
Total	-	300 000	100[2]

1 - Based on 363 days per year

2 - Total number of trips is double this figure.

It is evident from Table 10.3 that transportation of waste to the site would result in a total of approximately 100 additional vehicles per day or 200 trips per day.

10.3.3 Site Personnel

It is estimated that an average of 15 site personnel would commute to and from the site on a regular basis. This is expected to result in an additional 15 vehicles per day or 30 trips per day.

10.3.4 Total Traffic Generation

Construction of the landfill and associated infrastructure would result in an additional 6 vehicles or 12 trips per day for a duration of approximately 18 years. Transport of solid waste (100 vehicles)and the day to day operation of the landfill (15 vehicles) would result in an additional 115 vehicles or 230 vehicle trips per day for a period of 18 years.

10.4 DISTRIBUTION OF TRAFFIC

The road network likely to be used by landfill traffic is dependent on the location of potential developments in the region and the need for disposal of construction and demolition wastes to landfill from these sites. It is anticipated that the F4 Western Freeway, Wallgrove Road and Elizabeth Drive would be the main routes used by trucks transporting waste to the landfill.

10.5 POTENTIAL IMPACTS OF THE PROPOSAL

The additional traffic volumes generated by the proposal are not anticipated to have significant impacts on the flow of traffic on the F4 Western Freeway or Elizabeth Drive. Comparison of the AADT's provided in Table 10.2 indicated that the impact of 216 additional daily vehicle trips (generated by transport of waste and landfill operation) on the AADT's of the F4 Western Freeway and Elizabeth Drive would be less than 1.4%.

The impacts are likely to be more significant on roads with lower capacity such as Wallgrove Road which are currently approaching the limit of their vehicle capacity. Safeguard measures detailed below, would need to be implemented to ensure that the proposal has minimal impact on traffic flows on Wallgrove Road.

In addition to effecting the flow of traffic on some surrounding roads, increased traffic volumes are likely to have the following impacts:

- *Degradation of access roads* - as heavy vehicles would be likely to use the F4 Western Freeway, Elizabeth Drive, Wallgrove Road and other roads within the area, there is some potential for the roads to degrade. Potholes and loosened gravel may result, which in turn could create a hazard to local traffic; and
- *Traffic entering and exiting the site* - A potential safety hazard exists where vehicles are required to turn across on-coming traffic lanes when entering and leaving the site.

Recognising the above potential impacts, a number of safeguards have been incorporated into the proposal, as outlined in Section 10.6.

10.6 SAFEGUARDS

The following safeguards would be incorporated into the proposal to alleviate any impacts of the additional traffic:

- the site would not require the movement of waste through residential areas. Transport of waste through residential areas would be a function of the source of the waste. The location of the site with respect to the main road system is such that trucks carrying waste material can be directed to the arterial road system;
- a vehicle turning lane would be constructed at the entrance of the site to ensure that trucks travelling south along Wallgrove Road do not hinder or obstruct the flow of traffic;

- the weighbridge would be located approximately 50 metres from the entrance of the site to ensure that trucks waiting to drive onto the weighbridge do not block the flow of traffic on Wallgrove Road;
- the landfill access road would be sealed for some 140m, which would reduce potential hazards (skidding on loose gravel) to traffic on Wallgrove Road;
- the entrance/exit to the landfill access road would be appropriately signposted to indicate:
  - to traffic on Wallgrove Road that there is an intersection road; and
  - to traffic leaving the site to give way to traffic on Wallgrove Road.

  This measure would ensure that vehicles do not inadvertently enter the Austral Brickworks site; and
- heavy equipment used for excavation and extraction, construction and landfilling activities would be retained on-site for the duration of that phase of work, for which it is required.

10.7 CONCLUSION

The proposal would generate approximately 12 additional traffic movements per day during construction of the landfill and associated infrastructure, and approximately 230 additional traffic movements during operation. Increased traffic volumes are not anticipated to have a significant impact on traffic flow along the F4 Western Freeway or Elizabeth Drive, however, the impacts are likely to be more significant on roads with lower vehicle capacity such as Wallgrove Road.

Safeguard measures, as described in Section 10.6, would be implemented to minimise the impact of the proposed works on existing traffic flow and road conditions.

11.1 FLORA

No vegetation was identified in the area defined by Void 1. Vegetation occurring on the remainder of the site was restricted to Eastern Creek, the area in the vicinity of the sales office/yard and along the western perimeter at Wallgrove Road. As a result detailed botanical surveys were not required on-site, although the dominant elements of the vegetation communities were recorded.

Two (2) vegetation communities were identified as shown in Figure 11.1. These include:

(i) *Eucalyptus moluccana - Eucalyptus tereticornis* - open woodland located along the western perimeter of the site and in the vicinity of the sales office/yard; and

(ii) *Melaleuca styphelioides - Casuarina glauca* - creekline woodland along Eastern Creek.

These vegetation communities are described by Benson (1992) as Cumberland Plain Woodland, which has been extensively cleared for rural, residential and industrial development since European settlement. Cumberland Plain Woodland is classified as an Endangered Ecological Community in Schedule 1 of the Threatened Species Conservation Act (NSW) 1995 and thus the vegetation on-site is considered to have conservation value.

11.1.1 Threatened Flora Species

Threatened plant species in NSW are listed in Schedules 1 and 2 of the *Threatened Species Conservation Act 1995*. Results from a NSW NPWS Wildlife Atlas database search in the locality (search area: Easting 297000 - 307000; Northing 625 000 - 626 000) and a review of the *Western Sydney NPWS Biodiversity Study (1997)* indicate a total of five (5) Threatened plant species in the locality of the subject site. These five species are listed in Table 11.1 below.

Table 11.1

THREATENED PLANT SPECIES IN THE SITE LOCALITY

Plant Species	Status[1]
Acacia pubescens	Vulnerable
Persoonia nutans	Endangered
Pimelea spicata	Endangered
Pultenaea parviflora	Endangered
Dillwynia tenuifolia	Vulnerable

1. As listed in the Threatened Species Conservation Act, 1995

The two vegetation communities recorded on-site could support the five Threatened plant species known to occur in the locality.

11.2 FAUNA

11.2.1 Fauna Habitat Assessment

The Cumberland Plain Woodland is the sole fauna habitat identified on-site and would be expected to provide foraging, roosting and breeding resources for a range of fauna known to occur in the locality. The *M. styphelioides - C. glauca* woodland along Eastern Creek would also be expected to serve as a corridor of movement between larger habitat areas (i.e. Commonwealth land and Nurrangingy Reserve at Doonside to the north of the site) for a similar range of fauna.

11.2.2 Threatened Fauna Species

A review of previous ecological surveys including NPSW (1997) and results from an NPWS Wildlife Atlas database search (search criteria: Easting 297000 - 307000; Northing 625 000 - 626 000) was carried out to identify Threatened fauna species that could be expected to utilise and rely on the habitat on-site for their life cycle requirements. The twelve (12) Threatened fauna identified are listed in Table 11.2 below.

Table 11.2

THREATENED FAUNA SPECIES

Scientific Name	Common Name
Lathamus discolor	Swift Parrot
Petarus norfolcensis	Squirrel Glider
Mormopterus norfolkensis	Eastern Freetail Bat
Saccolaimus flaviventris	Yellow-bellied Sheathtail-Bat
Chalinolobus dwyeri	Large-eared Pied Bat
Miniopterus schreibersii	Common Bentwing-Bat
Scoteanax ruepellii	Greater Broad-nosed Bat
Myotis adversus	Large-footed Myotis
Hoplocephalus bungaroides	Broad-headed Snake
Litoria aurea	Green and Golden Bell Frog
Heleioporus australiacus	Giant Burrowing Frog
Falsistrellus tasmaniensis	Eastern False Pipistrelle

EASTERN CREEK WASTE MANAGEMENT CENTRE

Eastern Creek

FERRERS ROAD

PROSPECT

ROAD

ADMINISTRATION BUILDING
BRICK MANUFACTURING PLANT

SYDNEY WATER SUPPLY PIPELINE

SITE ACCESS ROAD

SALES BUILDING

M. styphelioides, C. glauca –

BRICK MANUFACTURING PLANT

HORSLEY PARK

GROVE

WALLGROVE

WEIGHBRIDGE

CRUSHING PLANT

VOID 1

Prospect Reservoir

E. tereticornis, E. moluccana – Open Woodland

CHANDOS ROAD

N

REVISION:	A	DESIGNED:	CB
SCALE:	1:10000	DRAWN:	HC
DRAWING No:	A8601191/0540	CHECKED:	SKT
CAD FILE NO:	G.036	APPROVED:	CB
DATE:	20/11/97	STATUS:	FINAL

LEGEND

- TRANSMISSION LINE
- CREEKS
- WATER BODY
- ROADS
- SITE BOUNDARY
- VEGETATION
- CLAY/SHALE STOCKPILE AREAS
- BRICK STOCKPILE AREAS

0 200 400 600
metres

CLIENT
AUSTRAL BRICK COMPANY PTY LTD

PROJECT
AUSTRAL BRICK SOLID WASTE LANDFILL EIS

TITLE
VEGETATION DISTRIBUTION

FIGURE
11.1

A3

Woodward-Clyde

11.3 STATUTORY REQUIREMENTS

Section 5A of the Environmental Planning and Assessment Act 1979 sets out the factors to be considered in deciding whether there is likely to be a significant effect on Threatened species, populations or ecological communities and hence if a Species Impact Statement is required. The Section 5A Assessment is required only when impacts to Threatened flora and fauna are predicted as a result of a proposed development. No adverse impacts are predicted on the flora and fauna occurring on-site as a result of the proposal, as the proposed works would not impact on the two vegetation communities identified within the subject property.

Consequently, the Assessment under Section 5A of the Environmental Planning and Assessment Act 1979 has not been applied to the site, in respect of the plant and animal species listed in the Threatened Species Conservation Act 1995, which may be present or utilise the habitats on-site.

11.4 IMPACTS

The proposal would not result in the loss of vegetation and fauna habitat identified on-site. Additionally, the proposal is not expected to result in an:

- increase in the risk of fire to the area (and thus change the existing fire regime on which the site vegetation is dependent upon);
- increase in the proliferation of weeds on-site (the invasive weed, *Tradescantia albiflora*, dominates the existing groundcover/understorey of the creekline woodland bisecting the site); and
- increase in the occurrence of dogs and cats on-site (known predators of native birds and small terrestrial mammals).

11.5 SAFEGUARDS

The Draft LEMP in Appendix B, which has been prepared in conjunction with this EIS, establishes controls and safeguards on the generation, collection and disposal of dust, stormwater, leachate and litter, which would serve to minimise indirect impacts on flora and fauna on the Austral Bricks site.

12.1 SOCIAL ISSUES

The potential impacts of the proposed landfill on the local community are listed as follows:

- direct and indirect effects in terms of local employment;
- effects on local businesses; and
- impacts on the amenity of the local area.

The proposed landfilling activities would result in 15 additional permanent jobs for people who live in the local area or other suburbs of western Sydney. These personnel would be required for a duration of approximately 18 years.

Continuation of excavation and extraction activities in Void 1 and its extension, would not result in additional jobs as personnel currently employed at the brickworks would undertake these activities. However, continuation of excavation and extraction activities would guarantee the security of jobs for those people currently employed in brick manufacture at the site.

In addition, the proposed excavation, extraction and landfilling works, would ensure that local businesses continue to benefit from the injection of spending into the economy.

The proposed works would have some impact on the amenity of the local area contributing to air, dust, noise, visual and water quality impacts, and the potential for disease, hazards and risk associated with the operation of the landfill. These issues have been addressed in detail in other sections of this EIS together with the safeguard measures to mitigate their effects.

The amenity of the areas adjacent to the site have been influenced by extraction and brickmaking activities which have been undertaken at the site since the early 1960's. With the proposed westward extension of Void 1 and the commencement of landfilling activities at the site, the impacts on the amenity of the area would be expected to increase. These impacts would be minimised by implementing the various safeguard measures in Section 24. Rehabilitation of the site at the cessation of extraction and landfilling activities would enable it to be redeveloped for recreational or other purposes which would improve the amenity of the local area and be compatible with local and regional planning objectives for the area.

12.2 ECONOMIC IMPACTS

Economic impacts on the region as a result of the proposal include:

- Continuation of excavation and extraction activities in Void 1 and its western extension guaranteeing the security of jobs for those people currently employed in brick manufacture at the site.
- Creation of employment opportunities for 6 people during construction of the landfill and associated infrastructure such as the weighbridge and site office.
- Operation of the landfill resulting in permanent employment opportunities for some 15 people for a duration of approximately 18 years.
- Generation of external employment opportunities for servicing and transport industries, and contractors undertaking environmental monitoring.

- Securing the future of the brickmaking plant at Horsley Park by providing a long term source of clay and shale. Extraction of these materials would be of economic benefit to Horsley Park and western Sydney region.
- Responding to the demand for additional landfill capacity in the Sydney region whilst ensuring that environmental impacts are minimised.
- Developing the rehabilitated site for recreation or other uses compatible with the Prospect Creek Reservoir which would improve the amenity of the area and benefit the local community.

12.3 CONCLUSION

The overall socio-economic benefits of the project are positive. The continuation of extraction activities at the site would result in economic benefits for Austral, as well as economic benefits to the community in the form of job security and the utilisation of a regionally significant resource. Landfilling activities would satisfy the demand for landfill space in the Sydney region, and would rehabilitate the site for recreation or other uses which would improve the amenity of the local area.

A cultural heritage assessment of the subject site was based on field surveys conducted by Woodward-Clyde personnel, and a search of the National Parks and Wildlife Service (NPWS) Register of Aboriginal Sites and the Heritage Council of NSW's database.

13.1 OBJECTIVES

The objectives of the archaeological and heritage assessment were:

- to inspect areas which may be affected by the proposed works and to identify any previously recorded or unrecorded Aboriginal and historic sites within these areas; and
- to define any constraints imposed by, and provide appropriate management recommendations for, any archaeological or heritage sites which may be adversely impacted by the proposed works.

13.2 METHODOLOGY

13.2.1 Register Search

A search of the NPWS Register of known Aboriginal Sites was conducted for a 5 km radius around the project site and including the subject site. A search of the Heritage Council of NSW's database was also conducted. The findings of the database searches are discussed in Section 13.4.

13.2.2 Field Survey

A visual field survey of the subject site was carried out on 6 August 1997 by Woodward-Clyde personnel.

Field survey and its effectiveness is related to surface visibility at the site, which is a measure of bare ground visible during the survey. The predominant factor affecting surface visibility is the degree of vegetation and ground litter. However, the depth and type of exposure, the extent of recent or secondary deposition, and the level of visual interference from surface gravels, are also important factors.

13.3 ARCHAEOLOGICAL BACKGROUND OF THE REGION

The subject site is located in the region known as the Cumberland Plain. Over the past decade, several archaeological studies have been undertaken in this region in order to assess the extent of Aboriginal occupation on the plain. Kohen and Others have revealed the presence of numerous open camp sites, small scatters of artefacts and isolated finds in the region (CMPS&F, 1997).

13.4 FINDINGS OF THE ARCHAEOLOGICAL AND HERITAGE SURVEY

As described in Section 3, the site was used for farming prior to the commencement of quarrying and brick manufacturing activities in the early 1960's. These activities have caused extensive disturbance and modification to the landscape.

No aboriginal heritage sites were identified during the field survey. Given that numerous Aboriginal archaeological sites have been found throughout the region, it is highly likely that

the site and the areas surrounding the site were once occupied by Aborigines. Had aboriginal sites such as open camp sites and artefact scatters once been present at the site, they would have been buried, destroyed or disturbed by past activities.

A search of the NPWS Register of known Aboriginal Sites revealed that no archaeological sites have been recorded within a 5 km radius of the site of the proposed landfill.

The site contains no items of heritage significance and no historic sites listed by the Heritage Council of NSW occur on the project site.

13.5 IMPACTS OF THE PROPOSAL

As no Aboriginal or European heritage sites were identified during the field survey or the search of the Heritage Council's or NPWS' databases, and owing to the disturbed and modified nature of the land, the proposal would not have any impact on archaeology or heritage.

