Appendix G – Air quality assessment

SITA Australia

Lucas Heights Resource Recovery Park Project

Air Quality Assessment

August 2015

Executive summary

SITA Australia (SITA) is proposing a number of activities at the Lucas Heights Resource Recovery Park (LHRRP) in Lucas Heights. This report has been prepared by GHD Pty Ltd to provide an assessment of air quality associated with the proposal as an input to the environmental impact statement (EIS).

GHD has undertaken odour modelling using odour emission data obtained from a comprehensive odour sampling program at the LHRRP. Sampled odour data was used to model the existing landfill, the most significant contributor of odour at the current site's activities. Future landfill operating scenarios were based on the proposed staging for reprofiling the landfill in 2016 and 2021 with 2021 considered to represent a potential future worst-case odour generating scenario.

The existing and proposed garden organics and ARRT processing areas have been modelled using representative odour emission rates from similar sites operating by SITA and other companies in New South Wales (NSW) and Victoria (VIC) and assumed uncovered composting. This was done to represent a worst case scenario.

A model run for the proposed LHRRP operations in 2016 (scenario 2) takes into account the current program to reduce odour from the identified larger odour sources on the landfill. This includes higher emitting areas on landfill batters and two other areas on the intermediate covered area in close proximity to the large excavated material stockpile. The predicted odour levels drop considerably at nearby sensitive receptors including over a 50% reduction at ANSTO.

Scenario 3 and Scenario 4 show the future landfill in 2021, the new 80,000 t/yr Garden Organics (GO) facility on the western side of the landfill, and the proposed ARRT facility with a biofilter. By using breathable membrane covers on the four week pasteurisation stage on the new GO facility, the predicted odour levels at all existing receivers is at or below the 2 OU impact assessment criteria, and shows significant reductions to the current modelled odour levels. The odour levels for the proposed Heathcote Ridge development are also predicted to achieve the 2 OU assessment criteria.

2021 is considered to be a worst-case scenario with landfill odour emissions expected to remain relatively similar from 2017 to 2037. The year 2021 was selected based on its proximity to the proposed residences and involves areas to be reprofiled which have a higher odour emitting potential. Once the whole site is converted to parkland it would have a significantly lower potential of causing any odour emissions.

Overall, it is noted that the proposal would result in improvements to odour levels at nearby sensitive receptors overtime, with the improvements realised as early as 2016. This is attributed to the identification and rectification of localised emission points identified during the site specific sampling program undertaken as part of the preparation of this EIS. This improvement is expected to continue over the life of the proposal as an increasing area of landfill is capped and rehabilitated.

SITA is committed to reducing key sources of odour onsite. This is demonstrated by the significant reduction in odour complaints received in the last two years. The existing gas extraction system has increased progressively as SITA increases electricity production which reduces fugitive landfill gas emissions. Since the studies documented in this report were commenced SITA has installed twenty nine additional landfill gas collection wells at the LHRRP. These were installed to address the issues identified by this study and generally to expand the gas collection system.

The proposed staging of the landfill would result in lowering the potential for odour impacts in the future by retaining the general proportion of capped and revegetated areas of the site and increasing these areas in time.

The proposed relocated and expanded GO facility would utilise aerated bunkers and breathable membrane covers on the active composting stage which would reduce the potential for odour. The new location for the GO facility is also located on the western side of the LHRRP, making it further away from the nearest sensitive receptors. The estimated odour emissions from the upgraded location and process would reduce by over 40% from the current odour levels.

The proposed ARRT is a new source of odour which would be located on the western side of the site. All air including odour from the facility would be treated in a biofilter prior to being released into the environment. Air from the biofilter would be discharged through the biofilter air discharge portal to increase dispersion of odour into the atmosphere which would reduce the potential odour levels offsite even more.

Overall, it is noted that the proposal would comply with the odour assessment criteria, based on the assessment detailed in this report.

Dust dispersion modelling undertaken for the proposal found that the maximum predicted dust impact complies with the dust criteria at all receptors.

This report therefore addresses the Secretary's Environmental Assessment Requirements and concludes that the proposal would meet the following objectives:

- No significant impacts on the community or environment
- Achieving the 2 OU odour performance criteria cumulatively at the nearest residential receptor
- Improving site gas capture and destruction either by power generation activities or gas flaring as required

Glossary

Term	Definition
ANSTO	Australian Nuclear Science and Technology Organisation
ARRT facility	Advanced Resource Recovery Technology facility
EIS	Environmental Impact Statement
Ektimo	Previously known as Emission Testing Consultants (ETC)
EPA	New South Wales Environment Protection Authority and any successor body
EP&A Act	*Environmental Planning and Assessment Act 1979*
Currently approved landform	The currently approved landform heights and contours outlined in the 1999 EIS
GIS	Geographic Information Systems
GO facility	The Garden Organics facility at LHRRP, that undertakes composting of waste including green and garden waste, but excluding waste types such as food waste and biosolids
GLALC	Gandangara Local Aboriginal Land Council
Landform reprofiling	Proposed changes to currently approved landform at the LHRRP.
LHRRP	Lucas Heights Resource Recovery Park
Mitigation	The application of techniques to reduce environmental impacts arising from the proposal
NPI	National Pollutant Inventory
OEMP	Operational Environment Management Plan and all relevant future documents, these will be provided for the landfill, GO, ARRT and post closure and will detail how these projects can be managed to meet the environmental outcomes for the site
PCYC Mini-Bike Club	The mini-bike club operated by the Police and Community Youth Clubs NSW Limited (PCYC).
SSC	Sutherland Shire Council
SEAR	Secretary's Environmental Assessment Requirements (formerly known as Director-General's Requirements or DGRs)
SICTA	Sydney International Clay Target Association and any successor body
SITA	SembSITA Australia Pty Ltd (SembSITA) is the holding company for the SITA Australia (SITA) group of companies in Australia. SembSITA is the parent company of both SITA and WSN Environmental Solutions Pty Ltd (WSN). WSN owns part of the land on which the LHRRP is situated, and leases the remainder from ANSTO. SITA holds the environmental protection licence (EPL), and so is the operator of the facilities at LHRRP. For simplicity, the term 'SITA' is used to refer to all of these organisations in this report.
Stage 5	This area of the LHRRP is the northern portion of the landfill and within the existing excavated void.

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1. Introduction

1.1 Purpose of this report

SITA Australia (SITA)[1] is proposing a number of activities at the Lucas Heights Resource Recovery Park (LHRRP) in Lucas Heights (referred to in this report as 'the proposal'). This report has been prepared by GHD Pty Ltd on behalf of SITA to provide an assessment of air quality associated with the proposal as an input to the environmental impact statement. Due to the existing operational arrangements at LHRRP, Sutherland Shire Council (SSC) is a joint applicant for the proposal. The environmental impact statement is being prepared by GHD in accordance with the requirements of Part 4 of the NSW *Environmental Planning and Assessment Act 1979* (the EP&A Act).

The report addresses the requirements of the Secretary of the NSW Department of Planning and Environment (the Secretary's Environmental Assessment Requirements (SEARs No SSD-6835) dated 3 February 2015 (as outlined in Section 1.6).

In addition to addressing the SEARs requirements, this report provides an assessment of how well the proposal meets SITA's objectives of having no significant impacts on the community or environment. Environmental management and mitigation measures related to air quality are proposed (where necessary) to mitigate potential impacts and ensure that they are managed in accordance with statutory requirements, regulations and community expectations.

1.2 Objectives

The following objectives have been identified:

- No significant impacts on the community or environment
- Achieving the 2 OU odour performance criteria cumulatively at the nearest residential receptor
- Improving site gas capture and destruction either by power generation activities or gas flaring as required

1.3 Proposal overview

The LHRRP consists of approximately 205 hectares (ha) in two ownerships. 89 ha is owned by SITA and 116 ha owned by Australian Nuclear Science and Technology Organisation (ANSTO) and leased to SITA for waste management or other agreed purposes. The following activities are proposed at the LHRRP and are collectively referred to as 'the proposal'. The proposal would not have a significant impact on the community. In addition to the proposal detailed below, SITA is committed to better environmental outcomes by the application of best practice prevention, mitigation and rectification measures:

- **Reprofiling of existing landfill areas to provide up to 8.3 million cubic metres of additional landfill airspace capacity.** This is equivalent to approximately 8.3 million tonnes of waste, assuming 1 tonne of waste utilises 1 cubic metre of waste disposal airspace. As the process of reprofiling would include removal and replacement of capping material over previously landfilled waste and augmentation of gas and leachate

[1] SembSITA Australia Pty Ltd (SembSITA) is the holding company for the SITA Australia (SITA) group of companies in Australia. SembSITA is the parent company of both SITA and WSN Environmental Solutions Pty Ltd (WSN). WSN owns part of the land on which the LHRRP is situated, and leases the remainder from ANSTO. SITA holds the environmental protection licence (EPL), and so is the operator of the facilities at LHRRP. For simplicity, the term 'SITA' is used to refer to all of these organisations in this report.

collection systems, the environmental performance of the site would be ultimately improved by reducing the infiltration of stormwater into the landfill (resulting in reduced landfill leachate in the longer term) and increase the overall amount of landfill gas recovered from the site.

As part of the proposal, SITA is seeking permission to increase the approved quantity of waste landfilled at the site from 575,000 to 850,000 tonnes per year. This would enable the reprofiling of the site to be completed in 2037.

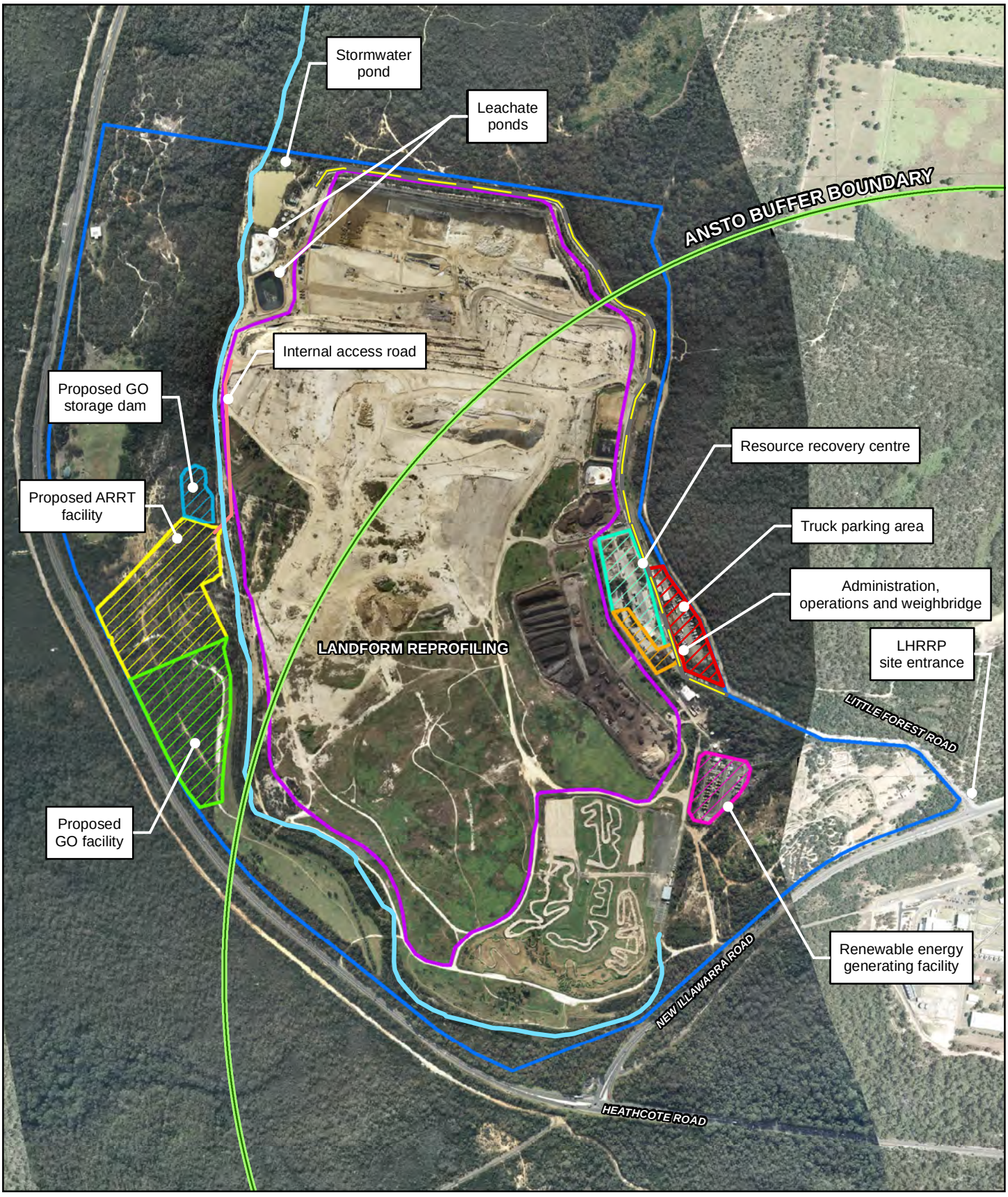
- **Relocation and expansion of the existing garden organics (GO) facility**. The existing garden organics facility would be relocated to the western side of the site adjacent to Heathcote Road. Approval is being sought to increase the approved capacity from 55,000 to 80,000 tonnes of green waste and garden waste received per year at the facility. The new facility would include the partial enclosure, active aeration and covering of the first four weeks of the active composting process, which coincides with the period of highest potential for odour generation, to enable more effective control of odour. Relocation of the facility would result in increased separation distances from the current nearest occupied land at ANSTO, existing residential areas and the proposed new residential area at West Menai.
- **Construction and operation of a fully enclosed advanced resource recovery technology (ARRT) facility**. The ARRT facility would be located on the western side of the site adjacent to the GO facility and would process and recover valuable resources from up to 200,000 tonnes of general solid waste per year, reducing the amount of waste disposed to landfill to approximately 60,000 tonnes per year. This would divert up to 140,000 tonnes of waste per year from landfill. SSC and other councils would have the opportunity to have their municipal waste processed by the ARRT facility.
- **Community parkland**. The landfill reprofiling would increase the area available for future passive recreation following site closure from 124 ha (existing approved parkland) to a total of 149 ha, an increase of approximately 25 ha. Landfilling would cease in 2037 after which time the site would be rehabilitated and converted to a community parkland, with capping and landscaping to be completed and the site made available for community use in 2039.

As part of the proposal SITA has committed to entering into an agreement with SSC in the form of a Voluntary Planning Agreement which includes ‘environmental undertakings’. In addition operational environmental management plans have been prepared for the landfill, GO facility, ARRT facility and post closure measures to manage potential environmental impacts, reflect regulatory requirements and provide guidance for site operators to undertake activities in an environmentally sound manner.

A Planning Proposal is being submitted in parallel with this State Significant Development Application. The Planning Proposal seeks to include new local provisions on the LHRRP site within the Sutherland Local Environmental Plan 2015 (SLEP), which would allow the proposal (a waste or resource management facility) to be undertaken on the proposal site.

The expansion of the LHRRP which is outlined in this EIS would permit the proposed future use of the land for recreational purposes, which is currently approved and would occur when the existing facility ceases operation in 2025. The proposal would however extend the timeframe for which the land would be unavailable for recreational purposes until 2037, due to the extension of operations at the proposed LHRRP.

These key components of the proposal are shown on Figure 1.1. The proposed final landform and preliminary masterplan for the parkland is shown in Figure 1.2.



LEGEND

- ANSTO buffer boundary
- Mill Creek
- Internal access road
- Existing access road
- Proposed GO facility
- Proposed ARRT facility
- Resource Recovery Centre
- Administration, operations and weighbridge
- Renewable energy generating facility
- Lucas Heights Resource Recovery Park boundary
- Landform reprofiling boundary
- Truck parking area

Paper Size A4

0 100 200 400

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

GHD

SITA Australia
Lucas Heights Resource Recovery Park

Job Number 21-23482
Revision A
Date 28 May 2015

Key existing infrastructure and proposed facility layout

Figure 1.1

N:\AU\Sydney\Projects\21\23482\GIS\Maps\MXD\21-23482-Z046_KeyProposedInfrastructure.mxd 15/133 Castlereagh Street Sydney NSW 2000 Australia **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com **W** www.ghd.com

Aerial Imagery: ESRI, 2014. Works: GHD/SITA, 2014. Roads: NSW LPMA, 2012. Created by:jrichardson

Paper Size A4

NOT TO SCALE

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SITA Australia
Lucas Heights Resource Recovery Park

Job Number 21-23482
Revision A
Date 24 June 2015

Proposed parkland master plan **Figure 1.2**

Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

N:\AU\Sydney\Projects\21\23482\GIS\Maps\MXD\21-23482-Z058_Parkland_Master.mxd

Data source: Taylor Brammer Landscape Architects Pty Ltd. Created by:jrichardson

1.4 Definitions

The following terms are used within this report when referring to the proposal site and surrounding areas:

- The 'LHRRP' refers to the entire Lucas Heights Resource Recovery Park. The boundary of the LHRRP is shown as the blue line on Figure 1.3
- The 'proposal site' refers to the areas where the activities described in Section 1.2 would be located. The boundary of the proposal site is shown as the red line on Figure 1.3

1.5 Location of the proposal

1.5.1 Existing

The proposal would be located within the boundary of the existing LHRRP. The LHRRP is located within the Sutherland local government area, approximately 30 kilometres (km) south west of the Sydney city centre. The LHRRP is bound to the west by Heathcote Road and New Illawarra Road to the south.

Specifically, the proposal would be located on:

- Lot 101 DP 1009354
- Lot 3 DP 1032102
- Lot 2 DP 605077

It is noted that the proposal directly affects only a portion of each of these lots. There is minimal encroachment into the SICTA leased land (part of Lot 3 DP 1032102).

The proposal site, within the boundary of the LHRRP, is shown on Figure 1.3.

The site is currently accessed from Little Forest Road, off New Illawarra Road.

Current facilities at the LHRRP include:

- Landfill
- Resource recovery centre and waste collection point
- GO facility for processing garden organics
- Renewable energy production (operated by Energy Developments Ltd)
- Truck parking area
- Community use areas (mini bike area at the southern extent of the site run by the Sutherland Police Citizens Youth Club and the Sydney International Clay Target Association (SICTA) leased land on the north western side of the site)

There are also several ancillary buildings and structures (e.g. weighbridge, machinery workshop, administration offices, stormwater and leachate dams).

The following land uses are located in the immediate vicinity of the LHRRP:

- Bushland areas that form part of ANSTO's exclusion zone (to the east and south)
- ANSTO's facilities (to the east on the opposite side of New Illawarra Road)

Land uses in the surrounding area include:

- Holsworthy Military Reserve (to the west, northwest and southwest)

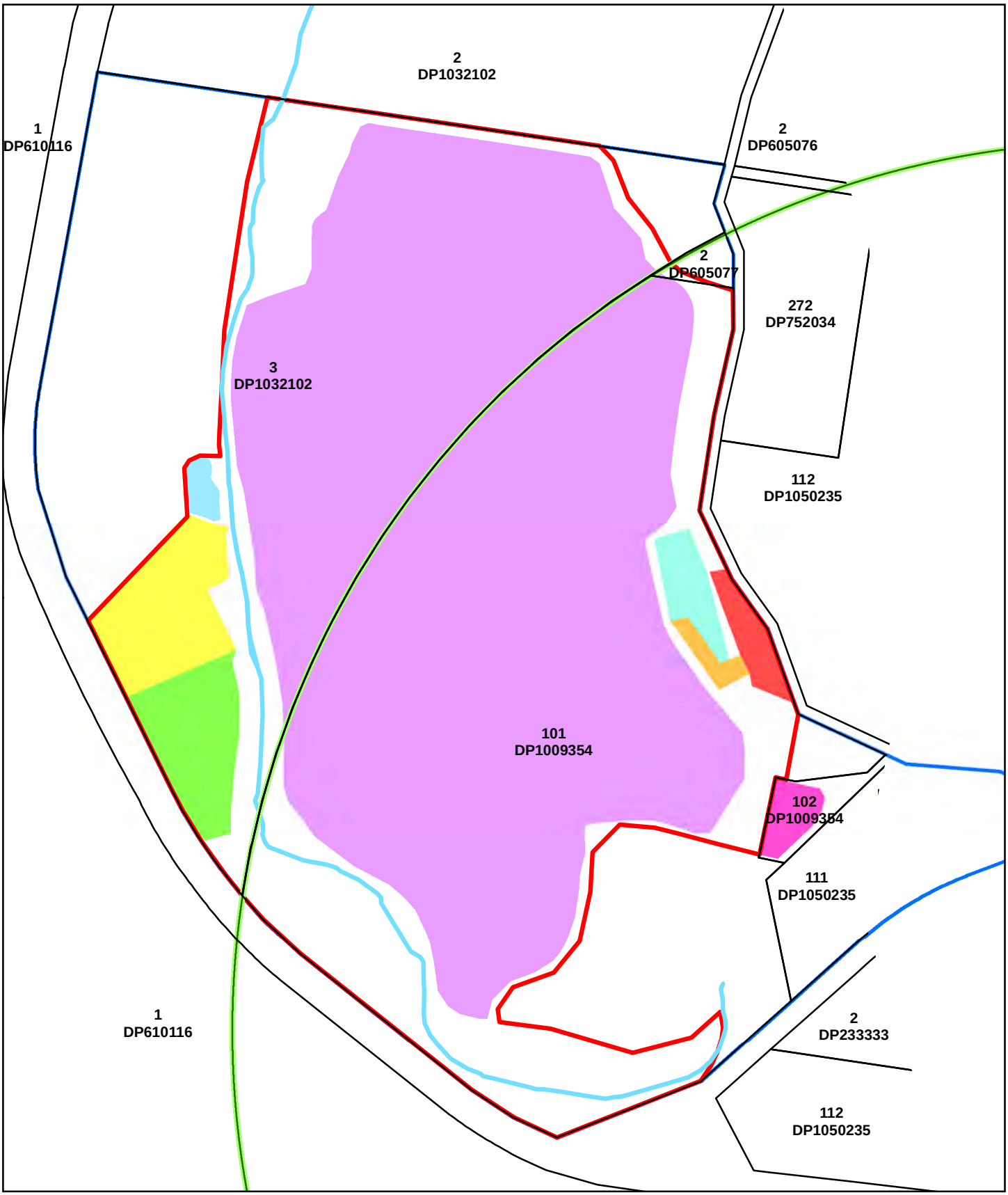
- The Ridge Sports Complex, a major regional sporting facility being developed on the site of the former Lucas Heights Waste and Recycling Centre (approximately 2.5 km to the north east)
- Lucas Heights Conservation Area (immediately to the north of the LHRRP)
- The suburbs of North Engadine (approximately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

Figure 1.4 shows these key areas.

1.5.2 Potential future surrounding land uses

The Gandangara Local Aboriginal Land Council (GALC) is proposing a development in the West Menai area. The West Menai State Significant Site contains 849 ha of mostly undeveloped land, covering parts of Menai, Barden Ridge and Lucas Heights.

The western boundary of the proposed development is Heathcote Road and the site extends east across Mill Creek to the edge of the existing Menai residential area close to New Illawarra Road. The location of the proposed West Menai State Significant Site is shown on Figure 1.4.



LEGEND

- ANSTO buffer boundary
- Mill Creek
- Cadastre
- Proposal site boundary
- Lucas Heights Resource Recovery Park boundary
- Truck parking area
- Proposed GO facility
- Proposed ARRT facility
- Resource Recovery Centre
- Administration, operations and weighbridge
- Renewable energy generating facility
- Landform reprofiling boundary

Paper Size A4

0 45 90 180 270 360

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

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GHD

SITA Australia
Lucas Heights Resource Recovery Park

Job Number	21-23482
Revision	A
Date	25 Jun 2015

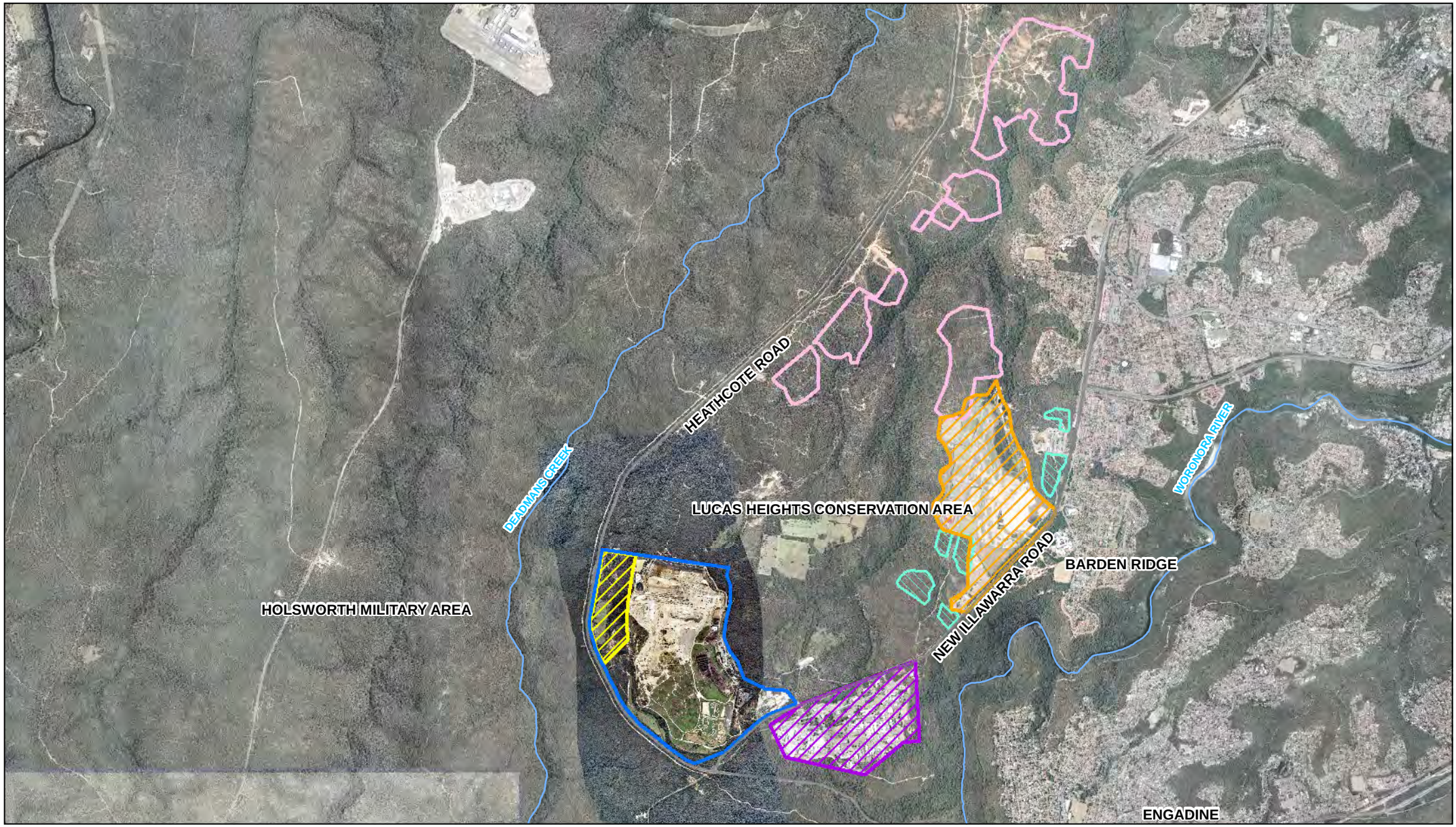
The proposal site

Figure 1.3

G:\21\23482\GIS\Maps\MXD\21-23482-Z059_TheProposalSite.mxd

15/133 Castlereagh Street Sydney NSW 2000 Australia **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com **W** www.ghd.com

Aerial Imagery: ESRI, 2014. Works: GHD/SITA, 2014. Roads: NSW LPMA, 2012. Created by:afoddy



Paper Size A4

0 250 500 1,000 1,500

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

Legend

- LHRRP boundary
- SICTA boundary
- ANSTO
- Barden Ridge Sports Complex
- Potential future receptors
- Future receptors – Residential

SITA Australia
Lucas Heights Resource Recovery Park

Job Number 21-23482
Revision B
Date 14 Aug 2015

Surrounding landuses

Figure 1.4

N:\AU\Sydney\Projects\21\23482\GIS\Maps\MXD\21-23482-Z063_SurroundingLandUses_Fig4-3.mxd

15/133 Castlereagh Street Sydney NSW 2000 Australia T 61 2 9239 7100 F 61 2 9239 7199 E sydmail@ghd.com W www.ghd.com

Aerial Imagery: SITA, 2014. Works: GHD/SITA, 2014. Roads: NSW LPMA, 2012. Created by:apmiller

1.6 Secretary's Environmental Assessment Requirements and agency requirements

The specific SEARs and agency requirements addressed in this report are summarised in Table 1-1.

Table 1-1 Secretary's Environmental Assessment Requirements and agency requirements

Assessment requirements	Where addressed in report
A description of all potential air emissions and odours and their sources, including construction, operational and transport sources	Section 6
A quantitative assessment of all potential air quality impacts and odour impacts for the development, including cumulative, on surrounding land and sensitive receptors under the relevant Environment Protection Authority guidelines	Section 8, Section 9
Details of any pollution control equipment and other impact mitigation measures for fugitive and point source emissions	Section 10
Details of the proposed management and monitoring measures	Section 10
Agency requirements	
New South Wales Environment Protection Authority (NSW EPA)	
1. The Proponent should provide details about the new pollution controls, including biofilters and/or stacks etc. for the ARRT plant. The EIS should contain an assessment of the proposed pollution controls to determine whether they will effectively mitigate odour from the site	Section 4 Section 7.5.3
2. All outdoor storage of organic materials, processed or unprocessed, must be clearly identified in the EIS with the type, their respective volumes and locations detailed on a site map. These outdoor stored materials must be included in the odour modelling	Section 7.3.2 Section 7.5.2
3. Detailed information about the new facility buildings and compost storage building including the number of access points; details about the doors to be used at those access points; and how dust and odour from these buildings will be managed	Section 7.5.3
4. Odour modelling should consider the cumulative impacts from the existing operations, existing landfill and the proposed activities to ensure potential impacts on the local community are adequately determined	Section 5.1.3
5. Contingency plans for how odours will be managed should the proposed outdoor storage of final AART product and/or GO compost cause odour issues	Section 10.3
7. Assessment of the proposed gas capture systems effectiveness to address odour emissions (in addition to electricity generation) from the proposed expansion to the landfill	Section 10.4
Part C 2. Air • Describe the topography and surrounding land uses. Provide details of the exact locations of dwellings, schools and hospitals. Where appropriate provide a perspective view of the study area such as the terrain file used in dispersion models. • Describe surrounding buildings that may effect plume dispersion. • Provide and analyse site representative data on following meteorological parameters: a) temperature and humidity b) rainfall, evaporation and cloud cover	Section 1, Section 2

c) wind speed and direction d) atmospheric stability class e) mixing height (the height that emissions will be ultimately mixed in the atmosphere) f) katabatic air drainage g) air re-circulation	
Part D 4. Air ***Describe baseline conditions*** • Provide a description of existing air quality and meteorology, using existing information and site representative ambient monitoring data. ***Assess impacts*** • Identify all pollutants of concern and estimate emissions by quantity (and size for particles), source and discharge point. • Estimate the resulting ground level concentrations of all pollutants. Where necessary (e.g. potentially significant impacts and complex terrain effects), use an appropriate dispersion model to estimate ambient pollutant concentrations. Discuss choice of model and parameters with the DECCW. • Describe the effects and significance of pollutant concentration on the environment, human health, amenity and regional ambient air quality standards or goals. • Describe the contribution that the development will make to regional and global pollution, particularly in sensitive locations. • For potentially odorous emissions provide the emission rates in terms of odour units (determined by techniques compatible with EPA / DECCW procedures). Use sampling and analysis techniques for individual or complex odours and for point or diffuse sources, as appropriate. *Note: With dust and odour, it may be possible to use data from existing similar activities to generate emission rates.* • Reference should be made to Approved Methods for the modelling and Assessment of Air Pollutants in NSW (DEC, 2001); Approved Methods for the Sampling and Analysis of Air Pollutants in NSW (DEC, 2007); Assessment and Management of Odour from Stationary Sources in NSW (DEC, 2006); Technical Notes: Assessment and Management of Odour from Stationary Sources in NSW (DEC, 2006); Load Calculation Protocol for use by holders of NSW Environment Protection Licences when calculating Assessable Pollutant Loads (DECC, 2009). ***Describe management and mitigation measures*** • Outline specifications of pollution control equipment (including manufacturer's performance guarantees where available) and management protocols for both point and fugitive emissions. Where possible, this should include cleaner production processes.	Section 1, Section 2, Section 5, Section 8, Section 9, Section 10
Part D 7. Cumulative impacts • Assess the impact of the proposal against the long term air, noise and water quality objectives for the area or region.	Section 5.1.3

1.7 Scope and structure of the report

1.7.1 Scope of report

This report provides an assessment of the potential air quality (odour and dust) impacts of the proposal. The assessment has been undertaken in accordance with the requirements of:

- Approved Methods for the Modelling and Assessment of Air Pollutants in NSW (NSW DEC 2005) ('the Approved Methods')
- Secretary's Environmental Assessment Requirements (SEARs), summarised in Table 1-1 above

1.7.2 Structure of report

The report is structured as follows:

- **Chapter 1 – Introduction.**
- **Chapter 2 – Existing regulatory requirements.** This chapter provides an overview of the legislation, policies and guidelines relevant to this assessment.
- **Chapter 3 – Existing environment.** This chapter outlines the existing operations at the LHRRP, existing meteorology and air quality.
- **Chapter 4 – Proposed major odour improvements.** This chapter outlines the key technical and management changes proposed that are considered as part of the assessment.
- **Chapter 5 – Methodology.** This chapter describes the overall assessment methodology.
- **Chapter 6 – Justification of odour emission rates**. This chapter provides the justification for adopted odour emission rates. In particular, it provides a description of the site specific odour sampling program undertaken as part of this assessment to assess the proposal impacts.
- **Chapter 7 – Odour modelling scenarios and justifications**. This chapter describes the scenarios modelled and provides justifications for the selected scenarios.
- **Chapter 8 – Odour impact assessment.** This chapter assesses the interaction of the odour emissions from the proposal with the existing receptors for the purposes of characterising impacts.
- **Chapter 9 – Dust impact assessment.** This chapter assesses the interaction of the dust emissions from the proposal with the existing receptors for the purposes of characterising impacts.
- **Chapter 10 - Mitigation measures**. This chapter contains the proposed measures to mitigate potential impacts identified in the impact assessment.
- **Chapter 11 - Conclusions and Recommendations.**
- **Chapter 12 – References.**

2. Existing regulatory requirements

2.1 Overview

The existing odour and dust requirements for the site stem from the development consent (DA No 11-01-99 consent ref R97/00029). In additional to this regulatory instrument there are several Environment Protection Licences (EPLs) for the LHRRP. The relevant requirements under these instruments are summarised below.

Furthermore, the overarching regulatory requirements for odour and dust emissions come from the *Protection of the Environment Operations Act 1997* (POEO Act 1997).

2.1.1 Development Consent

The DA No 11-01-99 consent (ref R97/00029) states the following:

- *The LH1 and LHWMC sites shall not emit offensive odour, in accordance with the provisions of the Protection of the Environment Operations Act 1997 (EPA GTA).*
- *The applicants shall take all practical steps to manage the LH1 and LHWMC operations so that there are no extra exceedances of the ambient air quality goals, specifically for total suspended particulates (TSP) of 90 micrograms per cubic metre (annual average) and the dust deposition goal of 4 gram per square metre per month (annual average). These goals apply when measured at any monitoring location specified in the Air Quality Management Plans.*

2.1.2 Environment Protection Licences

There are four EPLs which apply to the LHRRP and of which two apply to the portion of the LHRRP subject to this proposal. The relevant EPLs are 5065 (which applies to the landfill) and 12520 which applies to the GO facility. The relevant conditions from these EPLs are:

- *No condition of this licence identifies a potentially offensive odour for the purposes of section 129 of the Protection of the Environment Operations Act 1997.*

  Note: Section 129 of the Protection of the Environment Operations Act 1997, provides that the licensee must not cause or permit the emission of any offensive odour from the premises but provides a defence if the emission is identified in the relevant environment protection licence as a potentially offensive odour and the odour was emitted in accordance with the conditions of a licence directed at minimising odour."
- *All operations and activities occurring at the premises must be carried out in a manner that will minimise the emission of dust from the premises.*

2.1.3 Legislation

The POEO Act 1997 establishes, amongst other things, the procedures for issuing licences for environmental protection in relation to aspects such as waste, air, water and noise pollution control. The owner or occupier of premises engaged in scheduled activities is required to hold an EPL and comply with the conditions of that licence. The site is required to be managed in accordance with its existing EPL.

The POEO Act 1997 requires that no occupier of any premises causes air pollution (including odour) through a failure to maintain or operate equipment or deal with materials in a proper and efficient manner. The operator must also take all practicable means to minimise and prevent air pollution (sections 124, 125, 126 and 128 of the POEO Act 1997).

The POEO Act 1997 includes the concept of 'offensive odour' (section 129) and states it is an offence for scheduled activities to emit 'offensive odour'.

offensive odour *means an odour:*

(a) that, by reason of its strength, nature, duration, character or quality, or the time at which it is emitted, or any other circumstances:

> *(i) is harmful to (or is likely to be harmful to) a person who is outside the premises from which it is emitted, or*
>
> *(ii) interferes unreasonably with (or is likely to interfere unreasonably with) the comfort or repose of a person who is outside the premises from which it is emitted, or*

(b) that is of a strength, nature, duration, character or quality prescribed by the regulations or that is emitted at a time, or in other circumstances, prescribed by the regulations.

2.2 Odour assessment

2.2.1 Approved Methods

The Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales ('the Approved Methods') (NSW DEC, 2005) lists the statutory methods for modelling and assessing emissions of air pollutants from stationary sources in NSW. The assessment criteria for odour is applied at the nearest existing or likely future off-site sensitive receptor.

The Approved Methods also defines odour assessment criteria and specifies how they should be applied in dispersion modelling to assess the likelihood of nuisance impact arising from the emission of odour.

2.2.2 Odour assessment criteria

Odour impact is a subjective experience and has been found to depend on many factors, the most important of which are the:

- **F**requency of the exposure
- **I**ntensity of the odour
- **D**uration of the odour episodes
- **O**ffensiveness of the odour
- **L**ocation of the source.

These factors are often referred to as the FIDOL factors.

The odour assessment criteria is defined to take account of two of these factors (**F** is set at 99th percentile; **I** is set at from 2 to 7 OU). The choice of assessment criteria is also dependent on the population of the affected area as shown in Table 2-1.

Table 2-1 Odour criteria for the assessment of odour (DEC, 2005)

Population of affected community	Odour performance criteria (nose response odour certainty units at 99th percentile[1])
Single Residence (≤ ~2)	7
~ 10	6
~ 30	5
~ 125	4
~ 500	3
Urban (≥~2,000)	2

Note 1: This is a prediction of the odour level that may occur 1% of the time, or one hour in one hundred. Odour performance criteria are designed to be precautionary, so that impacts on sensitive receivers can be minimised.

The criteria assumes that 7 OU at the 99th percentile would be acceptable to the average person, but as the number of exposed people increases there is a chance that sensitive individuals would be encountered. The criteria of 2 OU at the 99th percentile is considered to be acceptable for large populations (more than 2,000 people).

The criteria have also been specified at an averaging time of nominally 1 second. The choice of the short averaging time recognises that the human nose has a response time of less than 1 second, so that modelling of odour impact should allow for the short-term concentration fluctuations in an odour plume due to turbulence.

As the Ausplume dispersion model (used in this assessment) cannot predict concentrations for a 1 second average, a ratio between the 1 second peak concentration and 60 minute average concentration has been applied in accordance with Section 6.6 of the Approved Methods. This is known as the peak to mean ratio (PM60). PM60 is a function of source type, stability category and range (that is, near or far-field), and values are tabulated in the Approved Methods.

2.3 Dust assessment

2.3.1 Approved Methods

Similar to odour, the Approved Methods (NSW DEC, 2005) lists the statutory methods for modelling and assessing emissions of air pollutants from stationary sources in NSW.

2.3.2 Dust assessment criteria

Table 2-2 summarise the current air quality assessment criteria for in-air dust and deposited dust prescribed by the Approved Methods.

Table 2-2 Criteria for particulate matter

Pollutant	Criterion	Average period
Total Suspended Particulate Matter (TSP)	90 µg/m^3	Annual
Particulate Matter < 10 µm (PM_{10})	50 µg/m^3	24 hour maximum
	30 µg/m^3	Annual

In addition to health impacts, airborne dust also has the potential to cause nuisance impacts by depositing on surfaces. Table 2-3 shows the maximum acceptable increase over existing dust levels.