13.6 SAFEGUARDS

In the absence of any heritage or archaeological sites or relics, no specific safeguards are required.

However, if any Aboriginal archaeological sites or heritage items are discovered during the proposed landfilling activities, they would be reported to the zone archaeologist of the NPWS and the Local Aboriginal Land Council and works would cease pending their consideration. These sites/items would then be assessed for significance and appropriate protection measures would be instituted, if required.

13.7 CONCLUSION

As no Aboriginal sites or heritage items were listed on the NPWS or Australian Heritage Council registers, or identified during the field survey, the proposed works would not impact on any known items or areas of archaeological or heritage significance.

14.1 VISUAL CHARACTER OF THE SITE

Three elements are typically used to describe the visual and physical characteristics of a landscape, namely:

- landform;
- vegetation; and
- land use.

These three elements form the basis of an assessment of the potential visual impacts of the proposed works on specific points of interest and on vantage points surrounding the site.

14.1.1 Landform

The terrain in the locality surrounding Austral Bricks is of low to moderate relief, with gently rolling hills such as the hill at the south-western edge of the site. The hill is the highest point within the site with an elevation of 92 mAHD.

Void 1 is also a significant feature on site. It comprises two zones:

- the upper platform which is located in the western portion of the pit at an elevation of approximately 70 mAHD; and
- the lower platform located in the eastern portion of the pit with an elevation of approximately 55 mAHD.

14.1.2 Vegetation

Two vegetation communities occur on the site. A stand of open woodland (*Eucalyptus moluccana - Eucalyptus tereticornis*) is located along the western perimeter of the site and in the vicinity of the sales office/yard. Creekline woodland (*Melaleuca stphelioides - Casuarina glauca*) occurs along Eastern Creek. No vegetation was identified in the area defined as Void 1.

14.1.3 Land use

Current facilities and operations within the Austral Bricks complex (which includes the project site) include:

- two brick manufacturing plants;
- two brick and paver stockpile areas;
- suitable materials/shale stockpile areas;
- two crushing plants;
- Voids 1 and 2;
- administration building;
- sales building;
- car park area; and

- weighbridge.

14.2 VISUAL CHARACTER OF SURROUNDING LANDSCAPES

The landform, vegetation and land uses of the surrounding areas are summarised below:

14.2.1 Landform

Prominent landform features surrounding the project site include:

- Prospect Reservoir to the east of the site at an elevation of 70 m AHD;
- rural residential and horticultural developments to the south of the site, with a maximum elevation of 100 m AHD sloping moderately towards Eastern Creek and the site;
- rural residential and horticultural developments to the west of the site and east of Walworth Road, with a maximum elevation of 100 m AHD sloping moderately in an easterly direction;
- rural residential and horticultural developments west of Walworth Road with a maximum elevation of 90 m AHD and sloping moderately in a westerly direction; and
- Eastern Creek Waste Management Centre with a maximum elevation of 60 m AHD and sloping gently away from the site towards the north east.

14.2.2 Vegetation

Natural vegetation communities surrounding the site have been mapped by D. H Benson in the Natural Vegetation of the Penrith Area 1:100 000 sheet. These vegetation communities are listed as follows:

- Grey Box Woodland - the main canopy species are *Eucalyptus moluccana* and *Eucalyptus tereticornis*; and
- Grey Box - Iron Bark Woodland - the main canopy species are *Eucalyptus moluccana*, *Eucalyptus tereticornis* and *Eucalyptus crebra.*

These areas of vegetation occur as isolated stands throughout the locality and along the bank of Prospect Reservoir. They do not serve as prominent screening media to vantage points surrounding the site.

14.2.3 Land uses

Land uses which surround the Project site are described in detail in Section 15 and are listed below:

- Sydney Water Supply Pipeline forming the northern boundary of the site;
- Waste Service's Eastern Creek Waste Management Centre to the north of the site;
- Eastern Creek Raceway to the north;
- Australia's Wonderland amusement park to the north west;
- Sydney West Electrical Substation to the north west;
- Rural residential and horticultural developments to the west and south;

- Monier PGH Holdings brickworks to the west;
- Austral Brickworks site located off Old Wallgrove Road to the west;
- A 132 kV transmission line easement forming the southern boundary of the site; and
- Prospect Reservoir and areas of rural residential land to the east.

14.3 VIEWS INTO THE SITE (EXISTING VISIBILITY)

An observation study was undertaken on 6 August 1997 to assess the existing visibility of the project site from fourteen vantage points in the surrounding area. The vantage points considered most likely to be affected by the proposed works were nearby residences and local roads. Table 14.1 lists the fourteen vantage points visited during the observation study, describes the views into the project site and the proposed landfill area from each and notes the corresponding selected number of photographic plates. Figure 14.1 shows the locations of the nominated vantage points studied, the direction of views into the site and the site's visual catchment.

Table 14.1
EXISTING VIEWS INTO THE SITE

	Vantage Point	Views into the Site
A	Ferrers Road adjacent to Eastern Creek Raceway	No views into the site.
B	View from Ferrers Road derelict residence	Partially-restricted long views into the site and proposed landfill areas.
C	Ferrers Road at eastern boundary of the site	Partially-restricted views into the site, however, the proposed landfill area is not visible. Vegetation along Eastern Creek and infrastructure associated with brick manufacturing screens the landfill area.
D	Ferrers Road between Chandos and Redmayne Road[1]	Partially-restricted long views into the site. No views into the proposed landfill area due to screening by vegetation along Eastern Creek.
E	Redmayne Road	No views into the site.
F	Residence at corner of Walworth Road and Redmayne Road[2]	Partially-restricted long views into the site. No views into the proposed landfill area, as the area is screened by vegetation.
G	Walworth Road residence[3]	Partially-restricted long views into the site and the proposed landfill areas.
H	Burley Road residence	No views into the site.
I	Wallgrove Road residence	No views into the site.
J	Wallgrove Road residence adjacent to the site[4]	Prominent, unrestricted views into the site. Bund wall restricts views into the proposed landfill area.
K	Wallgrove Road at western boundary of the site	Partially-restricted views into the site. Views are screened by vegetation. No views into

	Vantage Point	Views into the Site
		the proposed landfill area.
L	Wallgrove Road at entrance to the site	Prominent, unrestricted views into the site. No views into the proposed landfill area.
M	Wallgrove Road	No views into the site.
N	Chandos Road residence	No views into the site.

Note: 1. Plate 14.1
2. Plate 14.2
3. Plate 14.3
4. Plate 14.4

The observation study confirmed that the residence immediately adjacent to the site on Wallgrove Rd (J) and areas of Wallgrove Road at the entrance to the site (L) yielded prominent, unrestricted views into the site, however, the proposed landfill area was not visible. The residence is considered to be a sensitive receptor area (defined as a school, hospital or residential area) yet it does not possess views into the proposed landfill area.

Of the six vantage points (B, C, D, F, G and K) which yielded partially restricted views into the site, four vantage points, B, D, F and G possess subtle, long views (1 to 2 km) to the site. Vantage points C and K possess views into the site which were partially restricted by vegetation. None of the six vantage points yielded views into the proposed landfill area.

The remaining vantage points studied do not yield views into the site or the proposed landfill area.

14.4 IMPACTS OF PROPOSAL

The potential visual impacts of the proposed development have been assessed in terms of the visibility of the final landform and the number of people who would see it, as well as the distance and context of those views.

The proposed works are not expected to significantly contribute to any loss of overall visual amenity of the area, given:

- several of the vantage points only possess long (1 to 2 km), partially-restricted views into the site;
- the vegetation along the eastern and western boundaries of the site effectively shield the proposed landfill area from short distance views into the site from Ferrers Road and Wallgrove Road;
- the proposed landfill area is not visible from vantage points surrounding the site due to the elevated nature of the topography surrounding the landfill area. A bund wall screens the landfill area from Wallgrove Road; and
- the proposed works would not be out of context with the land use of the surrounding areas.

A number of mitigation areas are proposed below should there be any loss of visual amenity at the vantage points identified, as a result of the proposed works.

OLD WALLGROVE ROAD

Reedy Creek

AUTEL LANDFILL

EASTERN CREEK RACEWAY

Eastern Creek

FERRERS ROAD

PROSPECT

WALLGROVE ROAD

EASTERN CREEK WASTE MANAGEMENT CENTRE

Prospect Reservoir

SYDNEY WATER SUPPLY PIPELINE

SYDNEY WATER

SITE ACCESS ROAD

SALES BUILDING

HORSLEY PARK

WEIGHBRIDGE

CRUSHING PLANT

VOID 1

BURLEY ROAD

WALWORTH ROAD

CHANDOS ROAD

SYDNEY/NEWCASTLE OIL & GAS PIPELINE

ARUNDEL ROAD

REDMAYNE ROAD

FERRERS ROAD

A B C D E F G H I J L M N

REVISION: A DESIGNED: ST

SCALE: 1:25000 DRAWN: HC

DRAWING No: A8601191/0540 CHECKED: SKT

CAD FILE NO: G.038 APPROVED: CB

DATE: 20/11/97 STATUS: FINAL

LEGEND

- TRANSMISSION LINE
- CREEKS
- WATER BODY
- ROADS
- SITE BOUNDARY
- PIPELINE
- A VANTAGE POINTS STUDIED
- B EXTERNAL VIEWS OF SITE

0 200 400 600

metres

CLIENT

AUSTRAL BRICK COMPANY PTY LTD

PROJECT

AUSTRAL BRICK SOLID WASTE LANDFILL EIS

TITLE

VISUAL ASSESSMENT

FIGURE

14.1

A3

Woodward-Clyde

14.5 SAFEGUARDS

The following environmental safeguards are recommended to minimise any adverse impacts on visual amenity as a result of the proposed works:

- the removal of vegetation which screens the site would be minimised, where possible;
- if necessary, vegetated mounds would be used for screening;
- proposed safeguards to control and minimise fugitive dust emissions would be strictly enforced; and
- at the completion of landfilling the landform of the site would be designed to be compatible with the surrounding Cumberland Plain topography and landscaped with appropriate native, endemic species.

14.6 CONCLUSION

The observation study undertaken at fourteen vantage points surrounding the site indicated that although one sensitive vantage point yielded prominent, unrestricted views into the Austral Bricks property and other vantage points from which the property was visible yielded partially-restricted views, the proposed landfill area was not visible from any of the vantage points. Given this low level of visual interaction with the existing surroundings, the potential visual impact of the proposal is generally assessed to be negligible. A number of mitigation measures are proposed which would ensure that any adverse effects on the visual amenity of the local environment would be minimised.

15.1 LAND USE

15.1.1 Surrounding Land Use

Land uses in the area include extractive industrial operations, landfills, rural and rural residential areas, horticulture, market gardens, an amusement park, an electricity substation and Prospect Reservoir water storage (see Figure 15.1).

The Sydney Water Supply Pipeline which connects Warragamba Dam to Prospect Reservoir runs along the northern boundary of the site. Further north is Waste Service's Eastern Creek Waste Management Centre, Austral landfill and Eastern Creek Raceway. Australia's Wonderland amusement park is located approximately 2 km north-west of the subject site.

An extensive area containing rural residential and market garden activities lies to the west and south providing flowers, strawberries, tomatoes, garlic, onions, Asian vegetables and grapes for the Sydney market. Lot sizes typically vary from 0.5 ha to over 10 ha. Further west is Monier PGH Holdings brickworks, Sydney West Electrical Substation and an Austral brickworks and quarry holding.

A 132 kV transmission line easement is located within and runs along the southern boundary of the subject site. Prospect Reservoir is situated to the east of the site.

15.1.2 Existing Use of the Site

The Austral Brick property contains three voids, two of which are currently used for the excavation and extraction of clay and shale.Clay and shale extracted from the quarries are either used in the paver and brick making operations conducted on the property or are exported to other Austral plants.

Clay and shale which is extracted from the voids is stored in stockpiles on-site and then transported to the crushing buildings and ultimately the manufacturing plants. At the completion of manufacturing operations the bricks and pavers are stored in product stockpiles.

The section of the property which is the subject of this EIS lies to the west of Eastern Creek and contains Void 1 and land which extends from the margin of Void 1, west to Wallgrove Road.

15.2 OWNERSHIP

The project site which is some 25 ha in area is owned by Austral Brick Company Pty Ltd and is registered as Lot 3 in Deposited Plan 235478.

15.3 FUTURE LAND USES

Upon the completion of landfilling activities, the site would be rehabilitated and used for purposes consistent with State planning requirements for the Western Sydney Open Space Corridor (currently under consideration by DUAP). These uses include recreational activities of a limited scale. Rehabilitation of the site and design of the landform so that it is compatible with surrounding Cumberland Plain terrain and would contribute to the habitat value and amenity of the wider area.

15.4 IMPACTS OF PROPOSAL

15.4.1 Impacts on Local Planning

The subject site is within the area defined as the Prospect Creek Corridor and lies immediately adjacent to the Western Sydney Recreation Area. This area is presently under review by DUAP and will be incorporated in the Draft Regional Environmental Plan for the Western Sydney Open Space Corridor currently being prepared by DUAP. Rehabilitation of the land upon completion of landfilling activities would enable use of the land for purposes consistent with State planning objectives, and would be consistent with strategic planning for the locality and be compatible with the rural residential interface.

15.4.2 Impacts on Land Use

The proposed works would have little impact on brickmaking activities undertaken at the site as the proposed works will be physically separate from existing operations. Clay and shale would continue to be extracted from operational voids and bricks and pavers would continue to be manufactured at the remainder of the Austral Bricks property. Safeguards which would be implemented during the construction and operational phase of the landfill, would ensure the proposed works do not impact on these activities or on land uses surrounding the site, including the Sydney Water Supply Pipeline.

The proposed works would rehabilitate Void 1 and its extension area to the west, and provide opportunities for new uses.

15.5 SAFEGUARDS

In order to ensure the proposed works do not have any adverse impacts on existing land uses on-site and on the land use in the surrounding area, the safeguards detailed in Section 24 would be adopted. These safeguards relate to matters such as minimising the removal of vegetation which screens the site, traffic management measures during the proposed works, minimisation of fugitive dust emissions, control of noise levels, use of screening mounds and the implementation of water and sediment management plans to control erosion and on-site drainage. Implementation of these safeguards would ensure that the proposed works do not impact on the rural residential interface.

15.6 CONCLUSION

The proposed landfilling activities would have minimal impact on existing land use at the site and on the land use of areas surrounding the site. Upon completion of landfilling activities, the site would be rehabilitated and returned to a state which would enable development for a number of regional recreation, open space and leisure purposes, and in doing so would satisfy strategic planning land use outcomes for the area.

F4 WESTERN FREEWAY

HUNTINGWOOD

SYDNEY/ NEWCASTLE OIL AND GAS PIPELINE

AUSTRALIA'S WONDERLAND

EASTERN CREEK

EASTERN CREEK RACEWAY

AUTEL LANDFILL

Eastern Creek

Reedy Creek

GROVE ROAD

HORSLEY

PROSPECT

Prospect Reservoir

EASTERN CREEK WASTE MANAGEMENT CENTRE

SYDNEY WEST SUB STATION

SYDNEY WATER SUPPLY PIPELINE

HORSLEY PARK

AUSTRAL BRICKWORKS AND QUARRY

AUSTRAL BRICKWORKS PROJECT SITE

PGH BRICKWORKS AND QUARRY

BURLEY ROAD

ARUNDEL ROAD

THE HORSLEY DRIVE

REVISION:	A	DESIGNED:	ST
SCALE:	1:25000	DRAWN:	HC
DRAWING No:	A8601191/0540	CHECKED:	SKT
CAD FILE NO:	G.039	APPROVED:	CR
DATE:	20/11/97	STATUS:	FINAL

LEGEND

- TRANSMISSION LINE
- PIPELINE
- CREEKS
- WATER BODY
- ROADS
- SITE BOUNDARY
- INDUSTRIAL
- EXTRACTIVE INDUSTRIAL OPERATIONS
- AMUSEMENT PARK
- ELECTRICAL SUBSTATION
- LANDFILL
- EASTERN CREEK RACEWAY

0 200 400 600 800 1000

metres

CLIENT

AUSTRAL BRICK COMPANY PTY LTD

PROJECT

AUSTRAL BRICK SOLID WASTE LANDFILL EIS

TITLE

LAND USE

FIGURE

15.1

A3

Woodward-Clyde

16.1 LOCAL PLANNING POLICIES AND REQUIREMENTS

The Austral Bricks property is located within Fairfield LGA. Land uses within the vicinity of the subject site are governed by the provisions of Fairfield local Environmental Plan 1994 (LEP 1994). LEP 1994 was gazetted on 12 August 1994. It has been subject to a number of amendments since it was gazetted, to reflect changes in environmental planning requirements and the significant growth that has occurred in Fairfield City. LEP 1994 (as amended 18 October 1996) is the instrument controlling land use in the City at present.

Pursuant to LEP 1994, the Subject site is zoned 6(c) Recreation Corridor.

The objectives of the zone are:

- *to identify land required for regional recreation, open space and leisure purposes;*
- *to provide opportunities for the development of a wide range of recreation and other facilities that do not conflict with the existing or likely future use of the land for regional recreation or public utility purposes;*
- *to provide a visual and physical break between existing and future areas of urban development;*
- *to provide for the maintenance, enhancement and rehabilitation of natural systems for environmental protection; and*
- *to permit a range of uses by public utilities and other government agencies which are compatible with the locality's open space and recreation objectives.*

Uses permitted without development consent include landscaping, gardening or bushfire hazard reduction. Development consent is required of all uses except those listed above and uses prohibited within this zone. Prohibited uses include:

Abattoirs, advertisements, aged and disabled persons' housing, amusement centres, bulky goods salesrooms or showrooms, business premises, clubs, dwelling houses, extractive industry, generating works, group homes, hazardous industry, hazardous storage establishments, health consulting rooms, heliports, home businesses, hospitals, hostels, hotels, industry, institutions, intensive agriculture, junkyards, light industry, medical centres, mines, motor showrooms, multi-unit housing, offensive industry, offensive storage establishments, places of worship, plant hire, residential flat buildings, rural industry, sawmills, service stations, serviced apartments, shops, stock and sales yards, transport depots, transport terminals, vehicle body repair workshops, vehicle repair stations, veterinary hospitals, warehouses.

The proposed works involve three key elements excavation, extraction and landfilling.

Excavation and extraction activities have been carried out on this site for 37 years. The proposed development is for the continuation of existing excavation and extraction works associated with the Austral brick making operations on the site. As the use predates the EP&A Act 1979, it can be classified as an 'existing use' and does not require consent under the provision of LEP 1994.

Consent would be sought from Fairfield City Council for the landfilling component of the project.

Part 3 of LEP 1994 contains special provisions applying generally throughout the LGA. Clauses that are relevant to this project are described as follows:

- Clause 12(1) requires that consent must be obtained form Council if a person wishes to erect any structure within 20 metres of the top of the bank or mean high water mark of any creek or waterway. Sub clause (2) states that Council must not grant consent referred to in sub clause (1) unless it has made an assessment of the affect which the carrying out of the proposed development will have on ecological systems, the stability of banks, water quality and the needs of existing and potential users of water from those creeks and waterways.
- Clause 13(1) states that land within the City of Fairfield must not be cleared or filled for any purpose except with the consent of Council. Sub clause (2) states that consent will not be granted for the filling of land unless Council is satisfied that:
  - the landfill is required for the reasonable economic use of the land or for the provision of utility services;
  - appropriate measures are proposed to ensure that there will be no adverse impact on waterways or private or public properties;
  - the landfill will not adversely affect flow characteristics, flood behaviour or water quality or promote erosion;
  - the landfill will contain no putrescible waste or hazardous material; and
  - in the case of proposals to fill swamps or wetlands, the ecological and nutrient trapping values of the site have been assessed.
- Clause 17(1) states that development for the purposes of extractive industries and associated works may be carried out on Lot 3 DP 235478 being the subject land, but only with the consent of Council.

As stated previously, extraction is an existing use of the subject land. Clause 17(1) acknowledges this existing use and allows for the continuation of the use with the consent of Council. Sub clause (2) states that Council consent will not be granted if the proposed extractive activities:

- require the Council to provide services or roads, unless the cost of providing those services or roads is fully recoverable from the person carrying out the development;
- have an adverse impact on flood behaviour;
- involve the filling of land with fill containing putrescible waste or hazardous material; or
- have an adverse impact on water quality or ecological systems of Eastern Creek, Ropes Creek or Reedy Creek.

Sub clause (3) requires that on completion of the extraction, the land must be rehabilitated in accordance with the requirements of the Council and (in the case of sites within 20 metres of the top of the bank of any creek), the Department of Water Resources.

As stated above, extractive industries are permissible on the subject land with the consent of Council. Section 16.2.2 shows that Sydney Regional Environmental No 9 - Extractive Industry (No. 2) recognises the regional significance of continued extractive industries in certain locations in the Sydney Region including the subject site and allows extraction activities in certain locations subject to Council consent.

16.2 STATE PLANNING POLICIES AND REQUIREMENTS

16.2.1 Environmental Planning Policies

The following State Environmental Planning Policies (SEPP) apply to the project:

State Environmental Planning Policy No. 11 - Traffic Generating Development

SEPP No. 11 provides the RTA with the opportunity to make representation on an extractive industry or mining development application (Schedule 1(m)g SEPP 11) prior to Council determining the application.

Council is required under Clause 7(3) to forward a copy of the development application to the RTA within 7 days of receipt of the application.

State Environmental Planning Policy No. 44 - Koala Habitat Protection

SEPP 44 aims to encourage the proper conservation and management of areas of 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:

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

b) by encouraging the identification of areas of core koala habitat; and

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

Existing vegetation on site does not provide habitat for koalas and is unlikely to provide habitat. SEPP 44 therefore does not apply to the property.

State Environmental Planning Policy No. 46 - Protection and Management of Native Vegetation

The aim of SEPP No. 46 is to prevent inappropriate native vegetation clearance in NSW. Schedule 1 which lists LGAs to which the policy applies, does not include Fairfield LGA or the neighbouring Blacktown LGA.

16.2.2 Regional Planning

The following Regional Environmental Plans (REP) apply to the subject land and to the proposal:

Sydney Regional Environmental Plan No. 9 - Extractive Industry (No. 2)

REP No. 9(2) applies to the Fairfield LGA (as listed in Schedule 4 to the REP). Extractive industries permissible with consent in Fairfield LGA include those on lands listed as 'clay/shale extraction areas of regional significance - current and potential' in Schedule 1 of the REP which includes the subject land.

REP No. 9(2) aims:

a) *to facilitate the development of extractive resources in proximity to the population of the Sydney Metropolitan Area by identifying land which contains extractive material of regional significance; and*

b) *to permit, with the consent of the council, development for the purpose of extractive industries on land described in Schedule 1 or 2;*

c) *to ensure consideration is given to the impact of encroaching development on the ability of extractive industries to realise their full potential; and*

d) *to promote the carrying out of development for the purpose of extractive industries in an environmentally acceptable manner.*

Clause 7 of the REP applies to extractive industries permissible with consent. Subclause 3 states that Council must not grant consent to extractive industry unless:

a) *it has considered the effect of the development on flood behaviour, the water quality, quantity and hydrodynamics of any watercourse or underground waters and also the effect of flood behaviour on the development and operations associated with the development in the vicinity;*

b) *it has considered a rehabilitation plan prepared in accordance with the Guidelines for Rehabilitation Plans in the Extractive Industry Report;*

c) *it is satisfied that, while the development is being carried out, noise and vibration levels will generally be in accordance with the guidelines in the State Pollution Control Commission Environment Noise Manual (1985 edition) available at the offices of the Environmental Protection Authority and the Council's of the areas specified in Schedule 4; and*

d) *it is satisfied that rehabilitation measures will be carried out in accordance with the guidelines in the Urban Erosion and Sediment Control Handbook (1992) prepared by the Department of Conservation and Land Management and available at the offices of the Department of Land and Water Conservation.*

Once a application for an extractive industry has been obtained, Clause 8 requires that Council forward a copy of the application to the Department of Mineral Resources for comment within 7 days of receipt of the application. Council should not determine the application until a written representation has been received from the Director-General with respect to the application or the Director-General has advised the Council that no comment is to be made. A representation must be made by the Department within 21 days, after which it can be assumed by Council that the Department does not wish to make any representations on the application.

Clause 9 states that Council must consider the recommendations for future extraction contained in the *Extractive Industry Report (DUAP 1994)*. The Report recommends that extraction of the clay/shale resource on the subject site should only proceed subject to consideration of environmental and economic constraints.

The REP provides that Council should not prepare a draft LEP which prohibits development for extractive industry (Clause 13). In addition, Clause 14 requires that before Council exhibits a draft LEP which directly applies to the subject site, Council should serve written notice of the draft plan to Austral Bricks. Clause 15 requires Council to forward copies of the draft plan to the Department of Mineral Resources and the EPA, should it determine that the

draft LEP is likely to result in development which would restrict the *obtaining of deposits of extractive material* form the subject land.

Clause 16(2) places restrictions on development in the vicinity of the subject site. It states that Council must not grant consent for a development unless it is satisfied that the development is carried out in accordance with the consent and:

a) *the proposed development will not be adversely affected by noise, dust, vibration or reduced visual amenity from any nearby extractive industry; and*

b) *the proposed development will not in any way adversely affect any existing nearby extractive industry or prevent any such extractive industry from realising its full economic potential by adversely affecting future expansion of the extractive industry of which the Council is aware.*

Clause 19(2) requires that Council must not grant consent to extraction works unless it is satisfied that the extraction will be carried in a manner which 'maximises the creation of waste'.

Draft Sydney Regional Environmental Plan No. 20 Hawkesbury-Nepean River 1996

The draft REP No. 20 repeals and replaces the original REP No. 20 and amendments to that plan. It also incorporates amendments to REP 20 exhibited in 1995, as draft Amendment No. 2.

The draft REP No. 20 aims to protect the environment of the Hawkesbury-Nepean River system by ensuring that the impacts of future land uses are considered in a regional context. This reflects the Hawkesbury-Nepean Environmental Planning Strategy which states:

> *'The health, integrity and diversity of the Hawkesbury-Nepean catchment must be maintained and wherever possible improved. The catchment and its river system must be able to meet the needs of its residents and users so that it can continue to be an area that is enjoyed and used by the people of Sydney, now and in the future'.*

The Plan ensures that the impacts of future land uses within the catchment are considered in a regional context and in the light of matters such as water quality, water quantity, cultural heritage, flora and fauna and aquaculture.

Part 3 of the draft REP No. 20 sets out additional matters to be considered by the consent authority when assessing an application for a waste management facility or works described in Schedule 3 (Designated Development) to the Environmental Planning and Assessment Regulation 1994. These include consultation with the Hawkesbury-Nepean Catchment Management Trust and

a) *Any potential for ground contamination;*

b) *The adequacy of the proposed leachate management system and surface water controls;*

c) *The long-term stability of the final landform and the adequacy of the site management plan; and*

d) *If extraction of material is involved in the creation or other development of the waste management site, whether the extractive operation will have an adverse impact on the river system.*

16.2.3 Environmental Planning and Assessment Act

Under Section 77 of the EP&A Act, a development application is required for the proposed works, and, pursuant to Section 77(3)(d), an EIS must accompany the development application in the event of it being designated development. The proposed development is defined as a "Waste management facility" and is listed as designated development under Schedule 3 of the Environmental Planning and Assessment Regulation 1994 and an EIS is therefore required for these works.

Section 90 of the EP&A Act outlines matters for consideration in determining a development application. In order to fully address the impacts of the proposed development and demonstrate that full consideration has been given to the environmental effects of the proposed development, the requirements of Section 90(1) of the EP&A Act have been considered and have been addressed in the EIS in the sections indicated as follows:

(a) the provisions of:

(i) any environmental planning instrument;

Section 16 (Statutory Planning Controls) assesses the relevant provisions of environmental planning instruments (local, regional and state) in relation to the proposed development.

(ii) any draft environmental planning instrument that is or has been placed on exhibition pursuant to section 48(b) or 66(1)b;

There are no relevant draft environmental planning instruments pertaining to the subject site.

(iii) any draft State environmental planning policy which has been submitted to the Minister in accordance with section 37 and details of which have been notified to the consent authority; and

There are no relevant draft State environmental planning policies applicable to the subject site or proposed works.

(iv) any development control plan in force under section 51A or 72 that applies to the land to which the development application relates;

There are no relevant development control plans which are applicable.

(a1) the provisions of:

(i) any conservation agreement entered into under the National Parks and Wildlife Act 1974 and applying to the whole part of the land to which the development application relates; and

Not applicable. There are no conservation agreements which apply to the subject land.

(ii) any plan of management adopted under that Act for the conservation area to which the agreement relates;

Not applicable. No plan of management applies to the subject site.

(b) the impact of that development on the environment (whether or not the subject of an environmental impact statement) and, where harm to the environment is likely to be

caused, any means that may be employed to protect the environmental or to mitigate that harm;

Potential impacts of the proposed development on the environment are dealt with in Sections 6 to 20 of this EIS. Measures which would be used to protect the environment are detailed in Sections 6 to 15 of this EIS and summarised in Section 24.

(c) the effect of that development on the landscape or scenic quality of the locality;

The potential impact of the proposed works on the scenic quality of the locality are assessed in Section 14 (Landscape and Visual).

(c1) the effect of that development on any wilderness area (within the meaning of the Wilderness Act 1987) in the locality;

Not applicable. There are no wilderness areas in the locality.

(c2) the effect of that development on critical habitat;

The effect of the proposed works on habitat is assessed in Section 11 (Flora and Fauna).

(c3) whether there is likely to be a significant effect on threatened species, populations or ecological communities or their habitats;

Potential impacts of the proposed works on threatened species and their habitats are assessed in Section 11 (Flora and Fauna).

(c4) any relevant recovery plan or threat abatement plan;

Not applicable. There are no recovery or threat abatement plans applying to the subject site.

(c5) the effect of that development on any other protected fauna or protected native plants within the meaning of the National Parks and Wildlife Act 1974;

The effect of the proposed works on protected fauna or protected native plants is assessed in Section 11 (Flora and Fauna).

(d) the social effect and the economic effect of that development in the locality;

The social and economic impact of the proposed works on the surrounding community is examined in Section 8 (Socio-economics).

(e) the character, location, siting, bulk, scale, shape, size, height, density, design or external appearance of that development;

Details of the proposed development are provided in Section 4 (Project Description) and Section 14 (Landscape and Visual).

(f) the size and shape of the land to which that development application relates, the siting of any building or works thereon and the area to be occupied by that development;

A description of the subject site is provided in Section 3 (Study Area and Alternatives), and the size and shape of the land is illustrated on the figures throughout this EIS.

(g) whether the land to which that development application relates is unsuitable for that development by reason of its being, or being likely to be, subject to flooding, tidal inundation, subsidence, slip or bush fire or to any other risk;

Geotechnical, hydrogeological and hydrologic issues are addressed in Section 6 (Landform, Geology, Soils and Geotechnical), and Section 7 (Hydrology and Hydrogeology) respectively.

(h) the relationship of that development to development on adjoining land or on other land in the locality;

The relationship of the proposed works to development on adjoining land and existing land uses in the locality is assessed in Section 15 (Landuse and Property).

(i) whether the proposed means of entrance to and exit from that development and the land to which that development application relates are adequate and whether adequate provision has been made for the loading, unloading, manoeuvring and parking of vehicles within that development or on that land;

The proposed means of entrance to and exit from the subject site has been addressed in Section 10 (Traffic and Transportation).

(j) the amount of traffic likely to be generated by the development, particularly in relation to the capacity of the road system in the locality and the probable effect of that traffic on the movement of traffic on that road system;

Traffic volumes associated with implementing the project are estimated, and impacts resulting from site traffic are assessed in Section 10 (Traffic and Transportation).

(k) whether public transport services are necessary and, if so, whether they are available and adequate for that development;

The proposed development is not dependent upon or require public transport services.

(l) whether utility services are available and adequate for that development;

The proposed works do not require the provision of new utility services.