Table 2-3 Assessment criteria for dust deposition

Pollutant	Average Period	Maximum increase in deposited dust level	Maximum total deposited dust level
Deposited Dust	Annual	2 g/m^2/month	4 g/m^2/month

3. Existing environment

3.1 Existing operations and facilities

Existing operations and facilities at the site include:

- Landfilling of up to 575,000 tonnes per year of general solid (putrescible) waste
- GO facility located on the eastern side of the site for composting up to 50,000 tonnes per year of garden organics using open windrow composting
- A resource recovery centre to facilitate small vehicles (i.e. the community) dropping off recyclable materials and to enable the relaying of any unrecyclable waste to the active waste disposal area
- A renewable energy production facility consisting of reciprocating engines to collect biogas from the landfill and converting it to electricity
- Truck parking area
- Community use areas including the Sutherland Shire Police Citizens Youth Club (PCYC) minibike area and the Sydney International Clay Target Association (SICTA) clay target club

The only existing activities at the site that have significant odour generating potential are landfill disposal of waste and associated activities e.g. leachate management and the existing GO facility. These are discussed below.

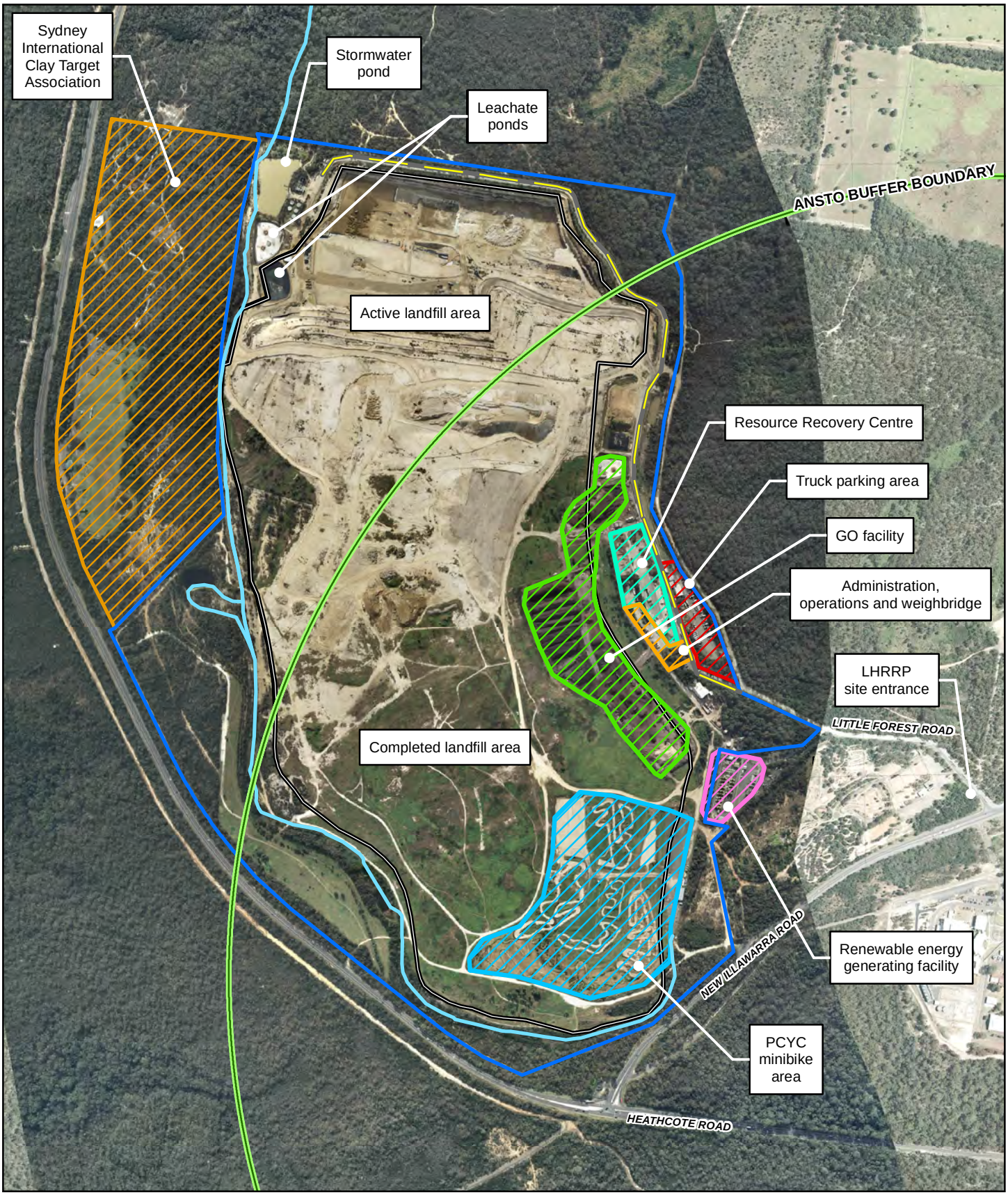
The LHRRP covers an area of 205 ha. The site consists of various stages of landfill including capped areas, intermediate cover and active landfilling areas, with the currently approved landfill footprint being approximately 100 ha in area. The GO facility is approximately 10 ha in area.

The existing GO facility is an open windrow composting facility located on the eastern side of the site nearby to ANSTO and it receives only garden waste for composting. No putrescible waste is composted at this site. During the composting process there is the potential for odour to be emitted that may be offensive to off-site receptors.

There are a range of environmental protection infrastructures in place to support the environmental management of the above activities, including leachate storage dams, stormwater detention basins, flocculation systems and biogas collection systems. This includes a range of odour mitigation measures, such as active gas extraction system, aeration of the leachate ponds. As part of this proposal SITA would continue and upgrade its environmental controls. Description of the mitigation measures are contained in chapter 10.

The existing infrastructure and facilities are depicted on Figure 3.1.

SITA has an on-site meteorological station that monitors wind speed, wind direction and temperature that helps correlate odour complaints with weather conditions and assist in rectification based on the NSW EPA *Environmental Guidelines: Solid Waste Landfills*: Odour Control (NSW EPA, 1996).



LEGEND

- ANSTO buffer boundary
- Internal access road
- Approved landfill footprint
- Site boundary
- Sydney International Clay Target Association
- GO facility
- Resource Recovery Centre
- Administration, operations and weighbridge
- Renewable energy generating facility
- PCYC minibike area
- Truck parking area

Paper Size A4

0 75 150 300

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

GHD

SITA Australia
Lucas Heights Resource Recovery Park

Existing key infrastructure and facilities

Job Number 21-23482
Revision A
Date 27 Apr 2015

Figure 3.1

15/133 Castlereagh Street Sydney NSW 2000 Australia T 61 2 9239 7100 F 61 2 9239 7199 E sydmail@ghd.com W www.ghd.com

N:\AU\Sydney\Projects\21\23482\GIS\Maps\MXD\21-23482-Z012_ExistingKeyInfrastructure6.mxd

Aerial Imagery: ESRI, 2014. Works: GHD/SITA, 2014. Roads: NSW LPMA, 2012. Created by:jrichardson

3.2 Existing meteorology and background air quality

3.2.1 Regional climate and prevailing meteorology

The local climate at Lucas Heights is similar to that of the broader Sydney metropolitan region with warm to hot summers and cool to mild winters. The local climate at the LHRRP is affected by broader regional patterns of synoptic pressure and wind with embedded weather systems. Synoptic features vary in intensity and location according to the season.

For instance, during summer a high-pressure belt is usually found over or just to the south of Australia, bringing warm weather while the subtropical easterlies cover most of the continent. In winter, the subtropical high-pressure belt is usually located further north over the continent, allowing westerly winds and occasional to frequent strong cold fronts to affect southern Australia. This allows the 'Southerly Buster' (an abrupt southerly change) to affect Sydney as cold frontal systems penetrate further inland of the continent.

3.2.2 Climate

Review of data from Bureau of Meteorology (BOM, 2014) and data from Queensland Government Department of Science, Information Technology, Innovation and the Arts (DSITIA, 2014) suggests that a warm temperate climate with strong maritime influence is experienced in the Lucas Heights area. Mean daily temperatures range from 26.0 °C to 17.0 °C in February and from 15.8 °C to 6.6 °C in July. Frost is not experienced in this area.

Seasonal variations occur in rainfall with a greater proportion being received during summer months. A generally even rainfall distribution is experienced over the region with a mean annual rainfall of 1015 millimetres (mm).

3.2.3 Wind pattern

Local wind climate largely determines the pattern of off-site odour impact. The characterisation of local wind patterns requires accurate site-representative hourly recordings of wind direction and speed over a period of at least a year – so as to account for seasonal variation. The nearest meteorological data available is from an on-site anemometer owned by SITA at the LHRRP. The 12 month on site dataset for the period October 2011 – September 2012 was used for this proposal and created following the Approved Methods. This is then a Level 2 impact assessment with site-specific data of "at least one year" and more than "90% complete" (NSW DEC, 2005 Section 4.1, p.10).

The effect of wind on odour dispersion patterns can be examined using the general wind climate and atmospheric stability class distributions. The general wind climate at a site is most readily displayed by means of wind rose plots, giving the incidence of winds from different directions for various wind speed ranges.

The features of particular interest in this assessment are:

- The prevailing wind directions
- The relative incidence of more stable light wind conditions (these define peak odour impacts from ground-based sources)

Annual wind rose

The average predicted annual wind rose for the site is shown in Figure 3.2 and indicates that predominant annual average wind directions are from the southwest to southeast quadrants - from the west around to the south-southeast. Typical of this region to the west of the Sydney Basin there is a westerly component, with a lesser easterly component. The annual average wind speed was 2.8 m/s. The observed wind speed distribution indicates that the largest

proportion of high wind speeds (> 6 m/s) are from the south and due west, while the largest proportion of light winds (<2 m/s) are from the west-southwest and south-southeast (cool air drainage effects from the surrounding creek valleys). The direction of light winds is seasonal, with light winds from the southwest quadrant (worst case for sensitive odour receptors) predominantly occurring in autumn and winter. Light winds in summer generally occur from the south southeast.

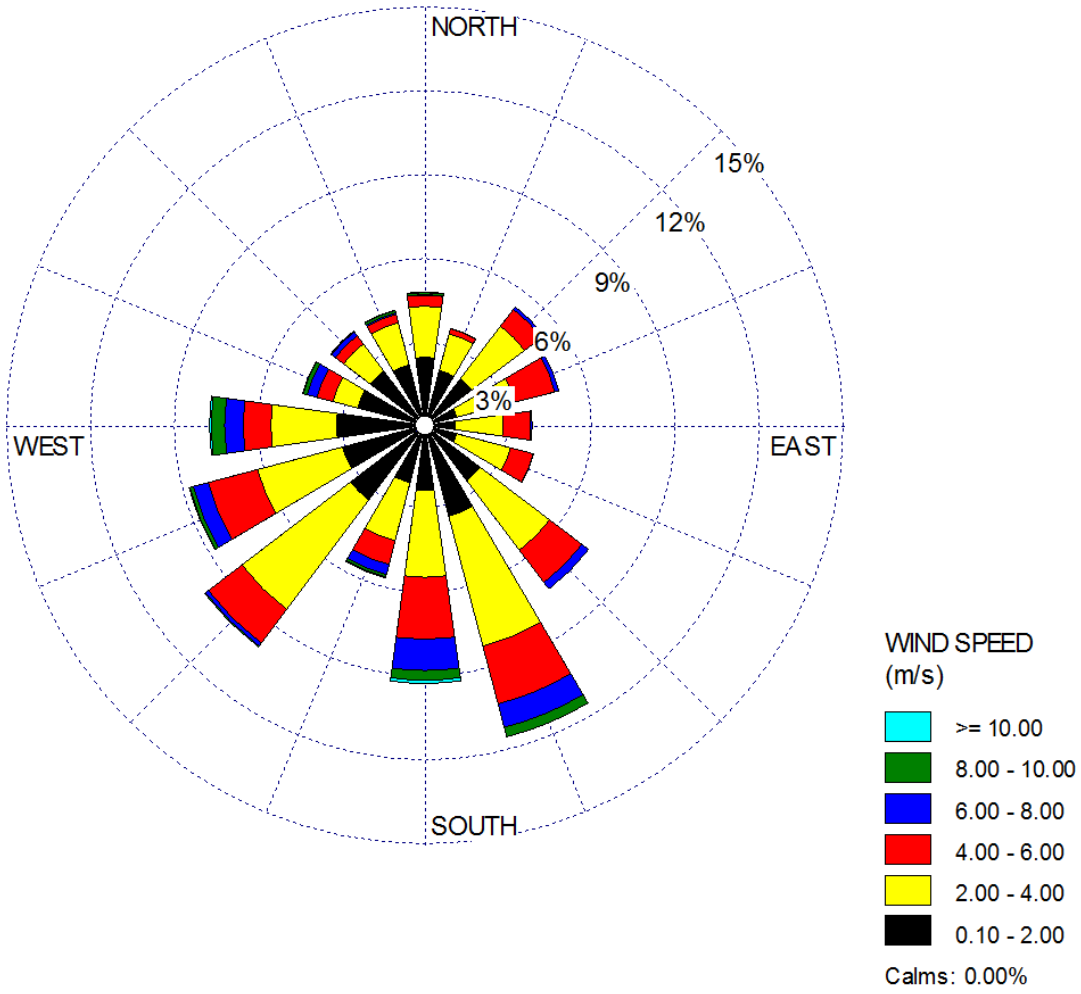


Figure 3.2 Annual wind rose – LHRRP 2011 – 2012

Seasonal wind roses

The average seasonal wind roses for the site are shown in Figure 3.3 and indicate that:

- In winter, the winds are predominantly from the southwest and west including a high percentage of the lightest winds (< 2 m/s). This observation reflects cool air drainage flows from the hills and Blue Mountains from the surrounding land in the west and southwest, as well as with the synoptic winter westerlies associated with the pre-frontal (stronger) winds
- In summer, the majority of stronger winds are from the southeast/south-southeast reflecting the synoptic sub-tropical ridge migrating to the south of this location during the warmer months of the year and the summertime sea breeze in the afternoon and evening. Lighter winds (< 2m/s) also come from this direction

Autumn and spring are transitional seasons with a mixture of both winter and summer observations, with peak incidences from the south-southeast, west and southwest.

The seasonal incidence of high winds (>6 m/s) is greatest in winter, and lowest in autumn, while the incidence of light (<2 m/s) winds is greatest in autumn.

The direction and high proportion of light winds in autumn are predominantly westerly and south-westerly. These air flows are likely to be associated with high stability due to a temperature inversion, and can be expected to define the directions of poorest dispersion for low lying odour emission sources. As the site is located a fair way inland with prominent stable winds from the west and southwest, the potential for odour impact is somewhat increased towards the east and northeast.

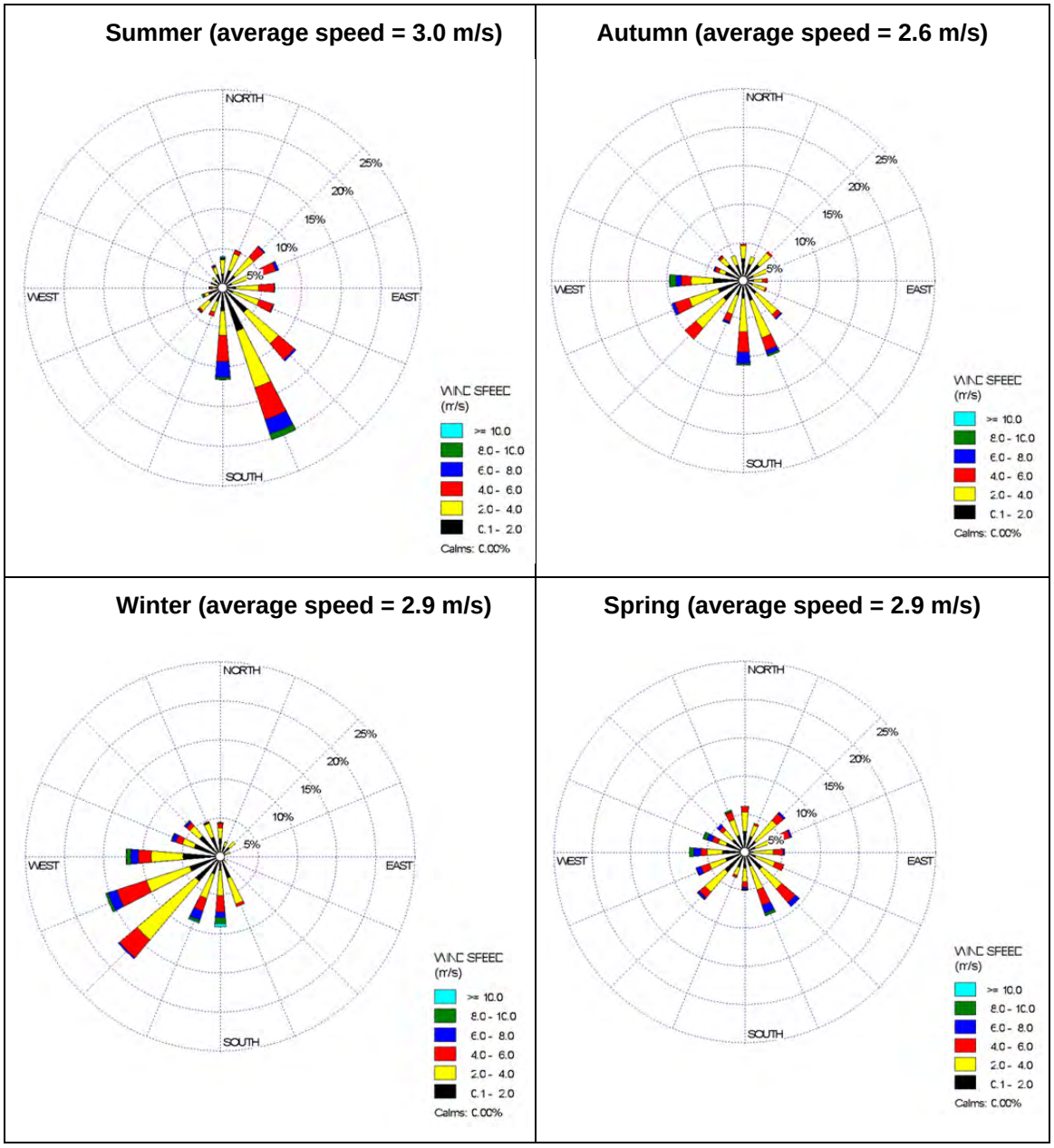


Figure 3.3 Seasonal wind roses, LHRRP 2011 – 2012

3.2.4 Annual pattern and seasonal variation in atmospheric stability

In the Pasquill/Gifford atmospheric stability scheme, stability is classified into six classes of A through F. A, B and C stability classes represent strongly, moderately and slightly unstable atmospheres respectively. Under unstable conditions dispersion of emissions from near-ground sources is good due to convectively vertical turbulent mixing. The stability category D denotes neutral atmospheric conditions (strong winds any time of day in moderate temperatures or lighter winds on overcast to mostly cloudy days and nights). Categories E and F denote slightly and moderately stable atmospheres when dispersion is poorest, as vertical mixing of air is suppressed. Stable atmospheric conditions occur in the absence of strong gradient winds, and mostly on nights with clear or only partly cloudy skies. They are often associated with ground-based radiation forced temperature inversions, sometimes with fog, mist or frost.

Neutral stability (D class) conditions generally occur most frequently and along with the prevailing wind direction can indicate the most common direction for potential odour impact. Under night-time E and F class conditions, odour emissions from ground based sources result in a downwind plume that is detectable to a greater distance than during the day with associated neutral or unstable atmospheric conditions. It is commonly these conditions that result in odour complaints at maximum range.

Figure 3.4 shows the stability rose for the entire data period (October 2011 – September 2012). Neutral atmosphere (D) comprises 47.7% of incident time while the A, B and C class contribute unstable atmospheres 19.7% of the time and the stable E and F conditions contribute 32.7%. Figure 3.4 shows that the majority of stable winds are from the southwest, west, south and south-southeast.