(m) whether adequate provision has been made for the landscaping of the land to which that development application relates and whether any trees or other vegetation on the land should be preserved;

The need to preserve vegetation on the subject site is addressed in Section 11 (Flora and Fauna), and the issue of rehabilitating the subject site following the completion of the proposed works is addressed in Section 4 (Project Description).

(m1) whether that development is likely to cause soil erosion;

Potential for the proposed works to cause soil erosion is assessed in Section 6 (Landform, Geology, Soils and Geotechnical).

(n) any representations made by a public authority in relation to that development application, or to the development of the area, and the rights and powers of that public authority;

The consultation process with statutory authorities is explained, and representations received from statutory authorities are dealt with in Section 5 (Consultation).

(o) the existing and likely future amenity of the neighbourhood;

The existing and likely future amenity of the neighbourhood is addressed in Section 15 (Landuse and Property).

(p) any submission made under section 87;

No submissions have been made at this stage.

(p1) without limiting the generality of paragraph (a), any matter specified in an environmental planning instrument as a matter to be taken into consideration or to which the consent authority shall otherwise have regard in determining the development application;

Fairfield Local Environmental Plan 1994, being the relevant environmental planning instrument, does not contain any special considerations not covered by the EIS.

(q) the circumstances of the case;

There are no special circumstances applying to the proposed works.

(r) the public interest; and

The public interest is well served through the continuation of resource extraction and the rehabilitation of the site through landfilling.

(s) any other prescribed matter.

Clause 65 of the Environmental Planning and Assessment Regulation, 1994 (as amended) requires council to consider the following additional prescribed matters:

(a) whether adequate provision has been made to enable disabled persons to gain access to the development or to the land on which the development is proposed to be carried out;

Disabled access to the proposed works is not required. Existing arrangements for access to the site will not be changed.

(b) the Government Coastal Policy, in the case of development on land in the area of a council referred to in Schedule 1;

The subject land is not affected by the Government Coastal Policy. In addition, the subject land is not affected by the operation of Sections 38 or 39 of the Coastal Protection Act, 1979.

(c) the effect of the development on:

(i) any protected fauna (within the meaning of the National Parks and Wildlife Act 1974); and

(ii) the habitat of any such protected fauna;

and the means to be employed to protect them from harm, or to mitigate the harm, if the development is likely to cause them harm;

The impact of the proposed works on protected fauna or the habitat of any such protected fauna, is assessed in Section 11 (Flora and Fauna).

(d) whether the development will endanger any species of animal, plant or other form of life, whether living on land, in water or in the air;

The potential for the proposed works to endanger any species of animal or plant is assessed in Section 11 (Flora and Flora).

e) *the matters set out in the document entitled "Planning for Bush Fire Protection" (published by the Department of Bush Fire Services) or in any other publication of that Department published in substitution for that document and approved for the time being by the Director.*

The subject sites and adjoining areas are not at significant risk from bush fire.

17.1 ECOLOGICALLY SUSTAINABLE DEVELOPMENT

The Commonwealth Government in its document *'Ecologically Sustainable Development: A Commonwealth Discussion Paper'* 1990 defined ESD 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'*

Generally, ESD aims to address the wise use or reuse of resources.

In NSW, the concept of ESD has been given legal definition by *the Protection of the Environment Administration Act* 1991 (NSW) which set up the NSW EPA. Section 6(1)(a) of the above Act provided that the EPA in protecting, restoring and enhancing the quality of the environment in NSW should have *'regard to the need to maintain ecologically sustainable development'*. This would require *'the effective integration of economic and environmental considerations in decision making processes'*. The principles which would assist in the achievement of ESD have been clearly set out in Schedule 2 of the Environmental Planning and Assessment Regulation 1994. These principles include:

(a) *The precautionary principle* - namely, that 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.

(b) *Inter-generational equity* - namely, that the present generation should ensure that the healthy diversity and productivity of the environment is maintained or enhanced for the benefit of future generations.

(c) *Conservation of biological diversity and ecological integrity* - namely, that while prices for natural resources should be set to recover the full social and environmental costs for their use and extraction, many environmental values cannot be priced in monetary terms.

(d) *Improved valuation, pricing and incentive mechanisms* - these mechanisms would enable environmental factors to be included in the valuation of assets and services.

The four principles are interrelated. For instance, intergenerational equity can only be achieved in many instances if biodiversity is conserved for the use and enrichment of future generations. The linkage of the four principles means that they must be considered individually and collectively when assessing whether a proposed project would contribute to ESD in Australia (Department of Urban Affairs and Planning, 1995).

These principles have been considered in light of this proposal and are discussed below, along with the issue of climate change and greenhouse effect.

- biological diversity and ecological integrity;
- inter-generational equity;
- precautionary principle; and
- valuation and pricing of environmental resources.

The World Bank (1994) summarised ESD as:

'The concept of sustainable development implies balancing environmental protection with the generation of increased opportunities for employment and improved livelihoods'.

17.2 CLIMATE CHANGE AND GREENHOUSE EFFECT

The Greenhouse Effect is the phenomenon whereby certain gases, known as greenhouse gases, capture heat radiated from the earth and re-radiate it back to the earth. This mechanism maintains the thermal balance that controls the earth's climate. It is now well established by a consensus of scientists, that the thermal balance may be disturbed by steadily increasing concentrations of certain greenhouse gases, principally carbon dioxide (CO_2). This change is known as the enhanced greenhouse effect and it is predicted that it may change global climate patterns.

CO_2 is the main greenhouse gas of concern. It is the inevitable product of the combustion of fossil fuels and accounts for approximately half of the total enhanced greenhouse effect. The other main greenhouse gases are methane, ozone (O_3), nitrous oxide (NO_x) and Chloro-Fluorocarbons (CFC's). The emissions of these other gases are much less than CO_2 but their effect in the atmosphere is significant because they are more effective as greenhouse gases.

Due to growing concern regarding the enhanced Greenhouse Effect, the Commonwealth Government, as part of its National Greenhouse Response Strategy, announced in October 1990 that it had adopted a planning target to reduce greenhouse gas emissions by 20% by the year 2005 (Energy Production Working Group, 1991).

The proposed landfill would not emit greenhouse gases such as methane, as only non-putrescible waste from building and demolition, clean excavated natural materials, commercial and industrial wastes which do not have hazardous characteristics, wood and green wastes and non-leaching contaminated soils would be disposed of at the site.

Vehicles used to transport waste to the landfill and machinery used to excavate and extract shale and to compact the waste and apply the cover material, would emit small quantities of greenhouse gases. Reductions in the production of greenhouse gases from transport would require a widespread response including the introduction of more efficient vehicles, the use of cleaner fuels and a focus on improved process management. Only an improvement in process management would have any affect on greenhouse gas emissions at the scale of a single project.

17.3 BIOLOGICAL DIVERSITY AND ECOLOGICAL INTEGRITY

Preserving biological diversity and ecological integrity requires that ecosystems, species and genetic diversity within species be maintained.

Environmental safeguards and monitoring programs would be implemented so as to maintain the biological diversity and ecological integrity of the region. Erosion and sediment control procedures would minimise adverse impacts on the soil and water resources and control the emission of airborne particulate matter. Monitoring would be undertaken to ensure the environmental control measures are operating effectively.

As discussed in detail in Chapter 11, it is not anticipated that the project would pose a significant threat to terrestrial flora or fauna, since the site has been substantially disturbed in the past, contains very little vegetation, and is unlikely to provide habitat for any Threatened

fauna species. Indeed the project would give rise to an increase in vegetative cover as the land is rehabilitated, providing increased wildlife habitat.

A detailed review of the environmental safeguards and monitoring programs which should be implemented for the proposed landfill are provided in Sections 23 and 24, respectively.

17.4 INTER-GENERATIONAL EQUITY

Inter-generational equity has been defined by Leiss (1990) as a concept which states that humans

> *'hold the natural and cultural environment of the earth in common both with other members of the present generation and with other generations, past and future'.*

In other words, the present generation has inherited the Earth from its forbearers and should ensure the diversity and productivity of the environment is maintained, or enhanced and passed on, in a condition which has a positive benefit for future generations. The most significant aspect of this concept is that future generations should not inherit a degraded environment.

As discussed previously, there is a requirement for new landfilling sites in the Sydney region due to the lack of long term waste disposal capacity. The proposal would provide additional landfill capacity whilst ensuring that the proposed works have minimal adverse impacts on the environment. Upon completion of landfilling activities the site would be rehabilitated and a landform created compatible with the surrounding Cumberland Plain topography. The land could then accommodate a variety of uses compatible with the objectives of the Draft Regional Environmental Plan for Western Sydney Open Space Corridor, which would be of significant benefit to future generations.

As the landfill is licenced, the operation of the landfill will be in accordance with the requirements of the EPA and the landfill will be designed to ensure that issues such as the breakdown of entombed matter over lengthening periods of time do not transfer problems to future generations.

17.5 PRECAUTIONARY PRINCIPLE

The Intergovernmental Agreement on the Environment (IGAE) prepared in 1992 and signed by Commonwealth, State, Territory and Local Government, provides a definition of the precautionary principle. The precautionary principle is defined as follows;

> *Where 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.*
>
> *In the application of the precautionary principle, public and private decisions should be guided by:*
>
> - *careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment; and*
> - *an assessment of the risk-weighted consequences of various options.*

The IGAE states that the precautionary principle is to be a guiding principle for informed '*policy making and program implementation*' by all levels of government in Australia. In this manner, it is to guide both the public and private sector in its decision making and assessment

of different options, particularly when decisions are being made in the face of uncertainty. In doing so, it requires avoidance of serious or irreversible damage to the environment, whenever practicable.

This project has taken on board the 'precautionary principle' by ensuring that potential environmental risks associated with the proposed landfill have been considered from the outset and that environmental management practices and safeguards are used to minimise environmental impacts.

Studies undertaken during the preparation of this EIS in relation to the potential impacts of the proposal on flora and fauna, archaeology and heritage, visual amenity, hydrology, soil and water quality, have not indicated threats of serious or irreversible environmental damage. However, where risk of potential environmental degradation has been identified, safeguards have been developed to ensure that significant adverse environmental impacts do not occur.

Should the project and its ancillary safeguards not proceed, the environment would be further degraded and could result in irreversible environmental damage. The proposed works would reduce the threat of environmental degradation.

In addition, environmental monitoring would be undertaken to assess the adequacy of the precautions and safeguards used to minimise environmental impacts. This would ensure any shortcomings of the operation are identified at the earliest possible stage in the process.

17.6 VALUATION AND PRICING OF ENVIRONMENTAL RESOURCES

The IGAE and the *Protection of the Environment Administration Act* both call for improved valuation, pricing and incentive mechanisms which should form an element of policy making and program implementation. In other words, environmental factors should be included in the valuation of assets and services.

The integration of environmental and economic goals is one of the key principles of ESD set out by the Commonwealth Government and is a feature of the IGAE.

Cost-benefit analysis can be applied to assist in deciding which way to proceed towards sustainable development. It is a means of helping decisions to be made in an objective and rational manner by allowing the costs of proceeding with a project to be measured against the benefits arising from the project in like and numeric terms.

It is difficult to assign a monetary value to the environment of the subject site, given the lack of precedence and guidelines in the valuation of environmental resources not considered for commercial use, the site's relatively disturbed nature and its size. However, by identifying appropriate safeguards to mitigate against adverse environmental effects and including the cost of implementing these safeguards in the total project cost, the value and price of environmental resources is more accurately reflected.

The IGAE also refers to the polluter pays principle. The environmental safeguards and monitoring aspects of the proposal set out in Chapters 23 and 24 of this EIS, ensure that any potential environmental impacts of the proposed works are minimised.

17.7 CONCLUSION

The proposed works incorporate environmental and economic objectives which collectively summarise the principles of ESD. It fully embraces the principles of ESD and would,

following rehabilitation, provide a landform with vegetation endemic to the region which enhances the ecological and habitat value of the local area.

18.1 ENERGY REQUIREMENTS

Energy sources for construction activities and excavation, extraction and landfill operations include electricity, diesel fuel, petrol and oils.

The energy likely to be expended in relation to the proposed works can be divided into six components as follows:

- *Construction* - Construction activities would involve preparing the base liner, constructing the leachate drainage and stormwater diversion drainage systems, and operating infrastructure such as the weighbridge building and site offices. Construction of the operating infrastructure and the landfill in the initial active area would take approximately 2 months.
- *Excavation and extraction of quarry material* - Void 1 would be extended westwards as shale is extracted from the void. Following extraction, the shale would be transported to storage areas and to other locations for brick and paver manufacture. Diesel fuel and oils would be required to power the heavy equipment used for quarrying activities which would be undertaken for a period of approximately 18 years.
- *Transport of solid waste* - Petrol or diesel fuel and oils would power trucks transporting solid waste from its source to the site for landfilling. Solid waste would be transported to the site for approximately 18 years.
- *Waste placement* - Diesel fuel and oils would be used to power heavy equipment (compactors and bulldozers) required for the placement and compaction of waste. These activities would be undertaken for some 18 years.
- *General site operation* - In addition to the consumption of diesel fuel and oils, relatively small amounts of electricity would be required for general workshop services, to operate the weighbridge and pumps, and to provide lighting and air conditioning in the administration building. Petrol would be required to power employee and visitor vehicles.
- *Transfer and placement of cover material* - This activity would involve the removal, stockpiling, trucking and placement of cover material for the duration of landfilling operations. Dump trucks powered by diesel fuel and oils would carry out these activities.

18.2 ESTIMATES OF ENERGY CONSUMPTION

Energy consumption for site operations has been estimated based on following assumptions:

- Construction activities would be undertaken for a period of approximately 2 months;
- An annual average of some 6 million tonnes of overburden/shale would be excavated and extracted from the void for a period of 18 years;
- Excavation and extraction activities would take place at an approximate rate of 350 000 tonnes per year;
- An annual average of approximately 300 000 tonnes of waste and cover per annum would be placed at the landfill over its lifetime of 18 years; and

- The working hours detailed in Section 4.4.8 would be adhered to wherever possible, however, activities may vary depending on specific requirements. Work would not be undertaken on public holidays.

Table 18.1 provides estimates of fuel usage for site operations.

Table 18.1
ESTIMATES OF FUEL CONSUMPTION FOR HEAVY EQUIPMENT

TYPICAL HEAVY EQUIPMENT	FUEL CONSUMPTION (litres/hour)	AVERAGE USAGE[4] (hours/year)	FUEL CONSUMPTION (litres/year)
Construction Activities			
1 Caterpillar D9N bulldozer	50[1]	560[3]	28 000[5]
1 Caterpillar 815B soil compactor	45[1]	560[3]	25 200[5]
1 Caterpillar 330 hydraulic excavator	34[1]	560[3]	19 000[5]
1 Caterpillar D20D articulated truck	12[1]	560[3]	6 700[5]
1 fuel truck	10[2]	200[3]	2 000[5]
12 tonne water truck	10[2]	200[3]	2 000[5]
Excavation and Extraction Activities			
1 Caterpillar D9N bulldozer	50[1]	3570	178 500
3 Caterpillar 631E scrapers	59[1]	3570	210 600
1 Caterpillar 988F wheeled loader	47[1]	3570	167 800
1 Fuel truck	10[2]	1200	12 000
12 tonne water truck	10[2]	1200	12 000
Landfilling Activities			
2 Caterpillar 826C compactors	63[1]	3390	213 600
1 Caterpillar D9N Bulldozer	50[1]	3390	169 500
1 Caterpillar 980F wheeled loader	15[1]	3390	50 900
1 Mack Prime Mover and trailer	15[1]	2390	35 900
1 Caterpillar 12G motor grader	17[1]	3390	57 600
1 Caterpillar D20D articulated truck	12[1]	2390	28 700
1 fuel truck	10[2]	1200	12 000
12 tonne water truck	10[2]	1200	12 000

1. Hourly rates of fuel consumption are from the *Caterpillar Performance Handbook, 1994* and are based on a medium or high load factor for equipment. Caterpillar equipment selected are indicative of the type of equipment to be used on site.
2. Based on hourly rates of fuel consumption as indicated by CMPS&F, 1997.
3. Average usage is for the two month period required to complete construction activities for the initial active area of the landfill.
4. Calculation of average usage is based on operating hours detailed in Section 4.4.8.
5. Fuel consumption is for the two month period required to complete the construction activities for the initial active area of the landfill.

Total fuel consumption over the duration of the project is as follows:

- *Construction* - 82 900 litres over the 2 month period required to complete construction activities for the initial active area of the landfill.
- *Excavation and extraction activities* - 10 456 200 litres over the 18 years required to excavate and extract material from the void.
- *Landfilling activities* - 10 443 600 litres over the 18 years required to fill the void with waste.

18.3 IMPACTS OF THE PROPOSAL

The major impacts of the proposal relate to the consumption of non-renewable energy resources and the effect using such resources has on air quality and the greenhouse effect.

At present, none of the activities proposed can be undertaken using alternative fuel sources, however, implementation of the safeguard measures described below, would ensure non-renewable energy resources are used efficiently.

Impacts of the proposal on air quality have been addressed in Section 8 and impacts on the greenhouse effect have been addressed in Section 17.2.

18.4 SAFEGUARDS

The following safeguard measures would be implemented to ensure efficient energy management:

- regular servicing would be undertaken to ensure heavy equipment is maintained in good condition;
- heavy equipment would be operated only when required;
- modern equipment with high levels of energy efficiency would be used;
- equipment which becomes inefficient over the life of the project would be replaced with modern equipment; and
- quarry and landfill operations would be scheduled so as to minimise the total operating hours of equipment. Such scheduling would serve to reduce on-site fuel consumption.

19.1 INTRODUCTION

A hazard is defined as a physical situation with potential for human injury, damage to property, damage to the environment or some combination of these factors.

Risks are determined by reference to:

- the potential for human or environmental exposure to the hazards given the existing and proposed site land use; and,
- the presence of significant ecological receptors.

19.2 IDENTIFICATION OF POTENTIAL HAZARDS

Risks associated with the proposed development in relation to matters such as air, water and soil quality, and transportation issues, have been addressed in detail in the relevant sections of this EIS. The measures required to minimise these risks would be incorporated into site operating procedures and contingency plans.

The overall risk to the health of on-site personnel (both workers and visitors) as a result of the proposal and the types of hazards likely to affect on-site personnel include:

- safety hazards (such as sharp objects, uneven terrain and unstable surfaces);
- biological hazards (such as poisonous insects, spiders and snakes, the risk of infection and tetanus from cuts and abrasions);
- health hazards from contact with waste;
- fire hazards;
- noise; and
- heat stress.

Heavy equipment used for moving and placing waste and cover material also creates safety hazards for workers or visitors in the vicinity of the operating equipment. Personal protective equipment (PPE) worn by workers may limit manual dexterity, hearing and visibility. PPE may also increase the difficulty of performing some tasks and place additional strain on the wearer when performing physical activity.

19.3 SAFEGUARDS

A site specific Health and Safety Plan (HASP), which establishes policies and procedures to protect workers and the public from the potential hazards posed by the proposed landfill, would be developed prior to development of the landfill. This HASP would;

- name key personnel and alternatives responsible for site safety
- describe the site's standard operating procedures;
- describe the risks associated with each operation conducted;
- confirm that personnel are adequately trained to perform their responsibilities and to handle the specific hazardous situations they may encounter;

- describe the actions to be taken to mitigate existing hazards to make the work environment less hazardous;
- describe protective clothing and equipment (such as hearing protection) to be worn by site personnel during various site operations; and
- set forth a contingency plan for safe and effective response to emergencies.

Actions which would be taken for the duration of the project to make the work environment less hazardous, are described below.

19.3.1 Control of Safety Hazards

The risk of injury resulting from safety hazards would be reduced by:

- making site personnel aware of potential safety hazards on-site;
- ensuring all equipment brought on-site is adequately maintained and complies with relevant WorkCover requirements. Equipment which is identified as being unsafe would either be made safe or removed from the site;
- being aware of the position of heavy machinery at all times;
- erecting fences and employing security personnel to prevent entry of unauthorised persons;
- ensuring that site personnel are aware that PPE limits manual dexterity, hearing, visibility and may increase the difficulty of performing some tasks; and
- ensuring tools or waste materials are not left where people are likely to trip over them.

19.3.2 Control of Exposure to Biological Hazards

The risk of injury from biological hazards would be reduced by wearing PPE such as leather gloves and boots, and by ensuring that all site personnel have had current tetanus inoculations

19.3.3 Control of Health Hazards Caused by Contact With Waste

Health hazards caused by accidental contact with waste would be minimised by:

- restricting public access to the tipping face;
- continuously compacting waste and applying cover material at regular intervals;
- appropriate engineering design of the landfill, followed by appropriate maintenance;
- controlling waste entry;
- erecting fences and employing security personnel to prevent entry of unauthorised persons;
- controlling indiscriminate tipping; and
- preventing scavenging.

19.3.4 Control of Fire Hazards

Work practices which would be employed to reduce the risk of injury resulting from fire hazards include:

- regular maintenance of on-site equipment to a level in compliance with relevant WorkCover requirements. Unsafe equipment would be identified by the equipment operator and either made safe or removed from the site;
- compaction of waste material to minimise air voids;
- regular application of cover material which minimises the potential for oxygenation of waste material;
- storing flammable and combustible liquids in accordance with the storage and handling requirements of Australian Standard 1940 and WorkCover;
- constructing 10 m fire breaks between stockpiles of tires, wood and green waste;
- ensuring heavy machinery operators have access to a fire extinguisher at all times and that hose reels or fire water is easily accessible; and
- not lighting fires or smoking on-site.

19.3.5 Control of Risks Caused by Excessive Noise

The risk of injury caused by excessive noise from heavy machinery would be reduced by wearing ear muffs or plugs and by standing as far away from the noise source as possible.

19.3.6 Control of Risks Caused by Heat

Sensible scheduling of work and rest periods, and frequent replacement of fluids can protect against the hazard of heat stress.

19.4 CONCLUSION

Risks associated with the proposed development in relation to air, water and soil quality, and transportation issues, have been addressed in detail in the relevant sections of this EIS. Measures required to minimise these risks are included within site operating procedures and contingency plans.

Previous sections of this EIS described the environmental risks, potential impacts of the proposed development and the ameliorative measures required to alleviate these risks. These measures would be built into site operating procedures and contingency plans for the extraction, landfilling and rehabilitation phases of the project.

The implementation of a HASP would ensure that on-site personnel would be protected from unacceptable risks from exposure to hazards. The HASP would contain policies and procedures to protect workers and the public from potential hazards, and would be put in place prior to the commencement of works.

20.1 INTRODUCTION

Vermin such as birds, rodents and other pests are often attracted to landfills in search of food sources. Landfills which receive putrescible solid waste or food waste are particularly attractive to vermin.

Birds are undesirable as they transfer pathogens to nearby reservoirs and crops, and deposit excreta and food scraps over surrounding areas. Pests such as rodents and insects transfer germs and disease as well as being a nuisance to users and neighbours.

As the waste received at the proposed landfill would be inert and non-putrescible solid waste, it is not anticipated that vermin would be a major problem at the site. However, in order to ensure insects and vermin are kept at acceptable levels, control measures detailed below would be implemented.

20.2 TYPES OF VERMIN

The types of vermin typically found at landfills include insects such as flies and mosquitos, rodents such as rats, birds including gulls and crows, foxes and feral cats.

20.3 CONTROL MEASURES

The strict application of daily landfill management procedures would be used to prevent any build-up of vermin populations at the site. Management procedures include:

- covering waste regularly and promptly at the tipping face;
- keeping the area of the active face to a minimum;
- undertaking proper compaction of the waste and covering layers to maximise the density of the fill;
- ensuring that water does not pond on the surface of the site and thereby propagate mosquito breeding;
- maintaining litter control through the minimisation of the active cell area, use of the systematic cellular tipping program and rapid cover placement over the refuse;
- maintaining a temporary litter fence around the perimeter of the active cell; and
- establishing a weekly litter patrol to collect any windblown litter from along fence lines.

The effectiveness of the above management procedures would be monitored by site personnel on a regular basis. In the event that a vermin problem develops, the following remedial measures would be considered:

- increased application of daily cover to provide an improved barrier to vermin;
- more frequent application of cover;
- the use of insecticides and pesticides;
- the use of scarecrows and bird scares; and
- baiting.

Minor pest problems would be dealt with by site personnel, whereas a specialist firm of exterminators would be contracted, to eliminate major pest problems should they arise. Care would be exercised in the use of pesticides and the operators would be informed of the nature of the materials they are handling, instructed in their use and would be provided with appropriate PPE and protective clothing.

20.4 CONCLUSION

It is not anticipated that vermin would be a major problem at the site as only inert, non-putrescible solid waste would be received at the landfill, and landfill management procedures would be used to prevent any build-up of vermin populations.

Before construction of the proposed landfill can commence, a number of steps would need to be completed. These steps include:

- completion of the EIS;
- project assessed by all Government departments and authorities prior to formal determination;
- consent issued by Fairfield City Council;
- produce a detailed design for the landfill;
- produce a final LEMP;
- secure all licences and approvals for construction works;
- development of contract documents; and
- calling tenders and entering into contracts for construction of the work.

21.1 CONSTRUCTION PROGRAM

The construction of the initial active areas of the proposed landfill is estimated to take approximately two months to complete and would involve a number of discrete activities. These activities are listed as follows:

- removing water contained in the liner sub-grade;
- preparation of the void;
- base liner preparation;
- construction of a leachate drainage system;
- construction of a stormwater diversion drainage system; and
- construction of operating infrastructure.

21.2 CONSTRUCTION METHODS

The specific pattern of construction activities would generally follow the sequence outlined below, although some activities may be carried out concurrently depending on the work program, and availability of labour and equipment.

21.2.1 Water Removal

Prior to commencement of construction activities, water currently in the base of Void 1 would be drained from the pit and either directed under licence from Sydney Water to sewer or discharged to Eastern Creek. Section 7.1.3 shows that the water is considered to be a quality suitable for discharge to Eastern Creek. It is likely therefore that water would be discharged to the Creek under the existing licence issued by the EPA.

21.2.2 Preparation of the Liner Sub-Grade

Excavation and extraction of clay/shale material from Void 1 would produce an irregular surface which would need to be trimmed and graded to form a uniform slope to the leachate

collection sump, prior to the installation of the liner. The base of the pit would be leveled and any soft spots or cracks in the base would be filled.

The walls of the void would be benched as the clay/shale is extracted, or retrospectively constructed from the perimeter of the existing pit using a hydraulic excavator. The benches would have slight slope with a width of 2 to 3 m and a height of 4 to 5 m.

21.2.3 Installation of Liner

A liner would be placed over the base of the void to provide an effective seal to the base of the landfill (Figure 4.7). An articulated truck would be used to place the liner at the base of the void.

21.2.4 Leachate Drainage and Collection System

A leachate drainage and collection system would be built at the base of the void directly above the liner (Figure 21.1). Construction of the collection system involves laying the leachate collection layer, excavating trenches and installing the leachate collection pipes.

A leachate collection layer comprising granular drainage materials would be placed at the base of the void. A bulldozer would be used to spread and compact the material to a depth of 500 mm. A small excavator in combination with hand excavation would be used to reposition the granular drainage materials to form trenches which grade down to a sump located in the lowest point in the cell. A minimum thickness of 50 mm of drainage material would be left at the bottom of each trench to serve as its base.

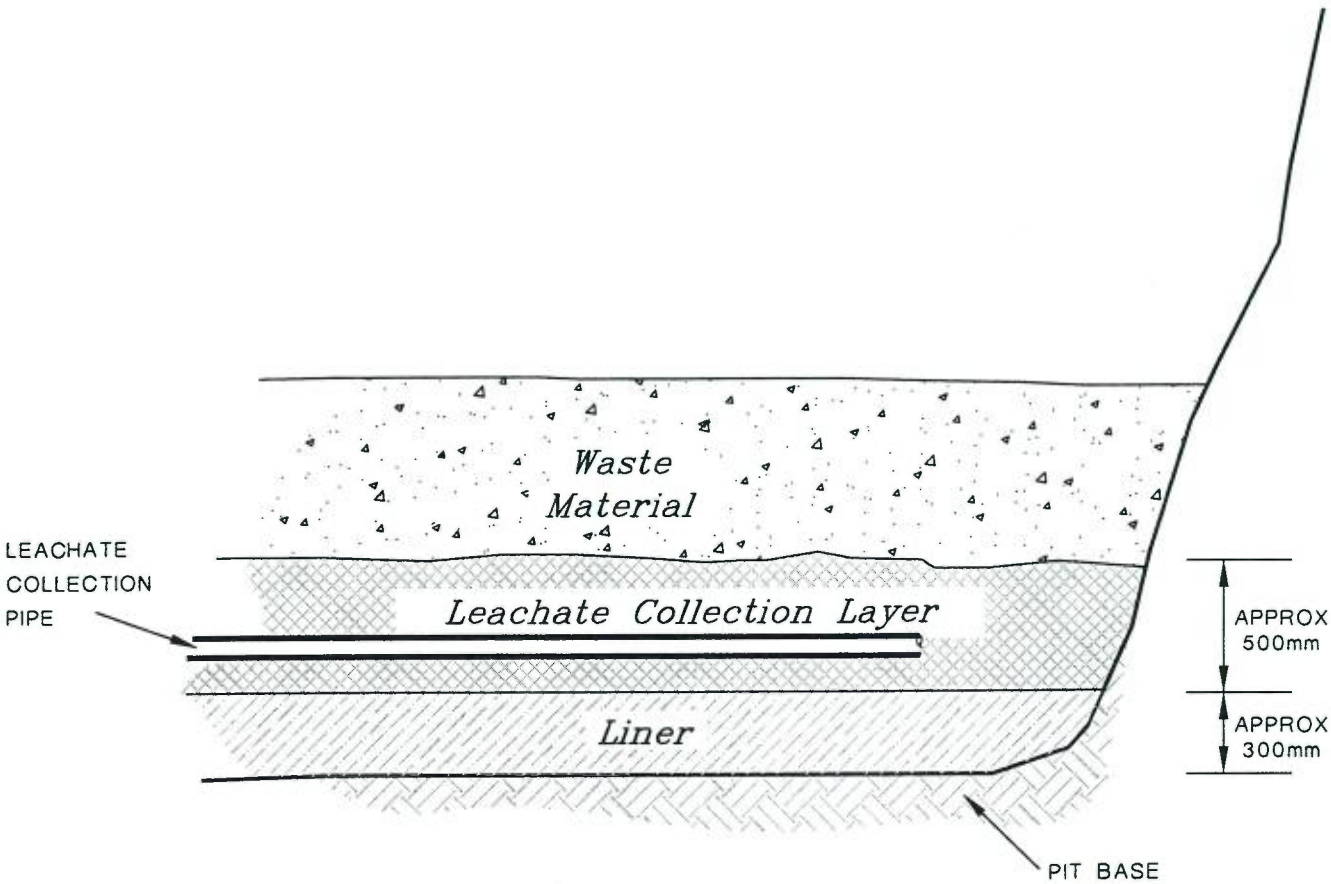
Leachate collection pipes would be cut to fit into the trenches and the lengths would be joined using a solvent. End caps would be placed on the end of each lateral pipe. A coarse drainage stone material would be deposited evenly and gradually in layers around the pipes.

A leachate sump would initially be constructed in the base of the cell but, after every 1.8 m lift of the landfill has been completed, it would be relocated to that level for easier management of filling and leachate control. A permanent rising main would be constructed from the initial sump in the base of the landfill, to enable leachate to be extracted and discharged to the leachate collection pond, located on the rim of the void. The length of the riser would be adjusted each time the leachate sump is relocated and drainage slots would be cut into the riser to allow leachate entry.

A temporary leachate collection pond would be constructed at the base of the void and a permanent pond, with a capacity of 100 m^3, would be constructed on the outer rim of the void (Figure 4.5). The ponds would be constructed of low permeability suitable materials to prevent infiltration of leachate.

21.2.5 Stormwater Diversion Drainage

A network of stormwater diversion drains would be constructed between the internal access road and the rim of the void to prevent stormwater flowing into the excavation and landfilling areas. The diversion drainage would typically comprise open channel V drains which would be designed and constructed to cope with 1 in 10 year, 24 hour duration storms. The drains would be excavated using a small excavator and the surface of the drains would be covered with a gravel road base and shotcrete.