The average seasonal stability roses for the site are shown in Figure 3.5 and show the following seasonal variation trends in atmospheric stability:

- In summer, the peak occurrence of stable winds is from the south-southeast
- In autumn, stable winds predominate from the southwest quadrant
- In winter, stable winds predominate from the southwest quadrant
- In spring, stable winds predominate again from the southwest quadrant

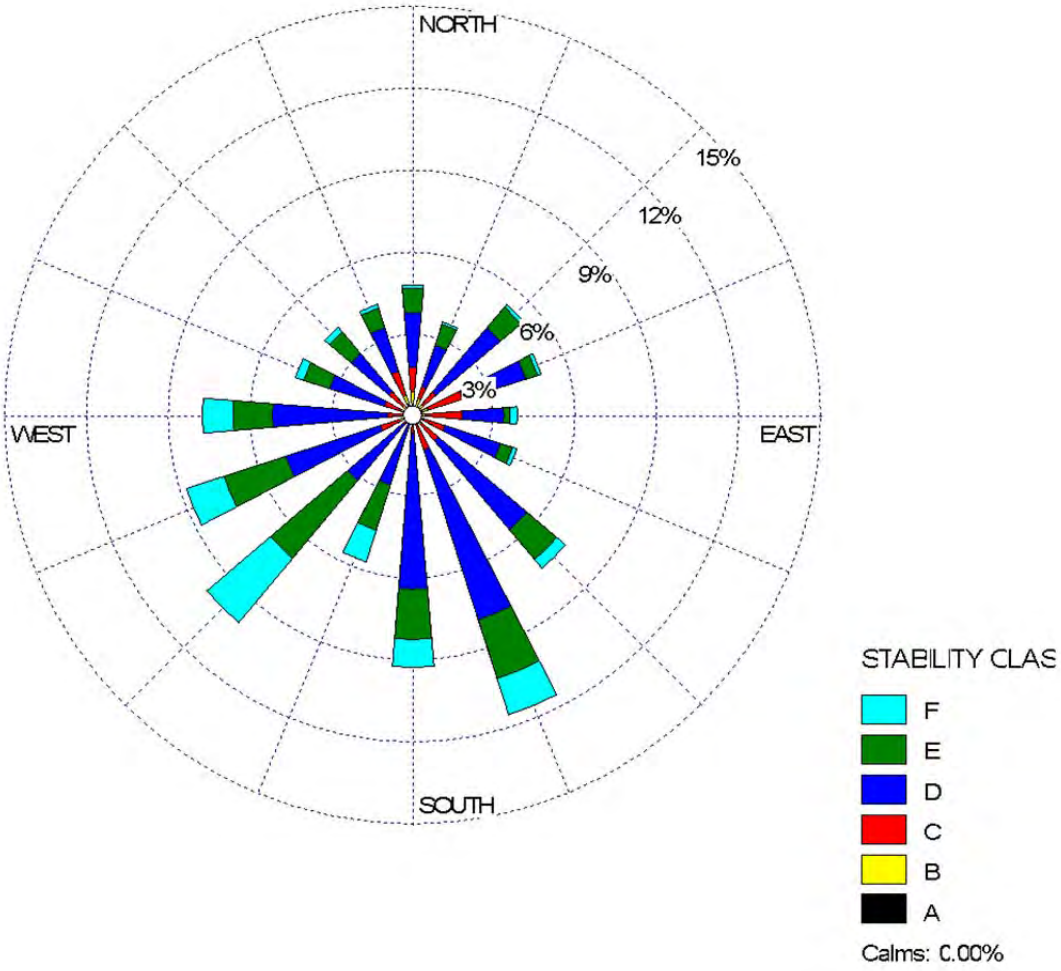


Figure 3.4 Annual stability rose, LHRRP 2011 – 2012

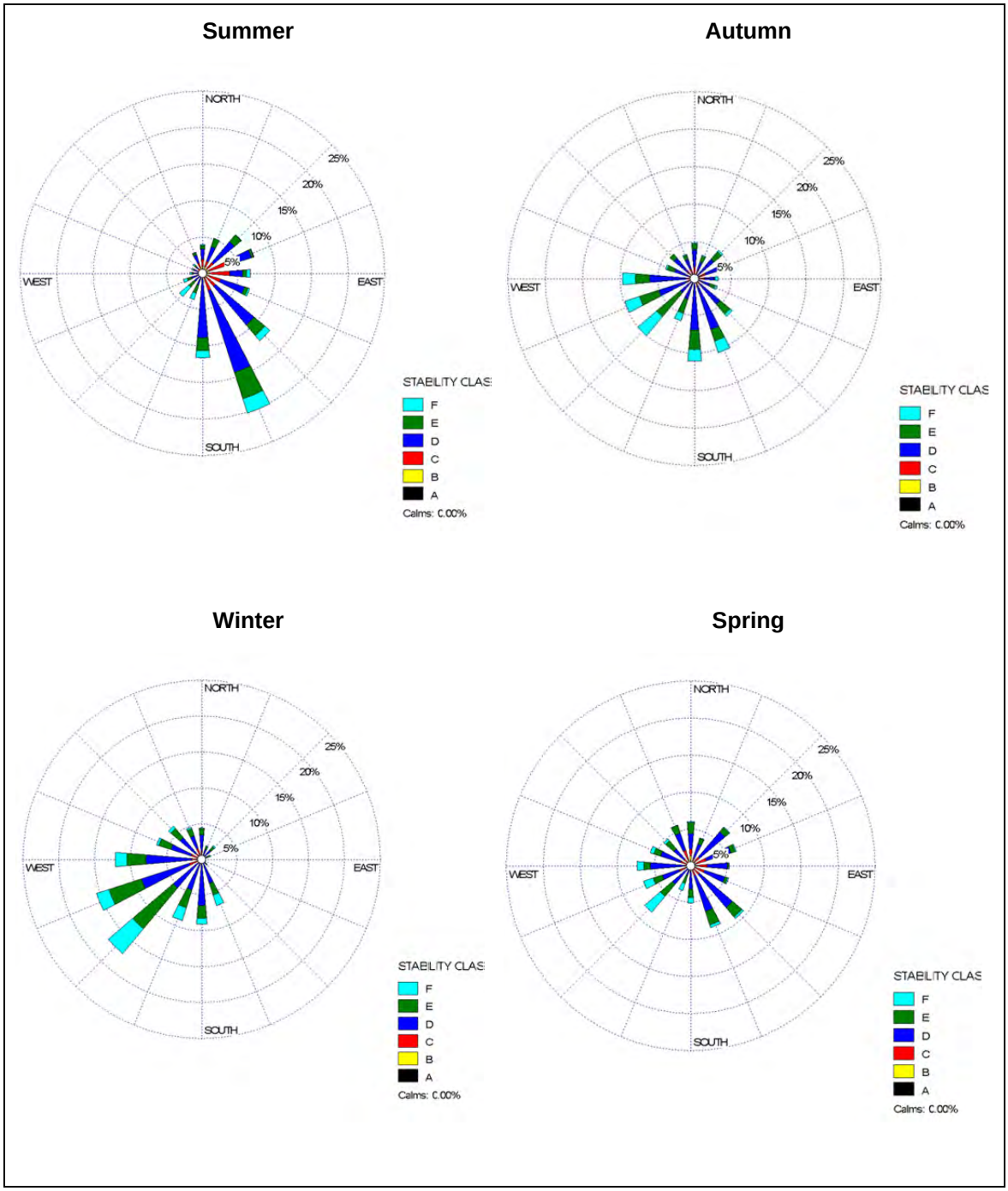


Figure 3.5 Seasonal stability roses, LHRRP 2011 – 2012

3.3 Background air quality

There are no significant odour emitting facilities located near (within 5 km) the proposal site. The old Lucas Heights Landfill 1, now the Barden Ridge sporting complex is a potential minor source of odour. This old site is all final capped landfill, and based on the odour sampling conducted as part of this assessment would not be a source of odour any more than an area of grass on undisturbed land.

Leachate generated at the site and transferred to it are temporarily stored and aerobically treated prior to discharge to sewer. This temporarily stored of leachate and its treatment is unlikely to cause any noticeable odour impacts on nearby receptors. SITA has advised that since it has taken over the operations of the LHRRP there have been no odour complaints attributed to the leachate temporarily stored at Lucas Heights 1.

It is therefore considered that there would be no other sources of background odour affecting the LHRRP site and surrounds.

No background dust measurements were available for Lucas Heights. It is expected background dust levels would be low. The prominent source of background dust would be areas subject to wind erosion and from urban activities. Pollen and vegetation derived dust would also be expected.

The closest air monitoring station is located at Liverpool operated by OEH, where PM_{10} is measured via a TEOM. The year of 2012 was assessed for an annual average background level which was recorded to be 19.7 $\mu g/m^3$ for a 24-hour average.

3.3.1 Dust deposition sampling

Dust monitoring records were provided by SITA. Dust deposition monitoring is undertaken at six locations at the LHRRP as shown in Figure 3.6.

A review of the available information has been undertaken on the data from six dust deposition gauges from January 2003 until February 2013. This data has been presented in Table 3-1.

There have been exceedances of the dust deposition criteria, with site DG4 exceeding the annual criteria 5 times since 2003, the last being in 2011.

Since SITA has operated the site (February 2011) until February 2013, there have been no monthly exceedances of the dust deposition criteria at dust monitoring locations DG1, DG2 and DG5.

Since February 2011 the monthly total dust deposition has exceeded the 4 g/m^2/month criteria for three months at DG3, nine months at DG4 and three months at DG6.

Elevated dust levels at these locations were likely due to large scale excavation works being undertaken in close proximity to these dust deposition gauges. These excavation works are scheduled for completion by 2016 by which time this potential dust generating activity would cease. However there may be some minor shaping works of the excavated natural rock batter in the northern and north-eastern areas of the landfill footprint.

Figure 3.6 Dust deposition monitoring locations

Table 3-1 Summary of dust deposition gauge monitoring results (insoluble solids g/m^2/month)

Site	Descriptor	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
DG1	Average	0.9	0.9	0.9	1.2	1.3	0.9	1.8	1.5	0.6	1.2	2.0
	Max	2.3	2.0	2.5	3.5	2.5	2.1	5.5	5.1	1.3	3.0	3.3
	SD	0.6	0.4	0.6	1.0	0.6	0.6	1.6	1.8	0.3	0.7	1.8
DG2	Average	0.9	1.1	1.1	1.4	1.2	2.0	1.3	0.7	0.4	0.5	0.7
	Max	2.2	2.5	3.1	3.5	2.7	10.0	3.3	1.6	1.9	1.2	0.7
	SD	0.7	0.7	1.0	1.0	0.8	3.1	1.0	0.5	0.5	0.3	0.1
DG3	Average	1.4	2.6	2.1	3.6	5.3	3.7	4.1	3.2	1.8	2.3	3.5
	Max	3.9	6.7	7.3	17.7	13.2	10.0	8.5	7.7	5.6	7.4	5.1
	SD	0.9	1.7	1.8	4.8	3.3	2.9	2.8	2.0	1.4	1.9	2.3
DG4	Average	3.7	4.2	9.0	3.3	4.6	3.9	4.9	2.3	5.1	2.8	2.5
	Max	9.4	7.2	44.9	9.5	7.1	6.1	8.2	4.9	12.1	6.2	2.8
	SD	2.0	1.6	14.1	2.6	1.7	1.3	1.8	1.2	3.5	1.7	0.5
DG5	Average	2.1	2.3	1.9	2.6	2.0	1.0	2.0	1.3	0.8	1.3	1.0
	Max	4.5	4.7	3.0	4.9	3.3	1.9	5.8	4.6	2.3	3.0	1.3
	SD	1.2	1.0	0.6	1.7	0.9	0.5	1.7	1.1	0.6	0.8	0.4
DG6	Average	2.5	2.3	2.7	3.0	3.1	2.7	2.2	1.7	1.5	1.7	4.5
	Max	12.5	4.1	4.8	7.2	9.0	9.2	7.5	3.2	7.7	4.2	5.3
	SD	3.4	1.2	1.0	2.0	2.2	2.6	2.0	1.0	2.1	1.3	1.2

3.4 Odour complaint history

SITA provided GHD a summary of odour complaints at the LHRRP from January 2004 to the end of 2014. Most of the odour complaints occur in autumn and winter during stable weather conditions.

2013 and 2014 have seen the lowest number of odour complaints in the last 10 years with 28 and 16 complaints respectively. It is expected that these reduced number of complaints are due to the adjustments SITA have made to the operations of the facility which took time to realise due to the scale of the facility.

The majority of these complaints were sourced from the surrounding suburbs of Engadine, Menai and Barden Ridge with the complaints location on average 3-5 km from the LHRRP. Most complaints describe the odour as rotting garbage/ gassy / rotten eggs (which would be attributed to landfill operations) and have been registered to have occurred early morning 6-9 am and evening 6-9 pm.

Figure 3.7 summarises the odour complaints received at the LHRRP between 2004 and 2014.

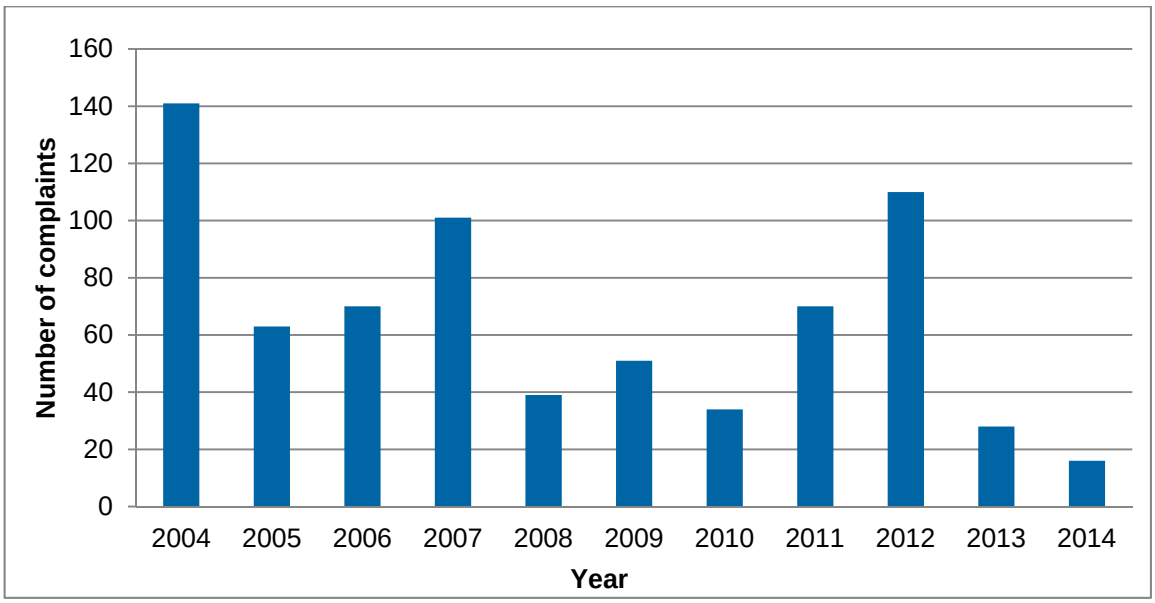


Figure 3.7 Frequency of odour complaints, LHRRP 2004 – 2014

3.5 Potential sources of odour

The potential odour sources for each of the existing and proposed activities are identified in this section.

3.5.1 Existing Activities

Landfill

The potential odour sources are:

- Depositing and landfilling waste on the active landfilling (tipping) area
- The covered areas (daily, intermediate and final), including the batters which are covered by intermediate cover
- Leachate ponds

GO Facility

The potential odour sources are:

- Receivals area
- Loading materials
- Compost and stockpiled materials, including blending materials
- Turning compost
- Compost pond

3.5.2 Proposed Activities

Landfill, GO and ARRT Facilities

The potential odour sources are the same as described above. The only additional potential odour sources to these are the strip back area and the emissions from the ARRT facility's biofilter.

3.6 Potential sources of dust

A review of potential sources of dust at the LHRRP has been undertaken, with dust levels for key activities listed below.

Landform

The following activities have been identified as potential sources of dust on the landform:

- Wheel generated dust from vehicles (including trucks and light vehicles) travelling on unpaved surfaces
- Excavators/front end loaders on landform
- Bulldozers
- Scrapers
- Graders
- Trucks dumping
- Loading stockpiles.

Dust generation would continue to be effectively controlled in the future as SITA has recently increased the site's water storage capacity.

ARRT including matured stockpiles

The following activities have been identified as potential sources of dust at the ARRT:

- Wheel generated dust from vehicles (including trucks and light vehicles) travelling on unpaved surfaces
- Excavators/FELs on landform
- Graders
- Trucks dumping
- Loading stockpiles.

With appropriate dust controls, including regularly sweeping of hardstand areas and water sprays if necessary dust from the ARRT operation is expected to be negligible.

Garden organics

The following activities have been identified as potential sources of dust at the GO facility:

- Shredding of garden organics
- Screening of the matured product

However, these sources are localised sources (significant distance to receptors) and would be negligible with the application of appropriate dust controls as proposed in the GO facility operations environmental management plans (SITA Australia, 2014c). In addition, the moisture content of incoming garden organics and matured compost products are generally quite high and therefore they would not be a significant source of dust.

Other materials required for blending with finished compost such as sand are not considered to have any significant potential to generate airborne dust. Sand particles are relatively large and only very strong winds can lift sand particles. In any event, the small number of sand particles disturbed by strong winds would settle quickly..

This is supported by GHD's site visit to the existing GO facility where no significant dust issues were observed.

4. Proposed major odour improvements

4.1 Improvements to existing operations

In undertaking this assessment, SITA's recent modifications to site operations to reduce the odour emission potential from the existing operations has been taken into account.

As part of this assessment, GHD was engaged to undertake a site specific odour sampling program (refer chapter 6 for details). One of the key findings from the site specific odour sampling program was the identification of major odour contributing areas, which are:

- the existing northern batter
- two areas of intermediate cover, one of them south of the virgin excavated natural material (VENM) stockpile and the other adjacent to it

SITA is committed to reducing potential odour emissions from the landfill component of the site and a major improvement would be achieved by the continued reduction of odour emissions from these areas. The existing landfill gas extraction and oxidation system is being refined in these areas to reduce their emission of odour. Other controls are also in place and may be implemented if needed (SITA 2014a).

4.2 Improvements due to the proposal

In assessing the odour emissions from the proposal, improved management practices that would be in place has also been taken into consideration. This includes:

- Phased reprofiling works to increase the final capped and revegetated areas of the LHRRP before reprofiling activities are undertaken on existing capped and revegetated surfaces. Site specific odour sampling (refer section 6) has shown that the intact capped and revegetated surfaces of the site are not contributors of odour emissions from the premises. By increasing the slope of the final landform, stormwater run-off would be more efficient and thereby would reduce leachate generation (GHD 2015b) and the potential for leachate to interfere with the efficient performance of the landfill gas extraction works.
- In regards to the composting operations, the proposal involves relocation of the existing GO facility to the west of the site further away from the existing and proposed receptors. Similar to existing operations, no putrescible waste would be composted at this site. In addition to this measure, the initial pasteurisation stage (duration of four weeks) of the composting process would be undertaken in aerated concrete bunkers and covered by semi-permeable covers. These proposed new controls would result in a reduction in the potential odour emitted from the relocated GO facility.
- The operations of the proposed ARRT facility would be conducted fully inside a building maintained under negative pressure, including the storage of the compost type products it produces. All air emissions from the ARRT would be treated in a biofilter before being emitted to the atmosphere which is considered to be best practice.

4.3 Improved management

In addition to the above technical improvements, SITA would enter a proposed Voluntary Planning Agreement (VPA) with SSC in accordance with the requirements of the EP&A Act. Under the VPA, SITA is committing to meet a number of environmental commitments in terms of actions it would take based on the site's environmental performance. Revised Operations Environmental Management Plans (OEMPs) have been developed as part of the EIS preparation for the:

- LHRRP (SITA 2014a)
- Proposed ARRT facility (SITA 2014b)
- Relocated GO facility (SITA 2014c)

5. Methodology

5.1 Odour assessment

5.1.1 Overview

The following points summarises the methodology adopted for the odour assessment:

- Site inspections were undertaken to develop an understanding of the existing LHRRP processes and potential odour sources, and to review odour complaint history. The site visits were also used to gain an appreciation of the potential receivers and surrounding terrain
- A review was conducted of the odour emission rates sampling regime of other landfill expansion projects in NSW which have been approved
- Extensive odour emission testing was undertaken at LHRRP to quantify a reliable dataset which takes into account variability of odour emissions from the landfilled areas of the site. Details of the odour sampling program are contained in chapter 6
- A meteorological data file was synthesised using weather data recorded from the site meteorological station to gain an understanding of the local wind climate and use as a model input for conducting atmospheric dispersion modelling
- An odour emissions inventory was derived using:
  - measurements of odour sources onsite
  - source emission rate measurements from the emissions inventories held by GHD
- A level two odour modelling assessment was undertaken of the potential operational odour impacts using the NSW Environmental Protection Authority's (EPA) approved regulatory model AUSPLUME to predict the potential for odour impacts at the nearest residences for three different scenarios. A level two assessment is a refined dispersion modelling technique using site specific input data. Chapter 7 describes the modelled scenarios and justifications for the scenarios
- The potential impacts of the proposal were considered against relevant odour criteria, with findings documented in chapter 8
- Proposal mitigation means were considered and the odour emission predictions were updated. Mitigation means are documented in chapter 10

5.1.2 Dispersion model

Dispersion modelling was undertaken using AUSPLUME 6.0, a Gaussian plume dispersion model developed by the EPAV[2] to assess the impact of airborne pollutants by computationally predicting down- wind concentrations for the model inputs representative of pollutant emissions at a given physical site under a range of hourly varying meteorological conditions over a period of a year or more. Features of the model include: building downwash (the effect of buildings in causing a plume to be dragged down to ground level where it can impact an area); area, line and volume sources; plume rise as a function of downwind distance; and terrain adjustment for point sources.