LINER DETAIL SYSTEM

NOT TO SCALE

Woodward-Clyde	CLIENT: AUSTRAL BRICK COMPANY PTY LTD PROJECT: AUSTRAL BRICK SOLID WASTE LANDFILL EIS	REVISION: A SCALE: N.T.S. DRAWING No: A8601191/0540 CAD FILE NO: G.022 DATE: 20/11/97	DESIGNED: CB DRAWN: HC CHECKED: SKT APPROVED: CB STATUS: FINAL	TITLE: SCHEMATIC LINER DETAIL FIGURE 21.1 A4

A permanent stormwater sediment pond, designed to a 1 in 10 year storm, would be located in the north western corner of the site and would collect runoff derived from the western portion of the site. A temporary stormwater collection pond would be constructed at the base of the void to collect stormwater from the excavation areas which would then be pumped to a surface stormwater sediment pond. The dams would be excavated using an excavator and bulldozer and would not need to be lined.

21.2.6 Operating Infrastructure

Infrastructure required to service the proposed operation includes:

- entrance gate and security system including a secure fence around the site;
- weighbridge and gatehouse;
- truck washdown facility;
- staff facilities, administrative offices and car parking area;
- Waste Transfer Station;
- waste recycling depot;
- truck parking area; and
- internal access and haul roads.

21.2.7 Construction of the Final Cap

At the completion of landfilling activities, a sealing layer would be placed over the surface of the waste material, to minimise rainfall infiltration. The sealing layer would comprise of a suitable compacted material with a coefficient of permeability of at least 1×10^{-8} m/s and would have a thickness of 900 mm. The material would be tipped directly onto the waste material and a bulldozer would be used to spread and compact the material.

A gas drainage layer with a coefficient of permeability of at least 1×10^{-5} m/s and a depth of 300 mm would be placed over the sealing layer. The drainage layer would be covered by a revegetation layer comprising topsoil, mulch and compost and would have a thickness of 1000 mm which is necessary to minimise erosion and provide a ready surface for planting.

The final surface of the cap would be constructed with a slope of approximately 5% to promote surface runoff away from the landfill masses. A cross section of the final cap is provided in Figure 4.7.

21.3 WASTE DISPOSAL

Waste materials expected to be generated during construction of the proposed landfill include scrap metal and other wastes which have been disposed into the void over the years, cleared vegetation, construction wastes such as offcuts of the leachate collection pipes and domestic and human wastes. The preferred methods for the disposal of these wastes are outlined as follows:

- any cleared vegetation would be chipped, composted and used on-site or sold to commercial landscapers;

- construction wastes and scrap metal recovered from the void would be stored in skips and landfilled when the landfill becomes operational;
- domestic waste would be disposed to a landfill licenced to receive putrescible waste; and
- human wastes would be disposed of in accordance with Fairfield City Council regulations and EPA requirements.

21.4 HOURS OF CONSTRUCTION

To minimise impacts of the construction works on property owners close to the subject site, construction hours would be limited to between 6.00 am and 6.00 pm from Monday to Friday and 6.00 am to 4.00 pm on Saturdays. Excavation and extraction work would not take place on Sundays or public holidays.

The landfill would operate every day except Good Friday and Christmas Day. The hours of operation are previously detailed in Section 4.4.9.

21.5 CONSTRUCTION WORKFORCE

A workforce of approximately six people would be required to construct the landfill and associated infrastructure such as the weighbridge, transfer station and the site office.

21.6 CONSTRUCTION VEHICLES

During the construction period, the vehicles likely to be used are shown in Table 21.1.

Table 21.1
TYPICAL CONSTRUCTION VEHICLES REQUIRED

Equipment	Purpose	Number of Items
Caterpillar D9N bulldozer	Placement and shaping of capping layers and granular drainage material. Excavation of the stormwater and leachate collection ponds.	1
Caterpillar 815B soil compactor	Compaction works.	1
Caterpillar 330 hydraulic excavator	Excavation of the stormwater drains, leachate drainage trenches, and stormwater and leachate collection ponds. Construction of benches.	1
Caterpillar D20D articulated truck	Transport of suitable liner materials and granular drainage material for placing at the base of the void.	1
12 tonne water truck	Application of water to bare surfaces to suppress dust.	1
Fuel Truck	Supplying construction machinery with fuel.	1

21.7 INSPECTION AND MAINTENANCE

Once constructed and operational, maintenance patrols would make regular inspections of the site. A checklist of inspection and maintenance activities to be undertaken during the operational phase of the project are provided in Table 21.2. Measures to be taken when these issues are identified are shown in Table 21.3.

Table 21.2
LANDFILL INSPECTION AND MAINTENANCE SCHEDULE

Item	Inspection and Maintenance Criteria
Weighbridge.	Operational effectiveness.
	Accuracy.
Security camera system.	Operational effectiveness.
Truck Washdown Facility.	Operational effectiveness.
	Clogging of sump.
	Operation of Pumps.
Leachate drainage and collection system.	Operational effectiveness.
	Quality of effluent.
	Operation of alarm system.
Temporary gas extraction wells.	Condition of extraction wells.
	Gas quality.
	Odours.
	Gas quantity.
Buffer vegetation.	Condition and health of vegetation.
Grass cover.	Presence of dead or bare areas. Presence of weeds or other exotics.
	Presence of large, deep rooted vegetation.
Internal access and haul roads.	Presence of potholes or loose gravel.
Landfill cover (structural).	Presence of erosion, cracks or holes.
	Ponding of water.
Leachate collection sumps and riser.	High leachate levels.
	Riser condition.
Stormwater diversion drains.	Erosion, side tracks and holes.
	Ponding of water.
Stormwater and leachate collection ponds.	Ability to contain volumes of leachate and stormwater runoff.
Fences.	Holes, missing or damaged posts.
	Broken gates or locks.
Lighting.	Operational effectiveness.
Monitoring wells.	Broken or problem locks.
	Testing problems.

Source: CMPS&F, 1997

Table 21.3
LANDFILL MAINTENANCE REPAIRS

Maintenance/Repairs	Measures to be Taken
Weighbridge inoperative.	Repair immediately.
Security camera system breakdown.	Repair immediately.
Vehicle washdown sump clogged.	Clear out and dispose of waste in the landfill.
Washdown pumps inoperative.	Arrange alternative pump, repair or replace old pump.
Temporary gas extraction wells inoperative.	Repair by qualified technician.
Buffer vegetation loss.	Identify cause, rectify and replant.
Loss of cover vegetation.	Reseed.
Weeds or exotics in grass cover.	Remove.
Holes, cracks or opening to the cover in the cap.	Reconstruct, replacing all material, soil and vegetation. Annotate as-built drawings as necessary.
Ponding of water on the landfill cap.	Drain or pump off. Fill depression and reseed.
Damage to leachate riser or collection system.	Repair or replace.
Fluid in leachate sump.	Remove and treat as necessary.
Inability of stormwater and leachate collection ponds to cope with demands.	Increase the capacity.
Leachate spill.	Clean up and remove all contaminated waste to the landfill.
Erosion of internal access roads or stormwater diversion drains.	Repair and reinforce original structures or re-route if required.
Fences damaged.	Repair or replace.
Lighting defective.	Repair or replace.
Gates or locks inoperable.	Repair or replace.
Signs and warnings unreadable or missing.	Repair or replace.
Monitoring wells inaccessible.	Repair or replace caps and/or locks.
Monitoring wells bent or broken.	Repair using specialist contractor.
Monitoring equipment damaged	Repair or replace.
Alarms inoperative	Repair or replace.

Source: CMPS&F, 1997

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. The cumulative impact of a project is a combination of each elemental impact of the project. The impact of individual projects, such as this one, when considered in light of other projects within a locality also needs to be assessed.

This chapter discusses both forms of cumulative impact by summarising impacts as identified in Part D of this EIS in total. The total impact of the project is then considered in conjunction with other known projects in the area.

22.1 TOTAL CUMULATIVE IMPACT OF PROJECT

The cumulative impact of all factors of the excavation, extraction and landfilling project is shown in Table 22.1.

Table 22.1

CUMULATIVE IMPACT OF PROJECT

FACTOR	IMPACT
Landform, geology, soils and geotechnical	Erosion potential ameliorated by controls such as diversion drains, sediment ponds and silt fences. Minimal vegetation clearance required.
Water Quality	Surface water and leachate management and erosion controls resulting in minimal impact on Eastern Creek.
Air Quality	Possible slight increase in dust generated during construction activities. Effects on air quality, if any, would be minor, localised and of short duration.
Noise and Vibration	Acceptable noise levels maintained with EPA guidelines at adjacent residences from both construction and operation.
Socio-economic	Project would create employment opportunities and secure the future of the brickmaking plant at Horsley Park. Impacts on the health of the community with regard to air and water quality, and noise etc are likely to be minimal. Development of the rehabilitated site for uses compatible with the Draft Regional Environmental Plan for the Western Sydney Open Space Corridor (currently being prepared by DUAP) would benefit the local community and improve the amenity of the area.
Archaeology and Heritage	No known Aboriginal archaeological site is located within the project site. Provided safeguard measures are implemented, no impact is anticipated.
Landscape and Visual	Construction and operation of the landfill is not expected to significantly contribute to any loss of overall visual amenity. The works are not visible from identified vantage points.

FACTOR	IMPACT
Flora and Fauna	Remnant woodland along Eastern Creek was identified as potential habitat for several Threatened species of birds and mammals. However, no significant impact on observed or possibly occurring flora or fauna species is expected.
Traffic and Transportation	Additional traffic, would cause minimal impact on the F4 Freeway and Elizabeth Drive. Safeguard measures would be implemented to ensure that the proposal has minimal impact on Wallgrove Road. These safeguards provide safe turning movements into the site and improved sight distances. No impact is expected from operational traffic.
Land use	Proposal would allow the continued extraction of clay materials and shale from operational voids and the manufacture of bricks and pavers. There would be no impact on operations on the remainder of the site and on surrounding landuses.

Table 22.1 indicates that the cumulative impact of the project would be minimal at most. Most of the impact from the proposal would be contained within the site boundary.

22.2 CUMULATIVE IMPACT WITH OTHER PROJECTS

Discussions with Fairfield and Blacktown councils and a review of LEP 1994 and State and Regional Policies indicated that there are two major projects, other than the proposed works, proposed for the region. These projects are:

- the quarrying, landfilling and site rehabilitation project proposed at the PGH Brickworks site, Horsley Park to the southwest of the project site; and
- proposed rezoning of 52 hectares of land on Wallgrove Road for large scale light, industrial purposes.

Construction of elements of the PGH Brickworks landfill would coincide with construction of the proposal. However, the cumulative impacts of these activities would most likely be confined, to the landfilling phases of each project. The cumulative impact of the proposals could most likely include the following:

- additional construction traffic on the local roads;
- additional demand on local water and power services; and
- increased vehicular traffic associated with landfilling activities.

A rezoning application for the 52 hectare site on Wallgrove Road is currently before Fairfield City Council. A draft Local Environmental Study (LES) is expected to be completed in December. At this stage it is unclear whether the LES establishes a demand nexus for large scale industrial development in this location, of sufficient merit to warrant a rezoning. As the proposal has not as yet been determined, it is considered premature to consider the cumulative impacts of the proposed light industrial park with the proposed Austral landfill.

22.3 CONCLUSION

The majority of impacts associated with the proposed works would occur during the excavation and landfilling phases.

As these works would take place over an extended period of time and the impact of individual factors is considered to be minimal, no significant cumulative impact is anticipated from the project. The cumulative impact of the proposed works with other known projects proposed for the area, is also considered to be minimal.

23.1 ENVIRONMENTAL MANAGEMENT AND MONITORING PRINCIPLES

A number of environmental management and monitoring tools have been identified in the preparation of this EIS. If the project proceeds, implementation of these measures would be necessary to ensure that the project has minimal impact on the physical, social and economic environments of the local area and wider region.

The proposed excavation, extraction and landfilling activities would be a significant undertaking. Without appropriate environmental management measures being incorporated into the detailed design of the project and the contractual arrangements associated with the proposed works, potential would exist for adverse impacts on the environment to occur. Adoption of an appropriate Environmental Management Plan (EMP) and monitoring program would therefore be an important component of the proposal and underlines the commitment of Austral to the safeguard measures outlined in this EIS.

23.2 ENVIRONMENTAL MANAGEMENT PLAN

An EMP is a procedural document which outlines the environmental goals of the project, the safeguard measures to be implemented, the timing of the implementation in relation to the progress of the project, responsibilities for implementation and management, and a review process.

In general the EMP addresses the excavation, extraction and landfilling phases of the project and is prepared following assessment of the project. It would provide a working tool to be used during the detailed design of the landfill and would detail environmental management procedures to be adopted during the excavation and extraction of clay and shale material and the operation of the landfill.

The EMP would include:

- establishment of environmental goals and objectives;
- conditions of project approval;
- list of actions, timing and responsibilities;
- supervision protocols fully identifying areas of responsibility for environmental management of the project;
- statutory requirements (licences and approvals required);
- a structured reporting system detailing all relevant matters on a regular basis;
- procedures and forms for documentation and reporting of issues;
- standard specifications incorporating environmental safeguards;
- training of personnel in environmental awareness and Best Practice Environmental Management Systems;
- guidelines for emergencies, contact names and corrective actions for non-conformance and notifications to appropriate authorities and affected parties;
- calibration and measuring of testing equipment;
- process surveillance and auditing procedures;

- review procedures and protocols for modification of the EMP;
- complaint handling procedure;
- site management and control procedures;
- monitoring procedures; and
- quality assurance procedures.

The EMP would be made available to the EPA, Fairfield City Council, government departments, statutory authorities, the community and all other interested organisations and individuals.

Key components of the EMP are the:

- General Site Management Plan;
- Water and Sediment Management Plan;
- Dust Management Plan;
- Noise Management Plan; and
- Landfill Environmental Management Plan.

The safeguards and environmental controls for each of these key components have been detailed previously in the text, however, the monitoring and management requirements associated with these environmental controls would be detailed in the following sections.

As a guide to establishing an EMP, the general structure would be similar to that shown below:

ITEM	*DESCRIPTION*
Introduction and purpose	*Details the objectives of the Plan.*
Statutory requirements and integration with other plans	*Details the statutory requirements, if any, and other obligations required to be met as part of the licensing approval.*
Environmental management procedures	*Describes the operational procedures for preventing environmental impacts, nominates responsibility to individuals, establishes reporting protocols and procedures, nominates corrective and preventative action procedures.*

ITEM	*DESCRIPTION*
Monitoring requirements	*Details the monitoring program for checking environmental performance of the project, nominates responsibilities to individuals, establishes reporting protocols and procedures, nominates corrective and preventative action procedures.*
Emergency response	*Contains emergency response plans.*

Monitoring requires an on-going commitment and continual maintenance of records, both prior to project commencement (baseline) and during site works. Should routine monitoring and/or external parties identify a potential issue relating to the site works, the EMP would have provision for the potential issues to be logged, validated and where required rectified. If necessary the scope of monitoring would be increased in order to address the potential issues as they arise. Figure 23.1 provides an outline of an issues response procedure which could be adopted.

23.3 GENERAL SITE MANAGEMENT PLAN

The objectives of the General Site Management Plan are as follows:

- where possible, control the visual impact of the site works;
- prevent unauthorised entry and minimise risk of injury;
- institute a site health and safety plan to protect on-site personnel and site visitors; and
- control traffic impacts of the project.