[11] http://www.epa.vic.gov.au/air/epa/ausplume-pub391.asp

The Approved Methods states that AUSPLUME 6.0 is the approved dispersion model for use in most simple, near-field applications in NSW, where coastal effects and complex terrain are of no concern. Site specific meteorological data has been used in the model making it appropriate for use at the site.

Model configuration

Key components of the model configurations are summarised below:

- 12 month meteorological data for the period October 2011 – October 2012 from the on-site anemometer
- A 10 km x 10 km square receptor grid, centred over the LHRRP, using a grid resolution of 100 metres
- An averaging period of three minutes
- Given that the plant odour sources are all at or near-ground, the effect of local terrain is not accounted for in AUSPLUME, and terrain was therefore not included
- Horizontal and vertical dispersion were parameterised according to equations for the Pasquill-Gifford curves
- A surface roughness height of 0.6 metres (mid-way between forest and rolling rural) was used

Full details of the parameter settings are given in Appendix B.

Peak to mean calculations

The Approved Methods states that peak to mean values are applied to the emissions from the sources in order to estimate the peak concentration. Peak to mean values are required as the evaluation of odour impacts requires the estimation of short or peak concentrations on the time scale of less than one second. Dispersion model predictions however are typically valid for averaging periods of 1 hour and longer. Thus in order to predict peak concentrations a ratio between extreme short term concentration and longer-term averages were used as defined in the 'Approved Methods' Table 6.1. The far field peak to mean values were applied to the area and volume sources at the site.

5.1.3 Cumulative odour impacts

Cumulative impacts were considered by modelling all three components of the proposal (reprofiling, GO facility and the ARRT facility) at different phases of the proposal, with consideration of existing operations. Details of the different phases modelled are described in section 7.1.

Cumulative impacts that considered other sites were not required to be modelled due to the fact that there are no other significant odour sources in the immediate vicinity of the project site. The cumulative impact of different odour sources onsite has been considered in this assessment. Lucas Heights 1 as discussed in Section 3.3 of this report is not a significant contributing source of odour in the area and would have a negligible influence on the odour predictions based on the recent odour complaint history.

5.1.4 Sensitive receptors

A sensitive receptor is defined in the NSW DEC odour assessment guideline (NSW DEC, 2006) as a location where people are likely to work or reside; this may include a dwelling, school, hospital, office or public recreational area. The nearest sensitive receptors to the LHRRP and their approximate distance to the site boundary are presented in Table 5-1.

The nearest off-site sensitive receptors are those who ‘casually’ attend at ANSTO Motel and the rest of the facility (R3 and R4). The nearest residential receptors are the suburbs of Engadine, R1 (approximately 2 km to the east), Barden Ridge R2 (approximately 3 km to the northeast) and Menai R3 (approximately 3.5 km northeast).

Table 5-1 summarises the locations of the existing nearby sensitive receptors in relation to the proposal.

GLALC is proposing a development in the West Menai area. The West Menai State Significant Site contains 849 ha of mostly undeveloped land, covering parts of Menai, Barden Ridge and Lucas Heights. The site is currently zoned 1(b) Rural (Future Urban) under the Sutherland Shire LEP 2000.

The western boundary of the proposed development is Heathcote Road and the site extends east across Mill Creek to the edge of the existing Menai residential area close to New Illawarra Road. The proposed development consists of discrete pockets of housing which limits the population size in each area.

Portions of this proposal, represented by receptor R6 Gandangara, were approved for development in September 2015. The remaining areas, represented by R7 Gandangara North, are yet to be approved. Discussions of the estimated populations associated with these developments are included in Section 8.2.

The nearest locations of the proposed West Menai State Significant Site are shown on Figure 5.1.

Table 5-1 Nearby existing and proposed sensitive receptors

Receptor (closest resident to LHRRP in suburb or proposed residence)	Approximate distance to the LHRRP (km)	Coordinates (x,y) m
R1 Engadine	1.8	315291, 6230476
R2 Barden Ridge	3	316012, 6232168
R3 Menai	3.3	315668, 6233536
R4 ANSTO	0.3	313344, 6230357
R5 ANTSO Motel	0.5	314349, 6230732
R6 Gandangara	1.5	314423, 6231674
R7 Gandangara North	1.6	313444, 6233310

LEGEND

Air quality sensitive receptors

LHRRP boundary

Paper Size A4

0 125 250 500 750 1,000

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

GHD

SITA Australia
Lucas Heights Resource Recovery Park

Job Number 21-23482
Revision Draft
Date 10 Feb 2015

Air quality sensitive receptor locations

Figure 5.1

G:\21\23482\GIS\Maps\MXD\21-23482-Z051_AirSensitiveReceptors.mxd

Level 15, 133 Castlereagh Street Sydney NSW 2000 Australia **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com **W** www.ghd.com

Aerial Imagery: ESRI, 2014. Works: GHD/SITA, 2014. Roads: NSW LPMA, 2012. Created by:mweber

5.2 Dust assessment

The following points summarises the methodology adopted for the dust assessment:

- A review was conducted identifying key dust generating operations to generate a dust emission inventory
- Potential dust impacts were modelled with the significant proposed construction and operational sources of dust. Dust modelling was undertaken with consideration to the Approved Methods to determine the concentration of dust (PM_{10}) over a 24 hour period. This approach was taken as it is considered more conservative that dust depositional modelling.
- The potential impacts of the proposal were considered against relevant dust criteria
- Proposal mitigation means were considered

Chapter 9 summarises the dust assessment undertaken for the proposal.

6. Justification of odour emission rates

6.1 Purpose

In order to produce a model that is representative of the current and proposed activities at the LHRRP, it is critical to have a representative odour emission profile for the different odour sources on site.

While it is not required by the SEARs to undertake site specific assessment, having representative, recent and process specific data is considered to add value to the project. The approach taken for this impact assessment is as follows:

- Undertake odour sampling to gather site specific data for the landfill operations
- For the proposed GO facility, use Australian data from similar operations
- For the proposed ARRT facility, use industry guidelines and experience to selected suitably representative and readily achievable emission rates

6.2 Overview of olfactometry

Olfactometry in Australia is undertaken in accordance with Australian Standard AS 4323.3:2001 Stationary source emissions Part 3: Determination of odour concentration by dynamic olfactometry.

The odour level (or concentration) of an odour sample is measured using a Dynamic Olfactometer, applying the 'forced choice' procedure in which two ports (one issuing odour free air, and one presenting the diluted odour sample) are to be smelt by a six person panel. Each panellist is forced to select a port (left or right) presenting the diluted odorant. If neither port is perceived to be odorous a choice must still be made but with the annotation 'guess'. When the dilution ratio reduces, a panellist may consider that one of the ports is odorous, but is not certain – in which case the annotation is 'maybe'. Finally, at a lower dilution ratio, the panellist is sure which port is odorous and the annotation is 'certain'.

The odour concentration of the sample is then defined as the dilution ratio required to bring the odour to a level at which 50% of the panellists (six are normally used) can correctly detect the odour with certainty. The unit used is an 'odour unit' or OU – as a ratio it is dimensionless.

The testing environment of olfactometry is devoid of the wide range of typical background odours which would typically vary between 5 and 30 OU.

A study that involves extensive ground truthing of model results to odour complaint history[3] states that the following thresholds are typical:

- Detection above background ambient > 10 OU
- Recognition from background ambient 20 – 50 OU
- Annoyance 40 – 100 OU

6.3 Odour sampling approach

Odour sampling in NSW is conducted in accordance with the Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales (NSW DEC, 2006). The two

[3] Lunney C, and Ormerod R, 1997, Implications of Odour Study Results for Policy Guidelines, National Conference of Odour Measurement Standardisation, UNSW Sydney

methods approved for odour sampling are OM-7 (AS4323.3-2001) and OM-8 (Odour sampling from diffuse sources USEPA (1986) EPA/600/8-8E/008).

Since the Approved Methods were published a new Australian Standard has been released (AS4323.4:2009 Stationary source emissions Method 4: Area source sampling – Flux Chamber technique). Area sources listed in AS4323.4 that are relevant to the LHRRP include:

- Landfill surfaces (e.g. working face, soil/compost/synthetic cover, clay capped and revegetated) of various ages
- Sewage treatment plant surfaces (e.g. inlet channels, primary sedimentation tanks, aeration tanks, activated sludge tanks, clarifiers, sludge lagoons, sludge drying beds, facultative lagoons, anaerobic lagoons and dissolved air flotation tanks)
- Composting surfaces (e.g. raw material stockpiles, compost windrows and final product stockpiles)

GHD met with the EPA on 1 May 2014 to discuss and seek feedback on the proposed odour sampling for this project. The EPA advised the following:

- Any departures from the Approved Methods for sampling of odour emissions needed to be justified
- The odour sampling program should take into account variability in the odour emission rate from the landfilled waste
- The odour assessment should consider existing and proposed receptors and be based on a cumulative assessment of odour emissions from the proposal

6.4 Odour sampling program

With the approval of SITA, GHD engaged Ektimo to collect samples of odorous emissions from the existing landfill operations. A comprehensive odour sampling program was undertaken as part of this assessment. For the landfill operations a total of 62 additional odour samples have been taken collected between May and June 2014. The odour analysis of the samples was conducted by The Odour Unit in their NATA registered laboratory in Sydney. All samples were analysed on the day the samples were collected and well within the recommended 24 hour window from the time of sample collection.

This data has been considered in addition to the 26 previous odour samples (Holmes Air Sciences, 2006) taken at the LHRRP.

The sampling program was designed to address potential variability in the odour emission rates from each of the odour emission sources at the landfill. The experienced Ektimo sampling staff repeatedly traversed the landfill to identify the odour sources and areas of odour emission variability. During the course of this sampling program which ran over approximately a three week period, the sample locations and approaches were adapted to enable collection of odour samples from the landfill areas of the LHRRP to address odour variability.

Table 6-1 outlines the odour source, the odour release mechanism, the sample collection technique and the number of samples. The details of the odour sampling, analysis program and sampling locations are provided in the attached report from Ektimo in Appendix E.

The sample locations are presented in Table 6-1 and depicted in figures in the report from Ektimo. The sampling method and number of samples collected was derived to match the variation in odour emissions detected from the site.

For certain landfill areas, the isolation flux chambers (IFC) technique was considered to potentially underestimate odour emissions. Upwind and downwind transects were used instead to collect samples to enable quantification of the odour emission rates from:

- Large areas which were observed to have potentially high odour emission rates (batters, and two locations on the existing intermediate cover south of the excavation void). In the case of the batter see Section 6.4.2 below
- The active tipping area to enable consideration of the odour from the tipping of waste from vehicles and its movement and compaction
- The leachate ponds to account for their aeration

Table 6-1 Odour sample locations

Odour Source	Odour release mechanism	Collection technique	Number of samples taken
Final capped area and background not over waste	Gas diffusion through surface	IFC	7
	Gas leakage via fissures (localised emission points)	IFC	3
Intermediate covered area south of excavated void (and therefore south of the landfill batters) and background not over waste	Gas diffusion through surface	IFC	7
	Gas leakage via fissures (localised emission points and localised emission areas)	IFC	5
		upwind & downwind transect	4
Test pits of the intermediate covered, final capped and background area. The test pits were south of Stage 5 (the excavation void) and the background area was not over landfilled waste	Direct odour emissions from exposed surface	IFC	11
Active tipping face & daily and intermediate cover (within Stage 5)	Direct odour emissions from exposed waste material	IFC	3
		upwind & downwind transect	4
Leachate pond	Quiescent surface	IFC	2
	Aeration of leachate	upwind & downwind transect	2
Stage 4 Batter (the western portion of the batter into the excavation void)	Gas diffusion through surface	IFC	3
	Gas leakage via fissures (localised emission points)	IFC	3
		upwind & downwind transect	4
SITA Batter (the eastern portion of the batter into the excavation void)	Gas leakage via fissures (localised emission points)	upwind & downwind transect	4
Total			62

A summary of this work is discussed in more detail below.

6.4.1 Active tipping face

In-field measurements of odour emissions from the active landfilling area at the LHRRP were conducted. Direct methods of odour emission rate (OER) measurement for extended sources (such as use of flow-through hoods and isolation flux chambers) could not readily be used in this area as:

- the operations of delivering loads to the tipping face by truck and the moving of waste to the tipping face by dozer and compacting would have to cease
- the emitting surface is highly heterogeneous and uneven, making the placement and sealing of hoods or chambers difficult

The indirect method of measuring the down-wind plume odour levels across a transect at short range was adopted instead. This method required concurrent sampling at each station on the transect, and required the atmospheric conditions (wind speed and atmospheric stability category) at the time of sampling to be measured/calculated. The method also required dispersion modelling to back-calculate the specific odour emission rate (SOER), (where SOER = OER/unit area) of the active tipping face.

During the tipping face odour measurements trucks were actively tipping waste and waste compactors were moving about the tipping face which contribute to the total odour. Measurements were also conducted in a manner to ensure the safety of the sampling staff by being a suitable distance from the tipping face and moving equipment.

6.4.2 Landfill batters

Odour from large area sources with variable emission such as the landfill batters were measured using the indirect method of measuring up and down wind of the source. The use of IFC for odour measurements on variable sources such as a batter may not consider the inherent odour variation of this source and could possibly lead to significant underestimation of the entire odour levels (Standards Australia, 2009).

Some parts of the landfill batters displayed signs of staining and cracks. Ektimo advised that there were areas where landfill gas was observed however this was variable across the batter. In order to gain an understanding of the overall potential odour emission, it was initially proposed to undertake up and down wind odour samples. The results of this work were inconclusive due the elevation and steepness of the terrain.

However it was concluded that the existing large surface area of batter in the excavation void area was a significant potential contributor of odour from the site.

6.4.3 Localised emission points on final cap

The localised emission areas and points were identified by a detailed walkover of the site.

Odour emissions from areas of variable emission such as larger emission areas on the generally flat intermediate cover (south of the landfill batters) were also measured using the indirect method of measuring up and down wind of the source.

Odour samples from smaller localised emission points (fissures) on the existing capped and revegetated surface and the old intermediate cover were undertaken using the IFC method. Although the emission rates from these areas were found to be high, the areas (measured using IFC) of these sources are very small compared other potential higher sources of odour onsite (for example the existing batters leading into the excavation void).

SITA has since rectified these localised emission points.

6.4.4 Final cap

Five IFC measurements were undertaken on the final capped area to determine any variability in odour emissions over the large area, following the work in the above section which had already identified the localised emissions points.

The odour from the final capped and revegetated areas was of a character essentially reported identical to that of the background measurements (of areas not on waste). Furthermore, the

sampling shows that the median of the grid measurements on the final capped and revegetated areas is in fact lower than the background measurements of the same character. Three minor localised emission points were identified on the final capped and revegetated area (discussed above). Based on this information it is reasonable that the final capped and revegetated area be assigned an SOER of zero (O), but with the inclusion of the identified localised emission points in the existing modelled scenario. SITA has advised that these localised emission points on the existing capped and revegetated area have since been rectified, hence why the future scenarios (2, 3 and 4) do not take these into account.

6.4.5 Daily and Intermediate cover

Daily cover and intermediate cover in the area where waste disposal activities are being conducted emitted an odour character indicative of waste. This differs to the older intermediate covered areas (south of the existing batter) which are generally not considered an odour source, with the exception of two main odour emitting areas (refer below).

Automatic tarp machines (ATM) (tarps as daily cover on the active tipping batter areas) have been extensively trialled over 2014. An application is before the EPA demonstrating their performance. It is expected that they would be approved by the EPA as an alternative to VENM daily cover and provided this approval is granted by the EPA the development application is seeking their continued use.

Daily cover

Odour from the daily cover area was measured by IFC nearby the active landfilling area. This was an area that had 150 mm of cover applied. This new area where landfilling had recently commenced did not have an operational gas extraction system.

Old intermediate cover (south of the landfill batters)

The odour emission rates measured from the intermediate covered areas (with active landfill gas extraction) were such that there were:

- The majority of the area was the same odour character as the character reported for the background measurements which are of areas not on waste. Where the one sample identified in the grid measurements was an odour of waste character, its location was part of the rectangular section south of the excavation stockpile.

  The intact intermediate cover area is not a contributor of odour from landfill waste.

  These results demonstrate the overall effectiveness of the active landfill gas extraction system for the intact intermediate cover area to prevent the emission of odour.

Three additional localised emission points were identified outside of the v section and rectangular area south of the excavation stockpile. SITA has since rectified these emissions.

- Two significant odour emission areas (hereafter referred to as the ‘v section’ and the ‘rectangular area south of the excavation stockpile’ due to the plan view shape of the areas).

New intermediate cover

Odour from the new intermediate cover area was measured by IFC at the active landfilling area. This was an area that had 300 mm of cover applied. Areas classified as new intermediate cover are present in the existing scenario and all future scenarios. These new areas where landfilling had recently commenced did not have an operational gas extraction system.

6.4.6 Leachate ponds

IFC measurements were undertaken during quiescent conditions. During aeration, odour from the main leachate pond was also measured using the indirect method of measuring up and down wind of the source.

The leachate pond released odour emissions at rates typical of other landfills.

6.4.7 Test pits

Test pits were excavated at a range of depths in the older areas of the landfill (south of the excavation void) to assess the odour emission from potentially stripping intermediate and existing capped surfaces to enable the continuity of waste and minimise the risk of the perching of leachate on cover layers. The results concluded that:

- For intermediate cover measurements the character of the odour from the samples differed at the two depths. At 150 mm the character of the odour was described as grass, dirt and mould, while at 450 mm there was a notable ammonia odour. Given that there was no ammonia or waste related odour detected at 150 mm these measurements have been excluded, while the measurements at 450 mm have been used in the modelling
- For existing capped area measurements at all depths the character of the odour from all samples were described as in similar terms as the character of the background measurements (not over waste). Given that there was no ammonia or waste related odours detected these sources have been excluded from the contribution of odour from the proposal

6.4.8 Landfill odour sampling conclusion

The outcome of this extensive sampling work has identified three areas where there are significant potential odour emissions from the landfill. GHD has identified that there are odour emissions from two areas on the intermediate covered area (south of the landfill batter) and the existing landfill batters at the northern end of the site. Control works to these areas are either completed or ongoing.

6.5 Odour emission rates

6.5.1 Landfill

Based on the sampling program described above in section 6.4, the applied odour rates used in the impact assessment are summarised in Appendix D. The justification for the odour emission rates applied in this study for the LHRRP is provided in Appendix C.

6.5.2 Garden organics facility

SITA proposes to:

- relocate the existing GO facility to the western side of the site
- increase its capacity from 50,000 t/yr to 80,000 t/yr
- include an active aeration phase which is to be covered with a semi-permeable membrane.

The additional controls would result in a lower odour potential from the relocated facility compared to the current composting operations. The new site is also located on the western side of the site, further away from the nearest sensitive receptor ANSTO and the existing and potential futures residences.

The new GO facility would be operated differently and more efficiently than the current eastern GO facility. Rather than have large static stockpiles that are on site for several months, a more refined and controlled process would be undertaken. This includes a definite 4 week pasteurisation period in concrete bunkers followed by 8 weeks of maturation. This more controlled process would result in reduced odour emissions from the current process. The proposed western GO is to be undertaken in concrete bunkers, meaning that the surface area of the total compost windrow would be minimised when compared to traditional open windrows. The compost in these bunkers would be covered with a semi-permeable membrane cover significantly reducing the odour emissions from this most active phase in the composting process.

SITA engaged GHD on 6 October 2008 to conduct a baseline odour survey of their green waste processing facility at 9 Bunting Road Brooklyn. The operations at Brooklyn comprised composting using uncovered windrows. Waste inputs were green waste and grease trap waste. Windrows are turned with a Topturn 53 and forced aeration is not applied. GHD used a schedule of measurements of windrow odour emission rate (OER) using an innovative 'temporary enclosure' device to ensure that the odour emissions from both the sides and the crest of the windrow were captured.

OER measurements were made on windrows to determine:

- The effect of turning each windrow
- The effect of ageing of each windrow on OER as it progresses through the 12 week maturation period
- The effect of removal of the grease trap waste component stream
- The effect of wind-stripping on windrow OER

OER measurements of windrows including greasetrap and those of just green waste were taken, from the results it was concluded that the removal of greasetrap waste from the windrows lead to a substantial ~ eight-fold reduction in windrow OER. Odour sampling was undertaken at 4 points in time (windrow ages 1 day, 1 week, 4 weeks and 12 weeks) to determine the mean windrow OER of the windrow array at Brooklyn. These measurements when plotted enable an approximate OER at every week in the process to be interpolated.

GHD has used this data to assess the potential odour emissions from the proposed western GO facility at the LHRRP. SITA propose to utilise covered windrows at LHRRP, so using odour emission data for uncovered windrows would yield conservative results in this assessment. GHD also understands that the proposed GO composting at LHRRP would be undertaken in a similar time frame to the operations at Brooklyn, with a 4 week pasteurisation period (active composting) followed by 8 weeks of maturation.

Data that GHD has obtained for other covered windrow odour trials in New South Wales and New Zealand suggest more than 4 fold reductions in odour would be expected when compared to the uncovered odour trials at Brooklyn. GHD are not in a position to reference this data as it is not in the public domain, however these trials did show the effectiveness that a covered system has on reducing odour emissions.

For current operations on the eastern side of the LHRRP (static piles followed by maturation) the ANL and other datasets has been used while for proposed GO operations to be conducted on the western side of the Site the SITA Brooklyn dataset was used. The justification of the utilisation of these datasets is provided in Appendix C.

Using the Odour emission rates from SITA Brooklyn for the new western GO facility is therefore considered conservative as this assumes emission rates with uncovered windrows when SITA would be using covered windrows with associated lower odour emissions.

For comparative purposes, GHD has also undertaken an odour modelling scenario assuming the use of breathable membrane covers. Literature indicates a range of odour reductions by using breathable membrane covers on greenwaste composting windrows, from 90% and up to 97% (Gore, 2008). GHD has conservatively used a 90% odour reduction of the SITA Brooklyn data for the first four weeks of the active composting period.

6.5.3 ARRT facility

The ARRT facility would be operated under negative pressure and this would prevent any uncontrolled odour emissions from the facility. All air from the operation of the ARRT facility would be emitted via a biofilter air discharge portal.

The proposed odour emission rate applied to the biofilter is 250 OU x Flowrate (OER). This value has been developed based on GHD's review of similar approved alternative waste treatment projects in NSW. The Victorian EPA have accepted 250 OU x Flowrate (OER) whilst in NSW a range of values have been accepted by the regulators based on the performance of well-maintained and operated bioilters.

This proposed odour emission rate is supported by GHD's recent work on behalf of the New South Wales Department of Planning and Infrastructure. GHD was engaged by the Department in 2013 to undertake a peer review of the performance of biofilters and odour modelling for the Bedminster Waste Facility at Raymond Terrace which accepts municipal solid waste, garden waste and bio-solids for processing. The measurements reported a mean value of 185 OU (with a lower value if the medium of the results was applied). This demonstrates that a well operated biofilter does achieve odour levels of less than 250 OU.

The details for the odour emission rate are provided in Appendix C.

7. Odour modelling scenarios and justifications

7.1 Scenarios overview

Four operating scenarios for the LHRRP have been considered in the odour impact assessment. These have been selected to predict the odour levels potentially experienced at offsite receptors from existing and proposed operations.

A summary of each scenario is presented in Table 7-1 and in the figures below. Maps of future landfill phases are shown in Appendix C.

- ***Scenario 1*** – Existing LHRRP (2014) includes the current landfill and garden organics composting on the eastern side of the site and all related potential odour emitting activities
- ***Scenario 2*** – Future Phase 1 (2016) includes the commencement of reprofiling of the site in 2016, improved odour controls for the landfill and garden organics composting on the eastern side of the site as for scenario 1. This scenario coincides with phase 1 of the proposed reprofiling works and it takes into account the time needed to establish the GO and ARRT facilities on the western side of the site
- ***Scenario 3*** – Future Phase 6 (2021) includes the proposed western GO facility with open windows (no covers) and the proposed ARRT facility. This scenario is conservative as SITA propose to use covered windrows on the new garden organics area for the initial pasteurisation stage which would further reduce odour emissions. This scenario is also considered to be the pseudo 'worst-case' for odour generation at the entire LHRRP, as the area of final cap would progressively be expanded from this point forward reducing emissions. This scenario coincides with phase 6 of the proposed reprofiling works when the stripping of the existing intermediate cover is closest to the existing and proposed residences. The justification for the selection of these scenarios is provided in section 7.2

  This scenario is considered the pseudo worst case as it does not consider the odour reduction that would be achieved by covering the pasteurisation composting stage (four weeks).
- ***Scenario 4*** – Same as scenario 3 however includes the use of breathable membrane covers on the four week pasteurisation stage on the new garden organics area.

Table 7-1 LHRRP operating scenarios assessed

	Landform	Garden organics	ARRT facility
Scenario 1	Current 2014	Current 50,000 t/yr	None
Scenario 2	2016	Current 50,000 t/yr	None
Scenario 3	2021	Western 80,000 t/yr	Yes
Scenario 4	2021	Western 80,000 t/yr with breathable membrane covers	Yes

7.2 Justification

The basis for selecting the above scenarios is described below and shown in Figure 7.1. In summary the current operations is shown to have the highest odour emitting potential and following the completion of the odour mitigation measures being implemented by SITA all future

stages would generate lower odour emission rates, with Phase 6 being assessed as being the future worst case due to its proximity to the proposed residences.

This is demonstrated in Figure 7.1 which provides a summary of the total relative potential odour emissions emitted onsite based on a mass balance. This figure shows estimated daytime odour levels from the landfill, the garden organics emissions and then the ARRT facility emissions when they can come on line in 2017. Total emissions are expected to reduce significantly in 2016, and rise partially again in 2017 with the introduction of the ARRT facility.

The significant reduction in potential odour emission between the existing operations and Phase 1 (2016) are attributable to SITA committing to engineer a solution to the three higher odour contributing areas from the landfill during 2015/16. The main odour contributing areas are the existing northern batter, the ‘v section’ and ‘rectangular area south of the excavation stockpile’. The range of solutions which are already progressively been applied to these areas are outlined in the OEMP (SITA, 2014a).

Since the studies documented in this report were commenced SITA has installed twenty nine (29) additional landfill gas collection wells at the LHRRP. These were installed to address the issues identified by this study and generally to expand the gas collection system.

2021 is considered to be a worst-case scenario with landfill odour emissions expected to remain relatively similar from 2017 to 2037. The year 2021 was selected based on its proximity to the proposed residences and in areas where stripping of old intermediate surfaces would occur. The odour sampling indicates that stripping in areas of old intermediate surfaces has a potential to release odour, whereas stripping over the capped and revegetated areas does not (refer section 6.4.7).

In subsequent years after 2021, as more of the landfill is capped and revegetated, potential odour emissions would be reduced from the site. In the preceding years from 2017 to 2021, the potential odour impacts are expected to be less as the reprofiling works are located further away from the proposed residences and are on areas that were previously capped and revegetated.

Once the whole site is converted to parkland it would have a significantly lower potential of causing any odour emissions.

The existing and Phase 6 are therefore modelled to represent worst case. Phase 1 is modelled to suggest the impact of the start of the proposal (start of re-profiling works).

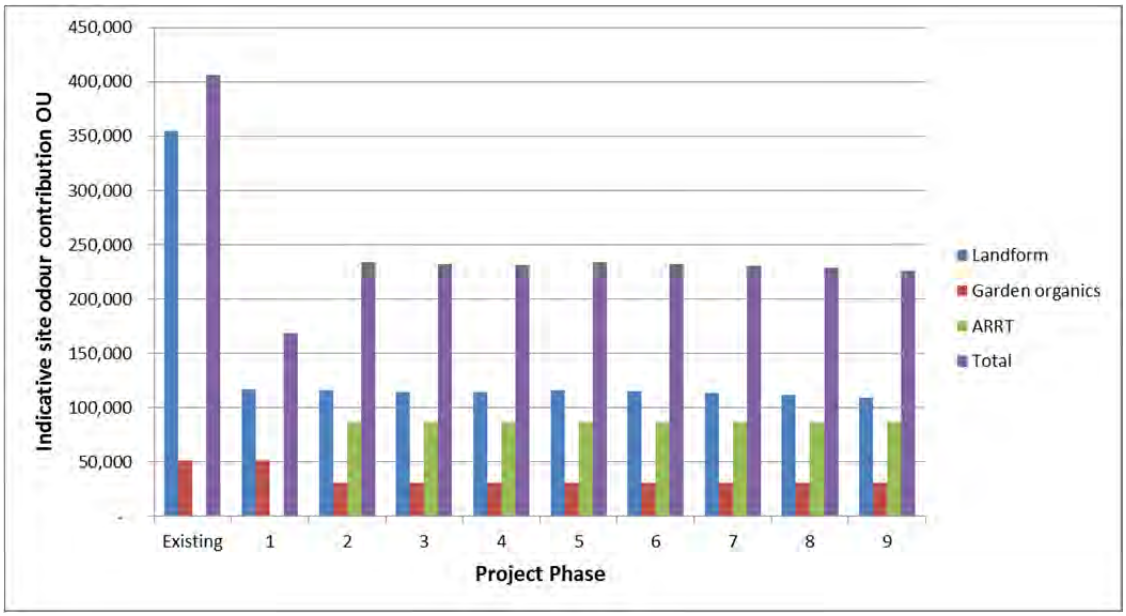


Figure 7.1 Summary of odour trends over time

7.3 Scenario 1 – Existing 2014

7.3.1 Landfill

Key aspects include:

- The approved waste disposal rate at the LHRRP landfill is 575,000 tonnes per year
- Since December 2013, landfilling is being undertaken at Cell 5.2B and Cell 5.3A which commenced in November 2014
- The cover material type across the remainder of the site is approximately 50% intermediate cover and 50% final capping and revegetated surfaces
- The current operating hours for the LHRRP site are 6 am – 4 pm Monday to Friday and 8 am – 5 pm on Saturdays and Sundays

Appendix D shows the current location of landfilling tipping face, the intermediate and final capped areas and the leachate ponds.

7.3.2 Garden organics facility

Key aspects include:

- The 1999 conditions of consent limit the amount of waste to be received at the existing GO facility to 55,000 tonnes per year. In addition, EPL No. 12520 caps the amounts of waste to be received at the existing GO facility at 50,000 tonnes per year. The EPL also limits the maximum quantity of GO and wood waste combined (either processed or unprocessed) that can be stored on site at any one time to 18,000 tonnes
- The existing GO facility was established in 2000 and accepts separated garden organics from kerbside collections, transfer stations and individual customers. The current footprint of the existing GO facility is approximately 10 ha. The existing GO facility is located on a previously filled stage (Stage 1A) of the landfill and is zoned 5(f) Special Uses (Waste Recycling)
- The current operations of the existing GO facility are summarised in Table 7-2 below and the current layout and configuration is provided in Figure 7.2. The current existing GO facility process takes between around 30 or more weeks to complete from delivery to blending. The current operating hours for the existing GO facility is 6 am – 5 pm Monday to Friday and 8 am – 5 pm on Saturdays and Sundays
- The area is surrounded by a landscaped earthen bund with the main access from an internal landfill road on the eastern side (refer to Figure 7.2). There is a second access road on the southern end for equipment. Site offices and amenities for staff are located on the northern side of the existing GO facility
- The existing GO facility produces a range of products suitable for mulch and compost applications. Mulch products are extensively used in ornamental landscaping, while composting products are used as soil conditioners for agricultural, horticultural and restoration projects

Table 7-2 Current existing garden organics facility process

Stage	Activity	Duration
1	**Receival, decontamination and grinding/shredding** Incoming garden organics is delivered to the receival, decontamination area and shredding area where gross contaminants are removed, it is shredded (or grinded).	1 week
2	**Static stockpile and watering** The material is then stockpiled for approximately one month – some water may be added at this stage to maintain moisture levels.	1 month
3	**Static stockpile - watering and turning** The product is then moved by truck to the initial composting area. During this phase the compost is turned regularly (every two weeks or monthly) and watered. The temperature of the piles is monitored regularly.	4 months
4	**Windrows for maturation** After approximately four months the material is then formed into windrows for further maturation, turned and watered as required. Turning generally occurs weekly over a period of six weeks.	6 weeks
6	**Blending** The matured compost is then moved to the blending area where it is mixed with sand, pre composted manure and or bark etc. ready for sale.	1 week

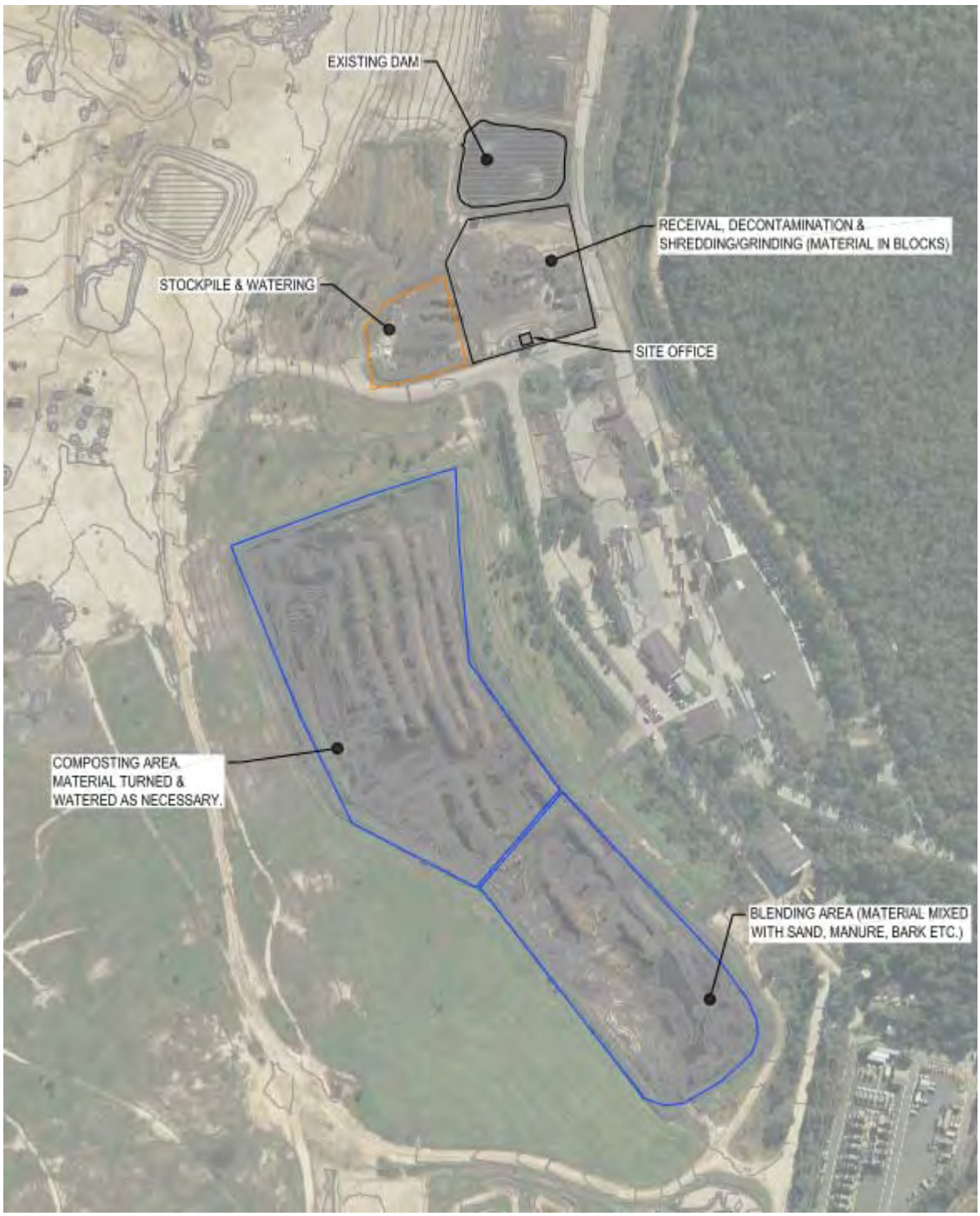


Figure 7.2 Existing garden organics facility operations and layout

7.4 Scenario 2 - Future 2016 (Phase 1)

Scenario 2 includes the commencement of reprofiling of the site in 2016 and the existing garden organics composting on the eastern side of the site.

7.4.1 Landfill

Key aspects include:

- The 2016 input rate for landfilling of waste at the LHRRP would be approximately 670,000 tonnes for this year of general solid waste (putrescible and non-putrescible).
- In this scenario, filling work ceases in Cell 5.2 and Cell 5.3 areas and re-profiling work commences. The first area to be filled is proposed to be Area E. The waste surfaces in Cells 5.2 and Cell 5.3 would have intermediate cover placed.
- Area E would be stripped of its existing cover material down to a maximum depth of 0.45 m and over an area of approximately 1 Ha of which only 2,500 m^2 would be less than 1 day old since it was stripped. On each day of landfilling the stripped surface would be extended to previously landfilled waste over an area of 2,500 m^2. The justification for this stripping arrangement was derived from site measurements outlined in section 6.4.7.
- Appendix D shows the 2016 location of landfilling tipping face and the intermediate and final capped areas and leachate ponds.

7.4.2 Garden organics composting

As per scenario 1 (section 7.3.2) above.

7.5 Scenario 3 – Future 2021 (Phase 6) pseudo worst case

Scenario 3 includes the proposed 2021 western garden organics facility with open windows (no covers) and the proposed ARRT facility. This scenario is also considered to be the 'worst-case' for odour generation at the entire LHRRP, as it is the area closest to the proposed and existing residences. However, this scenario doesn't take into account the proposal to cover the active composting windrows.

7.5.1 Landfill

Key aspects include:

- The 2021 input rate for landfilling of waste at the LHRRP would be approximately 850,000 tonnes for this year of general solid waste (putrescible and non-putrescible).
- Filling is completed in Area C (GHD 2015a). The portion of Area C reaching final levels would have the final cap placed and revegetated. The batters would be intermediate covered.
- Stripping is undertaken in Area F and becomes the active cell area. The stripping procedure of the areas over the existing intermediate covered area would be the same as described for Scenario 2. Stripping of the existing capped and revegetated areas would be extended to no more than 1.3 m over an area of approximately 1 ha in advance of the active landfill area. On the day of landfilling the cover material would be removed down to waste over an area equivalent to the area of the active landfill area.
- Appendix D shows the 2021 location of landfilling active cell and the intermediate and final capped areas.