23.3.1 Site Screening

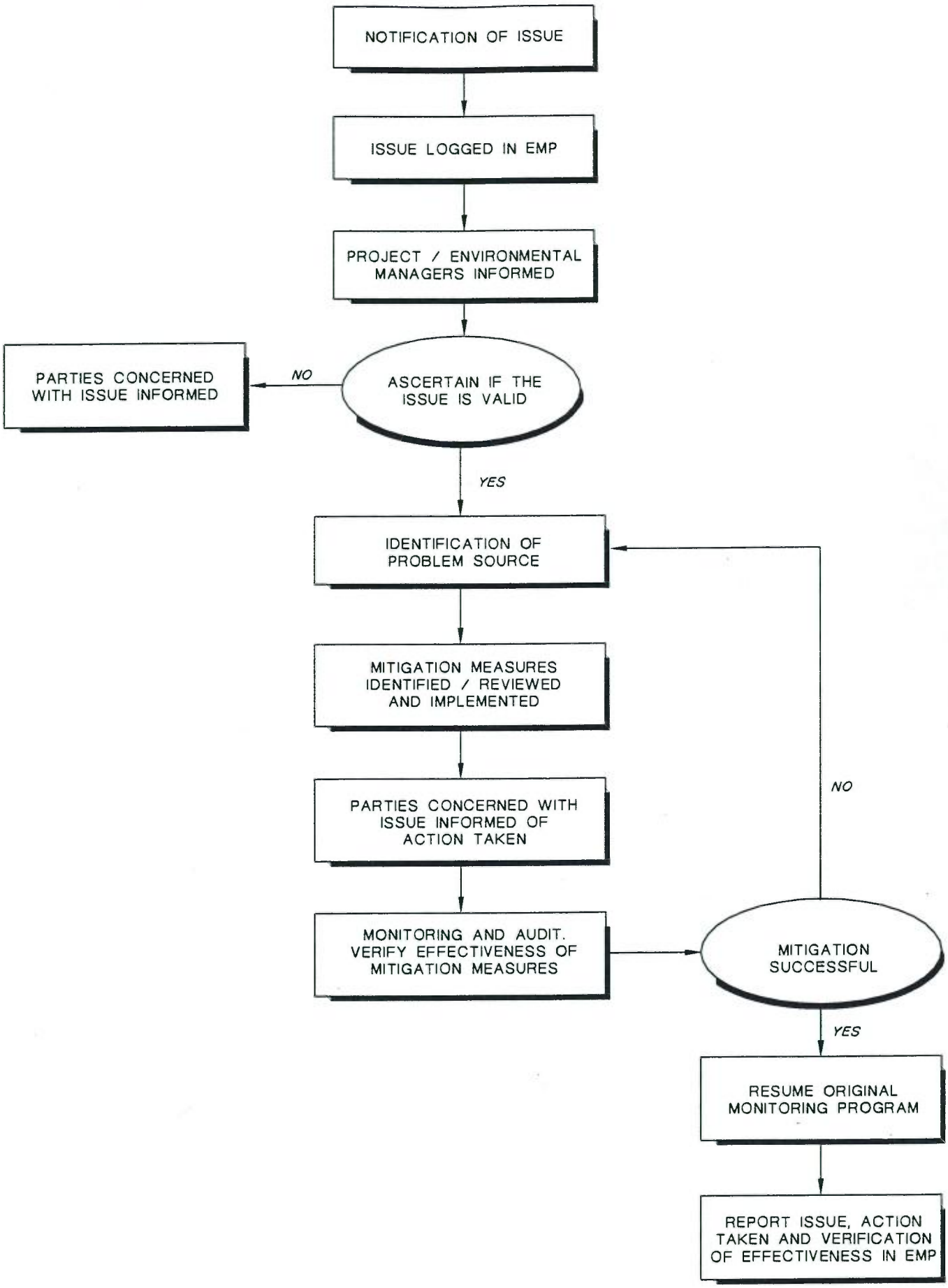
The proposed landfill area is not visible from locations surrounding the site due to the elevated nature of the topography surrounding the landfill area. Vegetation along the eastern and western boundaries of the site effectively shield the proposed landfill area from short distance views into the site from Ferrers Road and Wallgrove Road.

23.3.2 Site Security and Safety

Site security is an important component of an EMP. Implementation of appropriate security measures prevents the entry and injury of unauthorised personnel, and prevents theft or vandalism of any equipment or environmental control/monitoring structures.

The following security and safety measures would be adopted:

- fences would be erected around the site and would be inspected by the operations supervisor on a regular basis and repairs would be made promptly where required;
- signs would be erected at all potential access points, warning the public of the dangers of entering the site;



Woodward-Clyde	CLIENT: AUSTRAL BRICK COMPANY PTY LTD PROJECT: AUSTRAL BRICK SOLID WASTE LANDFILL EIS	REVISION: A SCALE: N/A DRAWING No: A8601191/0540 CAD FILE NO: G.047 DATE: 20/11/97 DESIGNED: ST DRAWN: HC CHECKED: SLT APPROVED: CB STATUS: FINAL	TITLE: ISSUES RESPONSE PROCEDURE FIGURE: 23.1	A4

- signs would be erected at locations within the site to warn on-site personnel of potential safety hazards, such as those associated with the movement of heavy equipment;
- the trucks used for transporting waste materials to the site would be required to ensure that soil adhering to the wheels or undercarriage is removed prior to leaving the site;
- all machinery and heavy equipment would be maintained in good working order and would comply with relevant WorkCover requirements; and
- machinery and heavy equipment would only be operated by skilled and experienced personnel.

23.3.3 Site Health and Safety Plan

The HASP, would provide a general description of the physical hazards associated with the excavation, extraction and landfilling activities, describe the procedures to be followed and the protective equipment to be used by personnel working on-site. All activities carried out would also comply with Austral's requirements for contractors and site health/safety clearance procedures.

Site Health And Safety Inductions

All personnel (including contractors) involved in excavation, extraction and landfilling activities would attend a health and safety briefing to be presented by Austral prior to work on the site. During the briefing session, an overview of the project would be presented including:

- scheduled excavation , extraction and landfilling activities and personnel responsibilities;
- site control procedures;
- hazard identifications and precautions;
- protective equipment usage;
- prohibitions; and
- emergency response.

The health and safety briefing would be repeated to any new personnel as they arrive at the site by the operations supervisor. In addition, on-site safety meetings would periodically review safety requirements and discuss modifications to the HASP. Site personnel and visitors would be required to sign in and out of the site office daily.

Compliance Agreements

All on-site personnel and contractors working at the site would be required to read a copy of the HASP, be assessed for understanding and sign a compliance agreement prior to commencing work.

23.3.4 Traffic Management

The traffic impacts of the project are considered to be minimal, however a Traffic Management Plan would be implemented to alleviate any impacts of additional traffic volumes, and would address operational protocols and safety factors.

The operational protocols which would be incorporated are:

- retention of heavy equipment on-site where possible;
- construction of a vehicle turning lane at the entrance of the site;
- implementation of signage to ensure smooth merging of site traffic and existing traffic;
- sealing the landfill access road; and
- promptly repairing the landfill access road when necessary.

23.4 WATER AND SEDIMENT MANAGEMENT PLAN

The Water and Sediment Management Plan would be used to minimise the effects of erosion and sedimentation, and to prevent a decline in surface water and groundwater quality during the excavation, extraction and landfilling activities. The Plan would be used to mitigate these effects by:

- minimising and controlling sediment released as a result of excavation, extraction and landfilling;
- controlling drainage and flooding;
- revegetating disturbed areas; and
- using water quality control devices such as sediment ponds to treat surface water before reuse or discharge from the site.

The specific controls and safeguards to be used have been detailed previously in Sections 6.8 and 7.4. The monitoring of the erosion and water quality control structures would include:

- A pollution control approval and licence would be obtained for erosion and water quality control works proposed for the site prior to commencing works on the site. The requirements of the approval and licence would be incorporated into the site EMP and responsibility for meeting statutory requirements delegated to appropriate project personnel.
- A series of detailed plans indicating the staging of the excavation, extraction and landfilling activities would be formulated and the necessary safeguards identified for each stage. At the commencement of each stage an audit of control measures would be undertaken and the implementation of control measures verified.
- Weekly inspection of erosion and water control structures, including sediment ponds, sediment fences and diversion drains would be undertaken. The control structures would also be inspected within 24 hours of significant rainfall events which cause runoff and erosion.
- If control measures do not meet the objectives of the plan, corrective action would be instituted. Follow up inspection would be undertaken to verify the outcome of the corrective action.
- Surface water quality monitoring would include quarterly measurements of non-filterable residue (FR), oil and grease , pH and other parameters as agreed with the EPA, from the sediment pond on the rim of the Void and Eastern Creek. Monitoring would also be undertaken after significant rainfall events.

- An evaluation of the sediment ponds would be made during the annual site audit.
- Groundwater quality would be monitored quarterly. Samples would be collected from the groundwater monitoring wells and analysed for a range of parameters as agreed with the EPA. Static ground water level in each of the monitoring wells would also be recorded.
- An annual report of inspections, monitoring and corrective action would be maintained and provided to relevant authorities for licencing purposes.

23.5 DUST MANAGEMENT PLAN

The overall objective of the Dust Management Plan would be to control the amount of dust generated from the proposed works and to ensure minimal impact on the air quality of the surrounding area. Controls and safeguards which would be implemented to achieve this objective are detailed in Section 8.6.

These procedures would ensure that the works are performed in such a way as to minimise the production of fugitive emissions emanating from the site. The work would be undertaken in a manner which conforms with all WorkCover regulations for the handling of dust to ensure emissions are minimised and within regulations. All due care would be taken to ensure that dust is not evident outside the site boundaries.

The requirements of the air licence for the site would be incorporated into the site EMP and responsibility for meeting statutory requirements delegated to appropriate project personnel.

Dust monitoring would be undertaken prior to, during and following the proposed excavation, extraction and landfilling activities. The likely location(s) of monitors would be based on the wind speed and wind direction information available for the local area. Exact location(s) would be subject to physical and logistic operational requirements.

Methods employed for monitoring include:

- one automatic wind recorder would be installed on-site to provide real time information on prevailing wind conditions. The recorder would be fitted with an alarm to indicate when winds exceed a speed for a certain period, so that dust generating activities on-site could cease until wind speeds decrease; and
- dust deposition monitors , used to measure the routine deposition of air borne particles over extended periods (typically monthly). This work would be performed in accordance with Australian Standard AS3580.10.1-1991, which provides a measure of mass deposition rate assessment of deposited insoluble solids.

The above methods of monitoring would be supplemented by the use of observational techniques and comprehensive daily logs of site activities which are standard practice for large landfill projects.

23.6 NOISE MANAGEMENT PLAN

The main objective of the Noise Management Plan is to ensure that the proposed works would be carried out in a manner which would have least impact on the noise environment of the surrounding area and conform to EPA guidelines. This would be achieved by ensuring:

- that best practice techniques are used to minimise unnecessary noise; and
- the regulatory limits for noise emissions are strictly adhered to.

The controls and safeguards outlined in Section 9 would be incorporated into the Noise Management Plan to ensure that noise impacts are within EPA guidelines.

Regulatory limits for noise would be met by applying the following management and monitoring procedures:

- all heavy equipment and machinery would be selected on the basis of its noise performance;
- all equipment and machinery would comply with regulatory standards for noise generation, including the EPA's Environmental Noise Control Manual;
- noise monitoring would be undertaken upon receipt of a complaint;
- all equipment would be operated in a correct manner which includes proper maintenance;
- testing of equipment for compliance with manufacturers specifications would be undertaken;
- screening banks would be constructed along the east, west and southern boundaries of the site ahead of landfilling;
- the nominated hours of operation would be observed; and
- all practical measures would be used to silence heavy equipment. All noise control equipment would be maintained in good order and used properly at all times.

23.7 LANDFILL ENVIRONMENTAL MANAGEMENT PLAN

As mentioned previously in this EIS, the Waste Minimisation and Management Act, 1995 and Regulation 1996, specifies that the proposed landfill requires licensing. All licensed landfills are required to produce an LEMP. A Draft LEMP has been prepared and is included in Appendix B.

The purpose of the Draft LEMP is to identify key environmental management issues and detail the site specific strategic approach that Austral would put in place to meet the Environmental Goals for the landfill's operation as identified in the Environmental Guidelines: Solid Waste Landfills (Landfill Guidelines), EPA, 1996. The Draft LEMP documents procedures aimed at:

- the control of discharges to waters (surface and groundwater);
- the control of atmospheric emissions;
- the provision of the greatest options for land use following rehabilitation;
- the promotion of responsible land management and conservation; and

- the prevention of hazards and loss of amenity.

23.7.1 Control of Discharges to Waters

The Draft LEMP details monitoring programs and management strategies for controlling leachate and preventing pollution of surface water and groundwater. The monitoring and management strategies are as follows:

- construction of a liner and leachate collection system to prevent leachate percolating into groundwater;
- regularly sampling and testing leachate to determine whether leachate has potential to cause environmental degradation of surface water or groundwater;
- construction of sediment ponds, diversion drains and other such control structures to prevent erosion and contamination of surface water;
- inspecting water control structures to ensure they are operating correctly;
- regularly sampling and testing surface waters to determine whether site operations are having an effect on water quality; and
- regularly sampling and testing groundwater from groundwater monitoring wells to determine whether site operations are having an effect on water quality.

23.7.2 Control of Atmospheric Emissions

The Draft LEMP details monitoring and management measures which would be used to control the emission of landfill gas. These measures are as follows:

- installation of a liner at the base of the Void and a final landfill cap to minimise the movement of gas;
- passively vent landfill gas through the landfill cap;
- construct a series of temporary gas extraction wells if gas or odour becomes a problem;
- flare gases extracted from the landfill;
- implement a surface gas monitoring program to determine whether the landfill cap and/or the gas extraction system are effective in limiting the emission of landfill gas; and
- undertake gas accumulation monitoring in buildings.

Measures such as covering waste to prevent oxygenation of the fill, compacting waste to minimise air voids and recycling leachate would be taken to reduce potential fire hazards at the landfill.

23.7.3 Land Management and Conservation

Management of the landfill and conservation of landfill space would involve:

- screening wastes to ensure that unacceptable wastes are not inadvertently accepted at the landfill;
- monitor the consumption of air space in order to accurately estimate the projected life expectancy of the landfill;

- recording the quantities, types and sources of wastes received so as to provide waste planners with accurate information regarding waste disposal rates and capacities;
- preparing reports which summarise the types and quantities of wastes received at the landfill;
- compacting wastes to ensure that landfill space is conserved;
- separating recyclable materials from incoming loads of waste in order to conserve landfill space;
- developing and implementing a strategy for landfill completion to ensure that it is filled to design specifications;
- continually review the filling plan and site contours; and
- generating a final rehabilitated landform which is consistent with the closure plan and the surrounding development, and which can be reused for an appropriate land use.

23.7.4 Prevent Hazards and Loss of Amenity

The measures for preventing hazards and loss of amenity which are detailed in the Draft LEMP include:

- maintaining site security to prevent waste dumping, fires and vandalism of pollution control devices. Site security measures include inspecting the site, locking gates when the landfill is closed and installing an alarm system;
- preparing reports summarising the findings of security inspections;
- controlling wind blown litter in the vicinity of the landfill;
- cleaning vehicles before they leave the site;
- covering wastes to reduce fly propagation, odours and litter generation;
- minimising the emission of dusts; and
- ensure there is adequate fire fighting capacity at any part of the landfill and that emergency response procedures are in place.

23.8 POST CLOSURE MONITORING AND MAINTENANCE

Austral would continue monitoring, and performing post closure maintenance of completed areas, until such time that there is scientific evidence that the landfill wastes have stabilised and do not have the potential to pollute. Once it is evident that landfill wastes have stabilised, a Certificate of Completion would be prepared summarising:

- hydrological monitoring data;
- leachate monitoring data;
- landfill gas monitoring data;
- surface monitoring data;
- water and sediment control evaluation report;

- physical inspection reports;
- revegetation analysis report;
- defined future use analysis; and
- environmental regulation compliance statement.

A number of environmental safeguards/mitigation measures to reduce any potential environmental impacts which may be generated by the proposed works have been detailed in the various subject sections.

These measures would be implemented throughout the duration of the project. Table 24.1 summarises these safeguard measures, sets out priorities for implementation, and lists the authorities responsible for ensuring that these safeguard procedures are carried out.