7.5.2 Garden Organics facility

Key aspects include:

- The proposed 80,000 t/yr GO facility and layout was designed by SITA
- SITA has provided a summary of the volumes to be composted each year and is presented in Table 7-3. The areas of the different stages in the process are presented in Table 7-4
- The proposed GO facility would be undertaken in concrete aerated bunkers. As the concrete bunkers have sides, the emitting surface area would be lower than traditional compost windrows. The surface areas and volumetric capacity of the different stages of the process have been calculated by SITA along with the residence time of each process. The location onsite of the different composting processes is shown in Figure 7.3

Table 7-3 Summary of 2017 green waste and garden waste organics inputs and outputs

In-coming product	Tonnes per year
Green waste	80,000
Pre composted turkey manure	2,000
Sand	35,000
Water	4,650
Total IN	121,650
Outputs	**Tonnes per year**
Residues	250
Loss of organic matter	10,066
Water losses	28,673
Mulch	12,000
Enriched compost (mix of green waste and manure compost)	35,661
Sand blended in compost products, as required	35,000
Moisture and other losses	Approximately 50,000
Total OUT	**121,650**

Table 7-4 Proposed 80,000 t/yr garden organics process

Area	Surface area (m^2)	Volumetric capacity (m^3)	Storage capacity/residence time
Reception area	1,650	5,000	1 day
Storage, preparation and shredding area	1,880	7,000	5 days
Active composting area	6,000	18,000	6 weeks (4 in peak periods)
Maturation area	5,000	15,000	8 weeks
Blending area	400	-	-
Storage area	7,000	21,000	5 months
Leachate pond	6,818	16,800	6 months (with odour emissions assumed for 12 months)
Traffic ways	12,900	-	-
Total	37,330	-	-

LEGEND

- Lucas Heights Resource Recovery Park boundary
- Internal access road
- Creek
- Landfill area

1. Waste reception/sorting/preparation
2. Active composting
3. Maturation
4. Finished compost storage
5. Mulch storage
6. Leachate pond
7. Reception
8. Blending
9. Hardstand
10. GO sump
11. Amenities office

Paper Size A4

0 10 20 40 60 80

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

SITA Australia
Lucas Heights Resource Recovery Park

Job Number 21-23482
Revision A
Date 05 May 2015

GO facility layout

Figure 7.3

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Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

Aerial Imagery: SITA, 2014. GO&ARRT: GHD/SITA Australia, 2014. Roads/Suburb: NSW LPMA, 2012. Created by:jrichardson

7.5.3 ARRT facility

Key aspects include:

- The ARRT facility involves the construction and operation of a new best practice fully enclosed 200,000 tonnes per year ARRT facility to process municipal solid waste
- The facility would generate an estimated 50,000 tonnes of compost type products and a further 40,000 tonnes of Processed Engineered Fuel (PEF) and other recyclables per year. It is estimated that approximately 60,000 tonnes per year of residuals from the ARRT facility would be deposited at the LHRRP site. The PEF would be exported off-site. The remaining 50,000 tonnes per year would be production losses, evaporation and conversion to carbon dioxide in the composting process
- The ARRT facility would be a mechanical biological treatment facility with two separate processing lines. One would be dedicated to processing mixed waste by separating organic material from the waste stream (for separate composting) and recovering recyclables (mostly ferrous metals and aluminium). The second processing line would remove contaminants from source-separated food and garden organics to prepare it for processing
- The organic material from each line would then be aerobically treated in a composting hall. The facility would incorporate best practice measures for odour control. This includes composting within the building to minimise the potential for odour impacts. The maturation process would also be completed in an enclosed building and all product material would also be stored internally until it is transported offsite for reuse. Air from both composting and maturation processes would be treated using a biofilter to reduce potential odour impacts
- A summary of the building and biofilter dimensions is provided below in Table 7-5

Table 7-5 ARRT and biofilter dimensions

Parameter	Dimensions
Building area	20,690 m^2
Building height	15 m
Building volume	310,350 m^3
Number of air exchanges per hour	4
Volume of air per hour	1,241,400 m^3
Volume of air per second to be treated	345 m^3
Biofilter air discharge portal height	20 m
Portal diameter	2 m

7.6 Scenario 4 – Future 2021 (Phase 6) with breathable membrane covers

Scenario 4 includes the proposed 2021 western garden organics facility with covered active composting windows (weeks 1 to 4) and the proposed ARRT facility. This is the expected worst-case operating scenario for the LHRRP.

7.7 Odour emission rates for scenarios

7.7.1 Current LHRRP (2014) – scenario 1

This scenario includes the existing landfill and garden organics area operating at 575,000 t/y and 50,000 t/yr, respectively. The inventory shows that the odour from the landfill increases in the afternoon due to the active tipping face operations however when the landfill is non-operational in the night time when the tip face is covered with at least 150 mm of cover material or equivalent material, odour emissions drop considerably. The landfill is the predominant source of odour onsite with over four times the total emission in the night time and 6 times in the daytime.

Landfill

The SOERs used in the model for the existing landfill are presented in Table 7-6. These are all based on measured odour emissions at the LHRRP. Other sources were identified in the final cap and intermediate cover as discussed in Appendix C that are not presented in the table below. The measured odour levels from these sources were very low (approximate OER of 100 in total) and do not contribute significantly to the total site odour footprint but nevertheless their contributions were included in the model. The contributions from the final capped area have since been rectified by SITA.

Table 7-6 Odour emissions for current landfill

Source	Surface area (m2)	SOER OUv/m2/s	OER OUv/s	SOER Reference
Active tip face morning	2,500	26	65,000	Ektimo, 2014
Active tip face afternoon	2,500	40	100,000	Ektimo, 2014
Daily cover	2,500	0.03	100	Ektimo, 2014
Daily cover area	10,000	0.03	300	Ektimo, 2014
Leachate pond (quiescent)	3,550	0.26	923	Ektimo, 2014
Leachate pond (aerated) for 2 hours of the day	3,550	1.8	6,390	Ektimo, 2014
Final cap	314,755	0	0	Ektimo, 2014
Intermediate cover	394,461	Intermediate cover without gas extraction – 0.05 Intermediate cover with gas extraction – 0.023	9,628	Ektimo, 2014
Landfill batters	Stage 4 – 44756 SITA – 64829	1.8 1.4	80,560 90,761	Ektimo, 2014
Larger emission point 1 “v section”	200	11	2,200	Ektimo, 2014
Larger emission point 2 “rectangular area south of the excavation stockpile”	11,456	5.5	63,008	Ektimo, 2014

Total AM			312,380	Ektimo, 2014
Total PM			347,380	Ektimo, 2014
Total non op			247,480	Ektimo, 2014

Garden organics composting

The SOERs used in the model for the existing garden organics composting are presented in Table 7-7. Turning of the windrows has been included in the emission rates of the 4 month old static stockpiles and the maturation windrows.

Table 7-7 Odour emissions for current garden organics composting

Source	Surface area (m2)	SOER OUv/m2/s	OER OUv/s	SOER Reference
Receivals area	564	4	2,256	URS, 2007
Shredding			5,740	URS, 2007
Static stockpile – 1 month	2,200	4.4	9,680	URS, 2007
Static stockpile – 4 month	10,210	2	20,420	URS, 2007
Maturation windrows	4,375	1.7	7,438	URS, 2007
Matured compost	730	0.6	438	URS, 2007
Screening			4,960	URS, 2007
Leachate pond	2,500	0.26	650	Ektimo, 2014
TOTAL		-	51,582	-

7.7.2 Future Phase 1 (2016) – scenario 2

This scenario includes the proposed landfill re-profiling in 2016 and the current garden organics area operating at 50,000 t/yr before it is relocated to the other side of the site. The inventory shows that the odour from the landfill increases in the afternoon due to the tip face however when the landfill is non-operational in the night time odour emissions drop considerably. Emissions for the 2016 landfill are presented in Table 7-8 and emissions for the current garden organics facility are presented in Table 7-7. The landfill is the predominant source of odour onsite during the daytime period however at the night the garden organics facility is the main contributor to odour emissions.

The SOERs used in the model for the 2016 landfill are presented in Table 7-8. This is based on several odour sources at the current site been mitigated by SITA and not included in this modelling scenario at the emission rates measured in 2014. This includes the key larger sources in the intermediate cover area known as the ‘v section’ and ‘rectangular area south of the excavation stockpile’ as well as the landfill batters.

SITA is currently optimising its gas management system in these larger sources areas to ensure that the odour emissions from these areas is typical of intermediate covered areas which have an effectively operating landfill gas extraction system.

Table 7-8 Odour emissions for 2016 landfill

Source	Surface area (m2)	SOER OUv/m2/s	OER OUv/s	SOER Reference
Active tip face morning	2,500	26	65,000	Ektimo, 2014
Active tip face afternoon	2,500	40	100,000	Ektimo, 2014
Daily cover	2,500	0.03	100	Ektimo, 2014
Daily cover area	10,000	0.03	300	Ektimo, 2014
Leachate pond (quiescent)	3,550	0.26	923	Ektimo, 2014
Leachate pond (aerated) for 2 hours of the day	3,550	1.8	6,390	Ektimo, 2014
Final cap	314,755	0	0	Ektimo, 2014
Intermediate cover	517,685	Intermediate cover without gas extraction – 0.05 Intermediate cover with gas extraction – 0.023	14,195	Ektimo, 2014
Stripped back area	2,500	1	2,500	Ektimo, 2014
total am			82,918	
total pm			117,918	
total no op			18,018	

Garden organics composting

The SOERs used in the model for the garden organics composting in 2016 are the same as the current scenario in Section 7.7.1.

7.7.3 Future Phase 6 (2021) – scenario 3 and scenario 4

This scenario includes the proposed landfill reprofiling area for 2021 and the proposed western GO facility operating at 80,000 t/yr. Phase 6 represents the worst-case odour generating scenario for the proposal.

The inventory shows that the odour from the landfill increases in the afternoon due to the tip face however when the landfill is non-operational in the night time odour emissions drop considerably. Emissions for the 2021 landfill are presented in Table 7-9 and emissions for the proposed GO facility are presented in Table 7-10. By 2021 the proposed ARRT facility would potentially be operational and the estimated emissions are provided in Table 7-12.

The landfill is the significant source of odour onsite during the daytime period however at the night the ARRT facility and GO facility are the main contributors to odour emissions. Odour emissions from the ARRT facility are through a biofilter air discharge portal and would therefore be dispersed into the atmosphere much better than other odour emissions. The character of the odour from the biofilter is also much different from landfill gas and green waste with characteristics similar to that of an ‘earthy soil smell’, but nevertheless this odour assessment conservatively assumes the three operations contributing to the total odour emission from the site.

Landfill

The SOERs used in the model for the Phase 6 (2021) landfill are presented in Table 7-9.

Table 7-9 Odour emissions for 2021 landfill

Source	Surface area (m^2)	SOER OUv/m^2/s	OER OUv/s	SOER Reference
Active tip face morning	2500	26	65,000	Ektimo, 2014
Active tip face afternoon	2,500	40	100,000	Ektimo, 2014
Daily cover	2500	0.03	100	Ektimo, 2014
Daily cover area	10,000	0.03	300	Ektimo, 2014
Leachate pond (quiescent)	3,550	0.26	923	Ektimo, 2014
Leachate pond (aerated) for 2 hours of the day	3,550	1.8	6390	Ektimo, 2014
Final cap	485,490	0	0	Ektimo, 2014
Intermediate cover	434,750	Intermediate cover without gas extraction – 0.05 Intermediate cover with gas extraction – 0.023	11,038	Ektimo, 2014
Stripped back area	2,500	1	2,500	Ektimo, 2014
total am			79,761	
total pm			114,761	
total no op			14,861	

Green waste composting

The SOERs used in the model for the green waste composting in 2017 are presented in Table 7-10. This data is conservative and assumes that the windrows are uncovered when in fact they would be covered.

Table 7-10 Odour emissions for proposed GO facility

Source	Surface area (m^2)	SOER OUv/m^2/s	OER OUv/s	SOER Reference
Receivals area	1,949	4	7,796	URS, 2007
Shredding	-	-	5,740	URS, 2008
Loading	5	8	40	URS, 2007
Active composting week 1	1,500	1.95	2,925	GHD, 2009
Active composting week 2	1,500	1.12	1,680	GHD, 2009
Active composting	1,500	0.97	1,455	GHD, 2009

Source	Surface area (m^2)	SOER OUv/m^2/s	OER OUv/s	SOER Reference
week 3				
Active composting week 4	1,500	0.89	1,335	GHD, 2009
Maturation	5,638	0.7	3,947	GHD, 2009
Finished compost	8,145	0.34	2,769	GHD, 2009
Screening	-	-	1,600	URS, 2007
Turning	713	1.18	841	URS, 2007
Leachate pond	6,818	0.145	989	Holmes Air Sciences 2006
Leachate pond (aerated) for 2 hours of the day	6,818	1.0	6,818	Holmes Air Sciences 2006
TOTAL			31,117* (unaerated)	

*The odour modelling took into account the aerated and unaerated state of the leachate pond.

The SOERs used in the model for the green waste composting in 2017 are presented in Table 7-11. This data is conservative and assumes a 90% odour reduction on the first four weeks of active composting by using breathable membrane covers.

Table 7-11 Odour emissions for proposed GO facility with breathable membrane covers

Source	Surface area (m^2)	SOER OUv/m^2/s	OER OUv/s	SOER Reference
Receivals area	1,949	4	7,796	URS, 2007
Shredding	-	-	5,740	URS, 2008
Loading	5	8	40	URS, 2007
Active composting week 1	1,500	0.20	293	GHD, 2009
Active composting week 2	1,500	0.11	168	GHD, 2009
Active composting week 3	1,500	0.10	146	GHD, 2009
Active composting week 4	1,500	0.09	134	GHD, 2009
Maturation	5,638	0.7	3,947	GHD, 2009
Finished compost	8,145	0.34	2,769	GHD, 2009
Screening	-	-	1,600	URS, 2007
Turning	713	1.18	841	URS, 2007
Leachate pond	6,818	0.145	989	Holmes Air Sciences 2006
Leachate pond (aerated) for 2 hours of the day	6,818	1.0	6,818	Holmes Air Sciences 2006
TOTAL			24,463* (unaerated)	

*The odour modelling took into account the aerated and unaerated state of the leachate pond.

ARRT facility

The SOERs used in the model for the ARRT facilities in 2017 (and onwards) are presented in Table 7-12. The biofilter emissions are based on the air flow of the building and have been assumed to be emitted through a portal as detailed in section 7.5.3. The biofilter emission rate is based on GHD's experience with a recommended odour level of 250 OU/m^3. Justification for using this value this is provided in Appendix C.

Table 7-12 Odour emissions for proposed ARRT facility

Source	Flow rate (m^3/s)	Biofilter emission rate OU/m^3	OER (OU/s)	SOER Reference
Biofilter	345	250	86,250	GHD

8. Odour impact assessment

8.1 Overview

The dispersion modelling was conducted to predict the pattern of maximum off-site ground level odour concentrations resulting from odour emissions from the site for scenarios discussed in chapter 7.

8.2 Odour criteria

8.2.1 Air quality assessment criteria

The air quality assessment criteria, as stated in the NSW EPA's 'Approved Methods and Guidance for the Modelling and Assessment of Air Pollutants in NSW' (Approved Methods) are included in Section 2.2.2 and Table 2-1.

The air quality assessment is required to be undertaken with consideration of the Approved Methods as:

- The SEARs require assessment of air quality in accordance with Approved Methods in order to meet the statutory obligations.
- The proposal is an integrated development and approval of the proposal is required by the NSW EPA. The NSW EPA will therefore review the air quality assessment and the review will be carried out with reference to the Approved Methods.

8.2.2 Existing sensitive receptors

The nearest sensitive receptor to the LHRRP is the ANSTO facility. The nearest existing residential areas are the suburbs of Engadine, R1 (approximately 2 km to the east), Barden Ridge R2 (approximately 3 km to the northeast) and Menai R3 (approximately 3.5 km northeast).

There is also potential for future residential developments to the north of the LHRRP. There is no certainty regarding the GLALC future development at this stage. The number of people potentially residing at the Heathcote Ridge development is expected to be significantly less than 2,000 people in the pockets closest to LHRRP.

Proposed odour criteria for nearby existing sensitive receptors is 2 OU for receivers R1, R2 and R3, as they are part of denser urban populations of greater than 2000 people.

One of the overarching aims of the project is to result in a reduction in the potential odour levels at the ANSTO premises. The approximate number of staff at ANSTO is over 1000 people, meaning that the criteria for R4 and R5 would be approximately 2.5 OU. It is important to note however that most staff would work during the daytime period, when worst-case odour impacts would not likely occur and most staff would work in an air conditioned environment that would not necessarily be impacted by the low levels of odour from the LHRRP.

8.2.3 Approved future sensitive receptors

Parts of areas north of the Lucas Heights Resource Recovery Park (the site) were rezoned in September 2015 to allow for the future development of six new discrete communities surrounding Barden Ridge. These are illustrated in Figure 1.4 and identified as receiver R6 – Gandangara.

Population estimate

The new communities to the west of Barden Ridge are subject to a minimum lot size of 550 m^2. Based upon spatial analysis of the approved area, the minimum lot size and an average occupancy of 2.1 persons per dwelling (as provided by SSC), the occupancy for each dwelling has been estimated for each pocket. Estimates of the number of occupants for each community are included in Table 8-1.

Table 8-1 Occupancy of rezoned areas west of Barden Ridge

Location	Area (ha)	Minimum lot size (m2)	Number of lots	Occupancy per lot	Occupants
North-West	2.54	550	47	2.1	99
North-East	4.79	550	88	2.1	183
South-East	2.05	550	38	2.1	80
South-West	6.20	550	113	2.1	238

The proposed development would consist of four new communities to the west of Barden Ridge, each with significantly less than 500 residents.

The communities to the east of Barden Ridge are subject to a minimum lot size of 200 m^2. Based upon spatial analysis of the approved area, the minimum lot size and an average occupancy of 2.1 persons per dwelling (as provided by SSC), the occupancy for each dwelling has been estimated for each pocket. The estimate for each community is included in Table 8-2.

Table 8-2 Occupancy of rezoned areas east of Barden Ridge

Location	Area (ha)	Minimum lot size (m2)	Number of lots	Occupancy per lot	Occupants
North	2.42	200	121	2.1	254
South	5.14	200	257	2.1	540

It can be seen that the two new communities to the east of Barden Ridge, would each have potentially have up to 500 residents. There is no allowance for roads, open spaces, shops (as each community would be self-contained), so the figures stated above are likely to be an overestimate of the number of people who would occupy this area. The number of future residents would be less than 500 residents in each case.

Applied assessment criteria

As outlined above, the proposed development would consist of four new communities to the west of Barden Ridge, each with significantly less than 500 residents, as well as two new communities to the east of Barden Ridge with less than 500 residents each. According to the Approved Methods, 3 OU is the relevant odour assessment criteria for assessing the significance of air quality impacts for the communities, as outlined in Table 2-1.

The proposed design of the landfill and other facilities, site operating practices, and mitigation measures outlined in the OEMPs has been undertaken to minimise odour emissions associated with the proposal.

SITA has established a mutual agreement with SSC and has committed to go beyond the EPA's statutory requirements as outlined in the Approved Methods by requiring that the assessment demonstrates that 2OU could be achieved. This target is a stricter requirement than the state agency and statutory assessment requirements. This means that the more stringent air quality targets ate being applied for the approved future receptors, despite the smaller numbers of residents.

This is summarised in Table 8-3.

Table 8-3 Comparison of required and applied assessment criteria

Location	Area (ha)	Estimated number of occupants	Approved Method assessment criteria (OU)	Applied assessment criteria (OU)
West of Barden Ridge				
North-West	2.54	99	4	2
North-East	4.79	183	3	2
South-East	2.05	80	4	2
South-West	6.20	238	3	2
East of Barden Ridge				
North	2.42	254	3	2
South	5.14	540*	2*	2

* Number of occupants is likely to be an overestimation as there is no allowance for roads, open spaces, shops etc. If less than 500 people, the assessment criteria would be 3OU.

8.2.4 Potential future sensitive receptors

As illustrated in Figure 1.4, there are a number of areas earmarked for potential future residential development. These are identified as receiver R7 –Gandangara North.

Like the approved areas, the proposed Gandangara development would consist of discrete pockets of housing and it is expected that each pocket would include no more than 500 people.

A target assessment criterion of 2 OU is considered in this assessment. This is more conservative than the NSW EPA's policy which proposes an impact assessment criterion of 3 OU.

8.3 Scenario 1 – Existing 2014

Results of scenario 1 are presented in Table 8-4 and Figure 8.1 below. Results are conservative and show that predicted impacts have the potential to impact on receivers. The predicted maximum odour impact from the site expressed as a 1-hour average at the 99th percentile at receivers R4, R5, R6 and R7 are above 5 OU, a level that may be detected above the background under some conditions. These worst-case conditions generally occur in the night time and early morning.