Table 24.1
SAFEGUARD MEASURES

ISSUE	SAFEGUARDS	IMPLEMENTATION PHASE	RESPONSIBILITY
Environmental Management			
Environmental management & monitoring.	• Prepare a Draft LEMP.	1	Austral
Geotechnical, Geology and Soils			
Erosion and Sediment Transport	• Minimise clearing of vegetation. Limit initial clearing to areas that need to be actively used for construction and storage. Revegetate bare surfaces.	2, 3	Austral
	• Construct buffer zones between the areas of disturbance and the natural drainage lines.	2, 3	Austral
	• Construct drainage works (diversion drains and sediment traps) to divert surface runoff away from disturbed areas.	1, 2, 3	Austral
1 Reconstruction	2 Construction	3 Landfill Operation	4 Post Operation

ISSUE	SAFEGUARDS	IMPLEMENTATION PHASE	RESPONSIBILITY
	• Use straw bales and sediment fences to prevent the migration of fine sediment.	2, 3	Austral
	• Construct stormwater sediment pond adjacent to the void and temporary sediment collection pond at base of landfill.	2	Austral
	• Construct diversion banks around stockpiles.	2, 3	Austral
	• Regular maintenance of erosion and sedimentation control devices to ensure they operate effectively and efficiently.	2, 3	Austral
	• Provide temporary revegetation to encourage short term stabilisation of disturbed areas.	2,3	Austral
	• Wash chassis and wheels of vehicles to remove soils and coarse materials	2,3	Austral
Geotechnical Issues	• Inspect exposed quarry faces to identify areas of structural weakness which may result in slope failure.	1, 2, 3	Austral/contractor
	• Follow statutory guidelines for the design of landfills and construction methods.	1, 2	Austral/contractor

1 Preconstruction 2 Construction 3 Landfill Operation 4 Post Operation

ISSUE	SAFEGUARDS	IMPLEMENTATION PHASE	RESPONSIBILITY
	• Adequate supervision of landfill construction.	2	Austral/contractor
Water Quality and Hydrology			
Flood Control	• Fill all depressions or possible flow paths to a level which would prevent flood waters entering the void.	1, 2	Austral
Drainage and Water Quality	• Construct drainage works (diversion drains and sediment traps) to divert surface runoff away from the void.	2,3	Austral
	• Construct stormwater sediment pond adjacent to the void.	2	Austral
Air Quality			
Generation of dust and suspended particulates	• Install on-site wind speed gauges to indicate excessive wind speeds.	2,3	Austral/Contractor
	• Prepare a Dust Management Plan detailing control and monitoring programs for minimising the impact of soil movement, dust and odour.	1	Austral
	• Use water trucks to suppress dust on internal roadways	2,3	Austral

1 Preconstruction 2 Construction 3 Landfill Operation 4 Post Operation

ISSUE	SAFEGUARDS	IMPLEMENTATION PHASE	RESPONSIBILITY
	• Water exposed surfaces and stockpiles as required. Use a polymer based binder to spray over product stockpiles and other bare surfaces.	2, 3	Austral
	• Stabilise long term stockpiles where possible.	2,3	Austral/contractor
	• Seal access roads. Water haul roads and other unsealed roads regularly.	3	Austral
	• Control vehicle speed along haul roads.	2,3	Austral/contractor
	• Ensure loads of soil in haul vehicles do not exceed the heights of the side and tailboards.	2,3	Austral/contractor
	• Cover materials prior to transport off-site.	2,3	Austral/contractor
	• Water loads of material being transported by trucks, if atmospheric conditions lead to excessive fugitive dust emission.	2	Austral
	• Install on-site wind speed / wind direction gauges to indicate excessive speeds. Reduce dust generating operations or temporarily cease during very windy conditions.	2	Austral/Contractors
1 Preconstruction	2 Construction	3 Landfill Operation	4 Post Operation

ISSUE	SAFEGUARDS	IMPLEMENTATION PHASE	RESPONSIBILITY
	• No material to be burnt on-site.	2,3	Austral
	• Use water sprays as required across work zones to suppress dust.	2,3	Austral
Noise			
Noise emissions	• Quarry extension and landfilling activities to take place within the hours outlined in the Draft LEMP.	2,3	Austral
	• Noise level monitoring on receipt of serious complaint.	2,3	Austral/contractor
	• Construct screening banks along the east, west and southern property boundaries ahead of landfilling.	2,3	Austral
Traffic and Transportation			
Traffic hazards and congestion.	• Select a transport route which would have the least impact on residential areas.	3	Austral
1 Preconstruction	2 Construction	3 Landfill Operation	4 Post Operation

ISSUE	SAFEGUARDS	IMPLEMENTATION PHASE	RESPONSIBILITY
	• Construct a vehicle turning lane at the entrance of the site to ensure that trucks entering the site do not hinder the flow of traffic and have adequate sight distances.	1, 2	Austral/contractor
	• Retain equipment on-site for the duration of that phase of work for which it is required.	2, 3	Austral
	• Construct the weighbridge 50m from the entrance to the site, to ensure that trucks waiting to drive onto the weighbridge do not block the flow of traffic on Wallgrove Road.	2	Austral/contractor
	• Seal the landfill access road to reduce potential hazards.	2	Austral
	• Erect signs to warn traffic on Wallgrove Road that there is an intersection road.	1, 2, 3	Austral
Flora and Fauna			
Potential for adverse effects on flora and fauna on the site.	• Safeguards relating to dust and litter control and stormwater and leachate management would serve to minimise direct impacts on flora and fauna at the site.	1, 2, 3	Austral
1 Preconstruction	2 Construction	3 Landfill Operation	4 Post Operation

ISSUE	SAFEGUARDS	IMPLEMENTATION PHASE	RESPONSIBILITY
Archaeology and Heritage			
	• If Aboriginal archaeological sites or heritage items are discovered during the works, they would be reported to the zone archaeologist of the NPWS and the Local Aboriginal Land Council.	2,3	Austral
Landscape and Visual			
Impact on visual amenity	• Minimise the removal of vegetation which screens the site.	2	Austral
	• Use vegetated mounds to screen the site.	1, 2, 3	Austral
	• Final landform would be rehabilitated and revegetated to be compatible with the surrounding Cumberland Plain topography.	4	Austral
	• Landscape with endemic local species.	4	Austral
Land Use and Property			
Impact on surrounding land uses	• Implement the safeguards detailed above to control erosion, dust and noise emissions.	1, 2, 3	Austral/contractor
1 Preconstruction	2 Construction	3 Landfill Operation	4 Post Operation

ISSUE	SAFEGUARDS	IMPLEMENTATION PHASE	RESPONSIBILITY
	• Revegetate final landform.	4	Austral
Hazards and Risk			
	• Develop a Health and Safety Plan for the works being undertaken.	1	Austral/contractor
	• Develop and implement measures to control exposure to chemical, biological, flammable, safety, electrical and other hazards.	1, 2, 3	Austral/contractor
Pests and Vermin			
	• Cover waste regularly and promptly at the tipping face and keep area of active face to a minimum.	3	Austral
	• Ensure water does not pond on surface of site.	2,3	Austral
	• Minimise the active cell area and rapidly place cover over the refuse to maintain litter control.	3	Austral
	• Maintain a litter fence around the perimeter of the property.	3	Austral
	• Establish a weekly litter patrol to collect any windblown litter along fence lines.	3	Austral
	• Use insecticides and pesticides should a vermin problem develop.	3	Austral/Contractor

1 Preconstruction 2 Construction 3 Landfill Operation 4 Post Operation

ISSUE	SAFEGUARDS	IMPLEMENTATION PHASE	RESPONSIBILITY
Site Management			
	• Ensure activities on the site incorporate adequate management practices as outlined in the Draft LEMP, for waste emplacement, management of soil erosion and surface water runoff, groundwater and leachate management, noise and air emission control, odour control, pest, vermin and noxious weed hazard control.	1, 2, 3	Austral/contractor
1 Preconstruction	2 Construction	3 Landfill Operation	4 Post Operation

This EIS has been prepared by AGC Woodward-Clyde Pty Ltd on behalf of Austral Bricks to assess the potential environmental impacts of the continuation of excavation and extraction activities in Void 1, extension of excavation and extraction works west to Wallgrove Road, and progressively rehabilitating the site by landfilling with inert waste and solid wastes, with the exception of putrescible waste. Rehabilitation of the site would enable it to be developed for recreation or other uses compatible with the objectives of the Draft Regional Environmental Plan for the Western Sydney Open Space Corridor currently being prepared by DUAP.

25.1 NEED FOR PROPOSAL

The proposed works are required to provide clay and shale resources for use in brickmaking operations and to rehabilitate the site so that it may be developed for recreation or other similar uses. The main features of the proposal include:

- excavation and retention in stockpiles of overburden, for use as landfill cover material and for site rehabilitation;
- extraction of clay and shale for use in brickmaking operations;
- construction of the landfill and associated infrastructure;
- progressively rehabilitating the site by landfilling with inert and all other solid waste with the exception of putrescible waste; and
- creating a landform compatible with the pre-existing Cumberland Plain topography and suitable for recreation or other similar uses.

25.2 IMPACT ASSESSMENT

This EIS has been prepared in accordance with Part 4 of the EP&A Act and the Environmental Planning and Assessment Regulation, 1994. Part 4 deals with environmental planning control and relates to development which is controlled by an existing planning instrument.

An assessment of the environmental impacts of the proposal was carried out which included the effects on soils and geotechnical issues, water quality, hydrology, hydrogeology, air quality, the noise environment, flora and fauna, archaeology, local traffic, and the visual and socio-economic environment.

The assessment of the possible effects of the proposal on the environment indicates that there is potential for minimal adverse impacts. These impacts, although minimal can be ameliorated by the safeguards recommended in this EIS.

25.3 CONSEQUENCES OF NO ACTION

If the proposal did not proceed or was deferred, clay and shale resources contained within the property may not be utilised by Austral and Void 1 would not be rehabilitated to a state suitable for redevelopment. As a consequence, the numerous benefits such as:

- the generation of local employment opportunities;
- the provision of additional landfill capacity;

- rehabilitation of Void 1 which would otherwise remain as an eyesore in the surrounding landscape;
- progressive rehabilitation of the land by staging landfill activities and revegetating the land according to a comprehensive revegetation strategy; and
- development of the land for uses compatible with the objectives of the Prospect Corridor lands

would not be attained.

25.4 JUSTIFICATION OF THE PROPOSAL

The proposal is justified for the following reasons:

- the proposal includes recycling to minimise landfill space used;
- the project intends to recover and recycle, reuse and reprocess, waste that can be viably recycled;
- the works would be carried out in a manner which doesn't have serious or irreversible environmental damage;
- the proposal would enhance the amenity of the local area for future generations;
- Austral Bricks is an established brickmaking operation which relies on the availability of suitable raw materials on site for manufacture of bricks and pavers;
- the clay/shale resource has been identified in *Sydney Regional Environmental Plan No. 9* as a material of regional significance enabling continued extraction of the resource in this area;
- expansion of extraction operations would enable continuation of brick making activities on site over a longer timespan then is currently achievable, providing continued employment opportunities in the local area;
- extraction activities in the past have resulted in a number of voids on site which are not used for any purpose save storage of stormwater and could potentially become significantly more degraded with time;
- in the longer term there is not sufficient landfill capacity to cater for future waste disposal requirements in Sydney. Use of a pre-existing void would be preferable to encumbering land which could be put to some other use;
- effective landfill management with a well designed site rehabilitation and restoration program would provide an opportunity for developing uses compatible with the objectives of the draft Regional Environmental Plan for the Western Sydney Open Space Corridor (currently being prepared by DUAP) and creating a landform reflecting the Cumberland Plain topography; and
- the ecological integrity and biodiversity of the site would be enhanced following a comprehensive landscaping and revegetation program with endemic local species.

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Plates

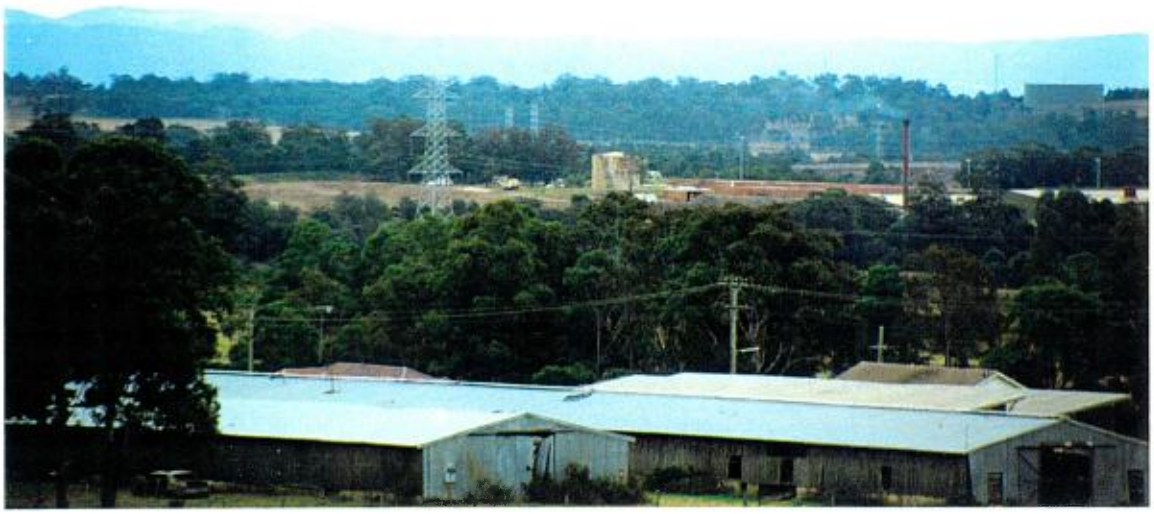

Plate 14.1: View looking west from Ferrers Road. Partially restricted long views of the site, however, the proposed landfill areas are not visible.

Plate 14.2: View looking north-east from residence at corner of Walworth Road and Redmayne Road. The proposed landfill areas are not visible.

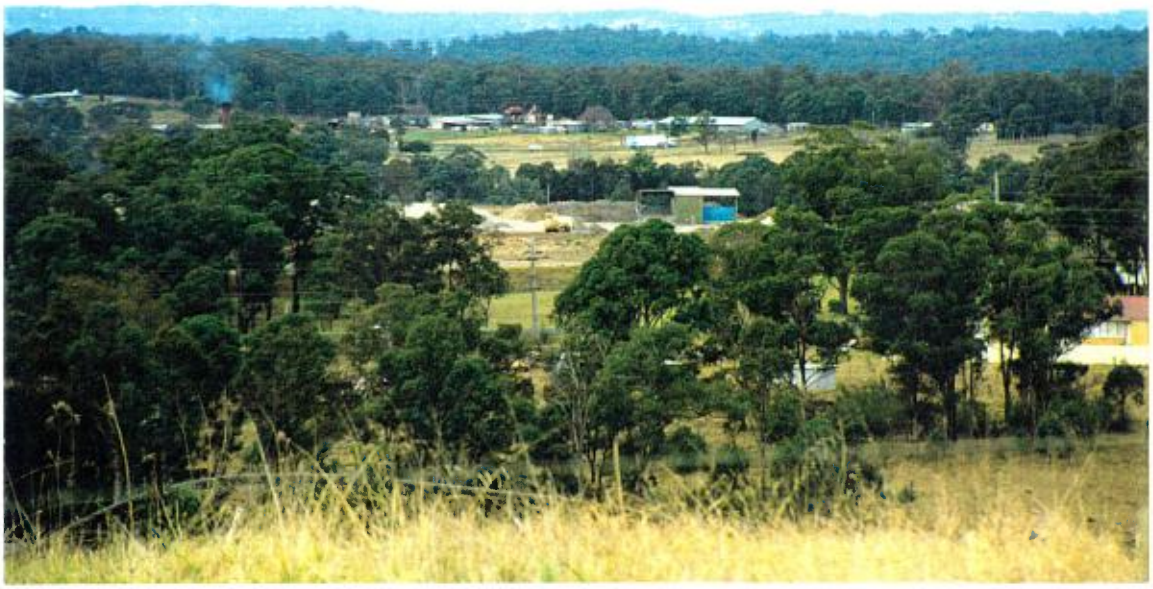

Plate 14.3: View looking north-east from Walworth Road residence. Stockpile areas are visible, however, the proposed landfill area is screened by vegetation.

Plate 14.4: View looking north-east from Wallgrove Road residence adjacent to the site. Bund wall restricts views into the existing void.