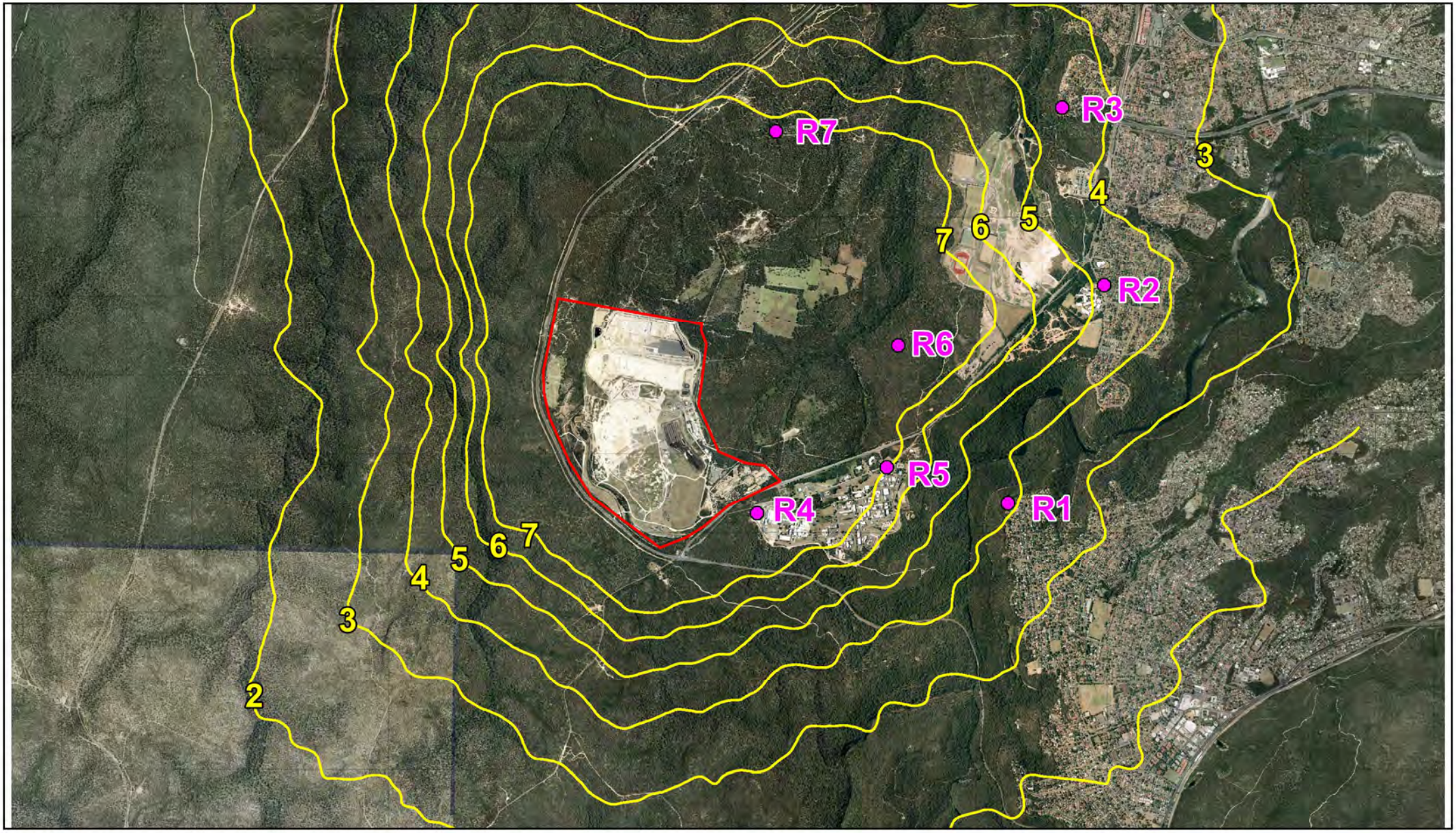
The predicted odour levels at receivers R1, R2 and R3 are all below 5 OU. This is consistent with the few complaints received from these areas as a level of less than 5 OU is not normally detected above the ambient background. The potential future receptors at R6 and R7 do not currently exist as the determination of the application for rezoning this land is yet to be made.

The maximum predicted odour impact at the ANSTO site (R4) is 10.9 OU. These worst case impacts are mostly during the night time period when impacts would be minimal, especially at ANSTO west where it is unlikely workers would be outdoors.

Table 8-4 Maximum predicted odour levels (99th percentile OU)

R1 – Engadine	R2 – Bardon Ridge	R3 – Menai	R4 – ANSTO West	R5 – ANSTO Motel	R6 – Gandangara	R7 – Gandangara North
4.1	4.8	4.5	10.9*	7.0	10.2	7.8

* The 99th percentile OU during the daytime is less than this value



0 400 800 1200
metres (at A4)

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid Of Australia, Zone 56

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W E
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LEGEND

Site Boundary

Predicted maximum 99.0th percentile (P/M60)

GHD
CLIENTS | PEOPLE | PERFORMANCE

SITA Australia
Lucas Heights Resource Recovery Park

Predicted Odour Impact - Scenario 1 Existing

Job Number 2123482
Revision A
Date 11/02/15

Figure 8.1

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Google Earth Imagery 2013. Created by: MA

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8.4 Scenario 2 – Future 2016 (Phase 1)

Results of scenario 2 are presented in Table 8-5 and Figure 8.2 below.

The predicted maximum odour impact from the site expressed as a 1-hour average at the 99th percentile at receivers R1, R2 and R3 are well below the impact assessment criteria of 2 OU and below a level recognisable above the background.

The potential future receptors at R6 and R7 are unlikely to exist in 2016 as the determination of the application for rezoning this land is yet to be made. Should this application be approved, it would take a period of time (potentially beyond 2016) for residential dwellings to be established at these locations.

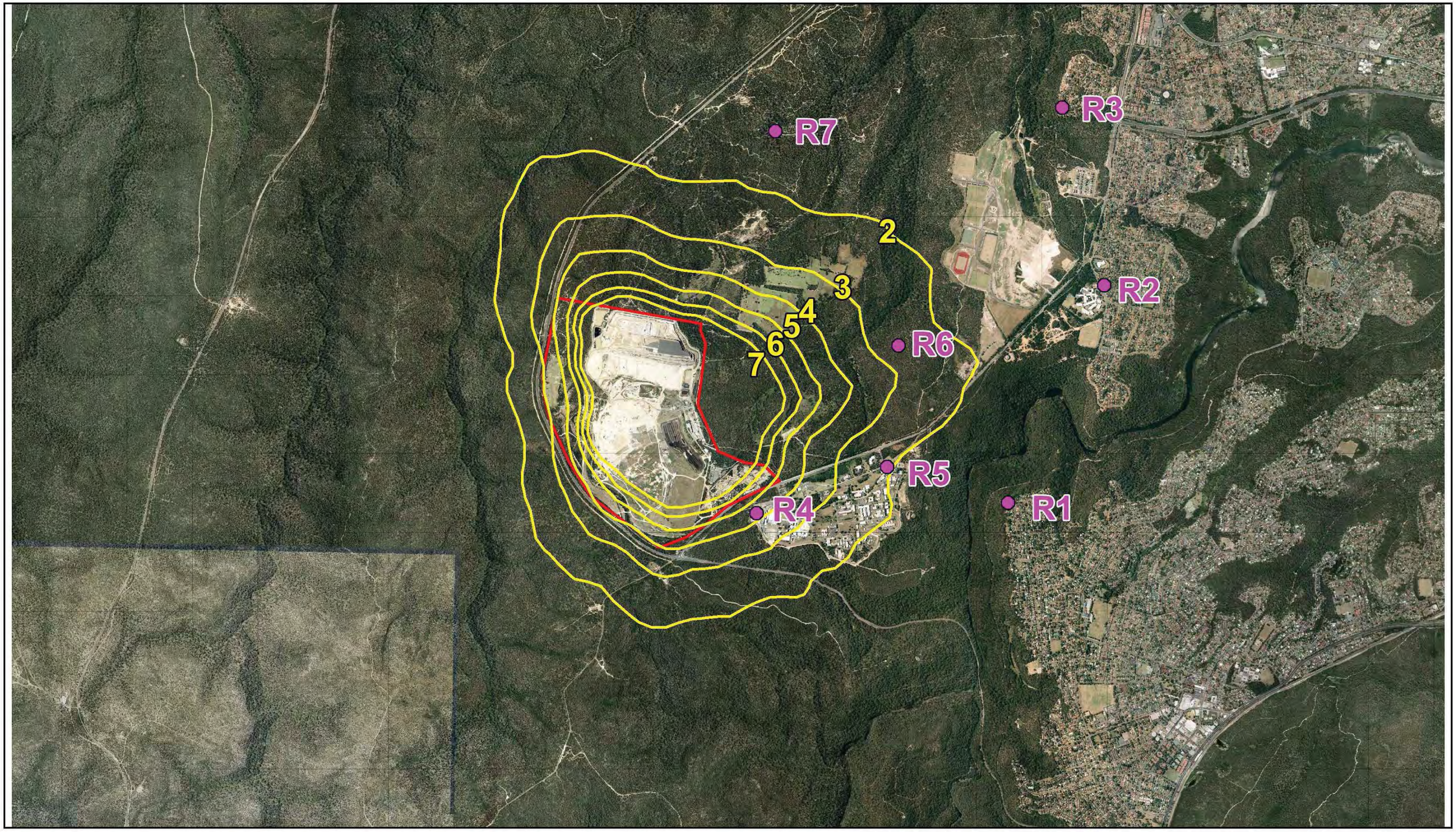
The maximum predicted odour impact at the ANSTO site (R4) is 4.2 OU. This represents over 50% reduction compared to existing levels.

It is noted significant improvement is predicted at odours receptors in this scenario compared with the existing scenario. This is largely due to the rectification of three larger odour sources identified during the site specific sampling program.

Table 8-5 Maximum predicted odour levels (99th percentile OU)

R1 – Engadine	R2 – Bardon Ridge	R3 – Menai	R4 – ANSTO West	R5 – ANSTO Motel	R6 – Gandangara	R7 – Gandangara North
1.1	1.0	1.1	4.2*	2.1	2.5	1.4

* The 99th percentile OU during the daytime is less than this value



0 400 800 1200
metres (at A4)

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid Of Australia, Zone 56

N W E S

LEGEND

Site Boundary

Predicted maximum 99.0th percentile (P/M60)

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Revision A
Date 27/02/15

Predicted Odour Impact - Phase 1 Future

Figure 8.2

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8/180 Lonsdale St Melbourne VIC 3000 Australia T 61 3 8687 8000 F 61 3 8687 8111 E melmail@ghd.com.au W www.ghd.com.au

Google Earth Imagery 2013. Created by: MA

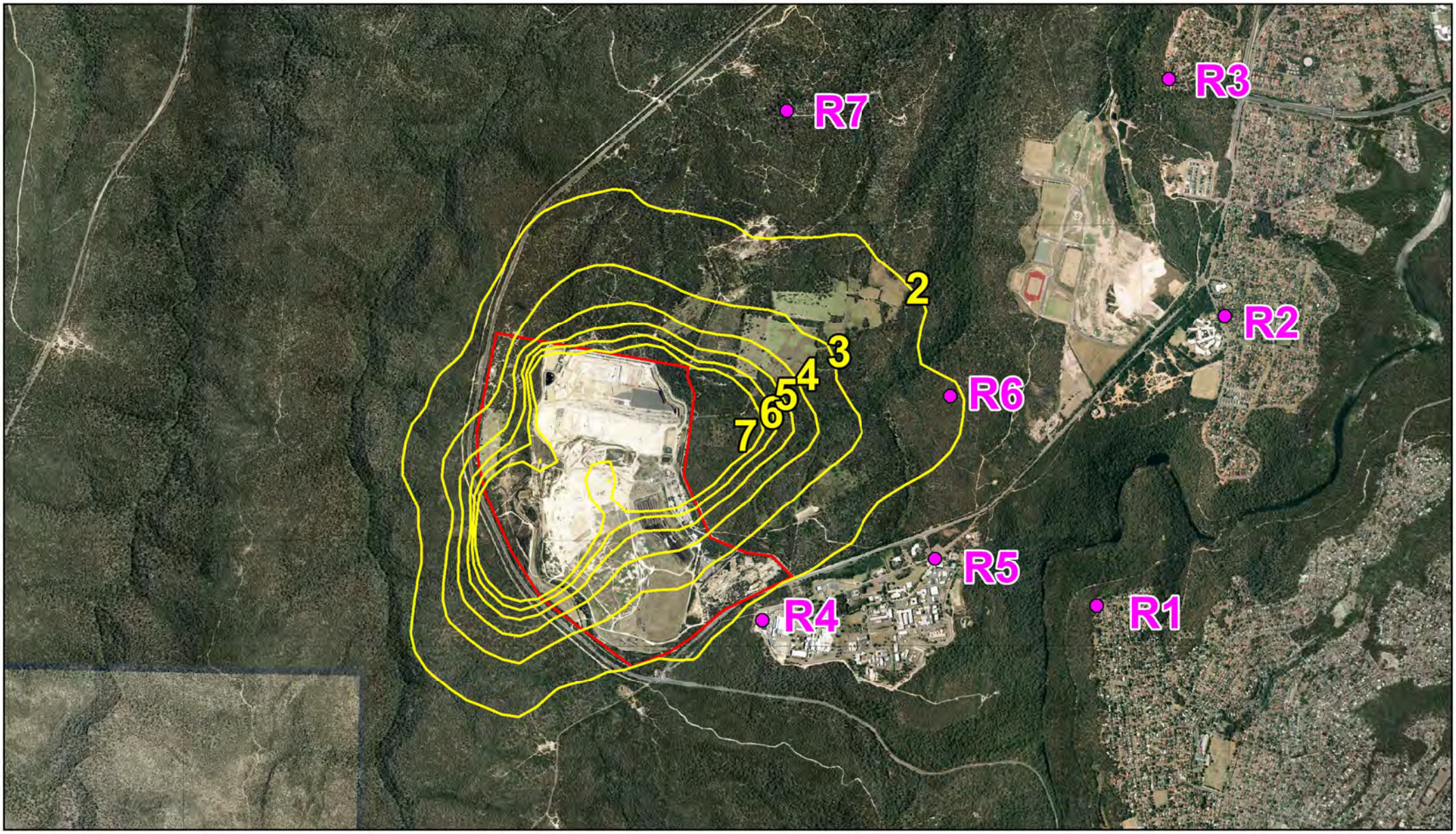
8.5 Scenario 3 – Future 2021 (Phase 6) worst case

Results of the odour predictions for scenario 3 are presented in and Figure 8.3 below.

Table 8-6 Maximum predicted odour levels (99th percentile OU)

R1 – Engadine	R2 – Bardon Ridge	R3 – Menai	R4 – ANSTO West	R5 – ANSTO Motel	R6 – Gandangara	R7 – Gandangara North
0.9	1.1	1.0	1.8	1.5	2.1	1.3

The predicted maximum odour impact from the site expressed as a 1-hour average at the 99th percentile at all existing receivers are below 2 OU, a level lower than that normally detected above the background. Five OU is commonly taken as a conservative measure of the odour concentration that can be detected against background levels and which could potentially give rise to complaint.



0 300 600 900
metres (at A4)

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid Of Australia, Zone 56

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Site Boundary

Predicted maximum 99.0th percentile (P/M60)

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Lucas Heights Resource Recovery Park

Predicted Odour Impact - Phase 6 Future

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Revision A
Date 15/05/2015

Figure 8-3

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Google Earth Imagery 2013. Created by: MA

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8.6 Scenario 4 – Future 2021 (Phase 6) with breathable membrane covers

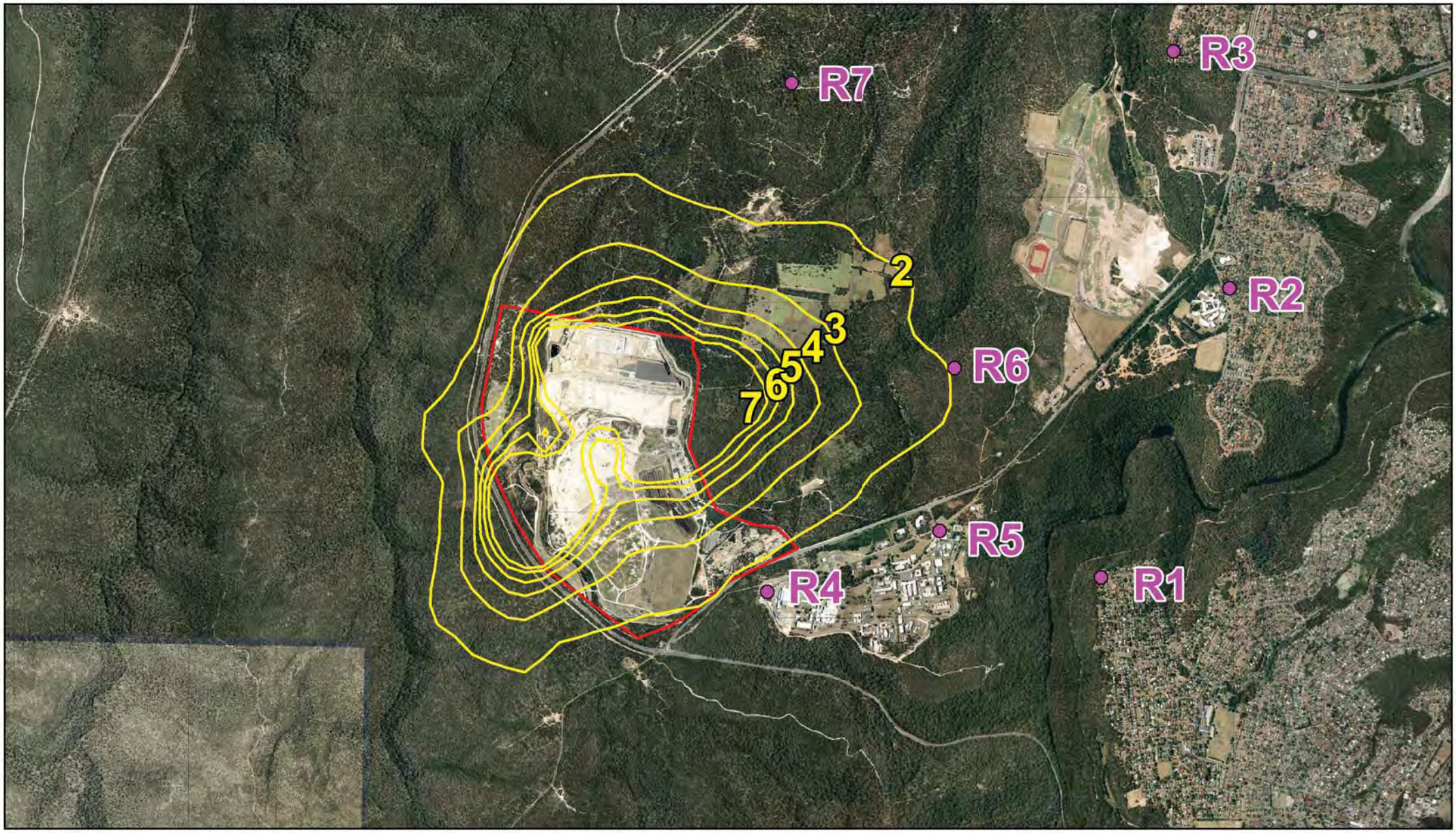
Results of the odour predictions for scenario 4 are presented in and Figure 8.4 below.

Table 8-7 Maximum predicted odour levels (99th percentile OU)

R1 – Engadine	R2 – Bardon Ridge	R3 – Menai	R4 – ANSTO West	R5 – ANSTO Motel	R6 – Gandangara	R7 – Gandangara North
0.9	1.0	1.0	1.7	1.4	2.0	1.3

The predicted maximum odour impact from the site expressed as a 1-hour average at the 99th percentile at all existing and proposed receivers are at or below 2 OU, a level lower than that normally detected above the background. Five OU is commonly taken as a conservative measure of the odour concentration that can be detected against background levels and which could potentially give rise to complaint.

The predicted odour levels for the proposal in 2021 therefore comply with the odour criteria at all existing and proposed nearby sensitive receptors.



0 300 600 900
metres (at A4)

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid Of Australia, Zone 56

N W E S

LEGEND

Site Boundary

Predicted maximum 99.0th percentile (P/M60)

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Revision A
Date 15/05/2015

Predicted odour impact -
Phase 6 Future - with breathable membrane covers

Figure 8-4

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9. Dust impact assessment

9.1 Overview

There is potential for dust emissions during the construction and operational phases of the project. Dust dispersion modelling has been undertaken to assess the potential worst-case dust impact of the proposal.

No background dust (PM_{10}) measurements were available for Lucas Heights. It is expected background dust levels would be low. The prominent source of background dust would be areas subject to wind erosion and from urban activities. Pollen and vegetation derived dust would also be expected.

The closest air monitoring station is located at Liverpool operated by OEH, where PM_{10} is measured via a TEOM. The year of 2012 was assessed for an annual average background level which was recorded to be 19.7 $\mu g/m^3$ for a 24-hour average.

9.2 Dust criteria

Dust assessment criteria are in accordance with the Approved Methods are described in Section 2.3 .

9.3 Maximum dust impact scenario

An indicative worst-case dust modelling scenario was undertaken for the LHRRP. Significant sources of dust at the site are wheel generated dust from trucks travelling on unpaved surfaces, wind erosion from unsealed surfaces such as the intermediate cover and stockpiles, unloading waste and bulldozers moving waste around. The worst-case dust scenario considers both construction of the GO / ARRT facilities and operational activities occurring at the same time.

An inventory of potential dust impacts is shown below. It can be seen that the largest contributor of dust is wheel generated dust from trucks. The worst case dust scenario assessed included a long haul route of 2 km per truck on unsealed surfaces from sealed access road at the north of the site to the proposed construction area of the GO and ARRT facilities.

The potential sources of dust would move around the site as the construction footprint and the landfilling activities move around. As such an assessment against the worst-case 24 hour PM_{10} criteria is most relevant to determine compliance.

9.4 Dust emissions inventory

Equipment	Default TSP Emission Factor	Default PM_{10} Emission Factor	Unit	Application	TSP Emission Rate (kg/hr)	PM_{10} Emission Rate (kg/hr)
Waste truck - dumping	0.48	0.24	kg/h	Assumed one truck constantly unloading all day.	0.48	0.24
Waste Truck – travelling on unpaved roads	4.23	1.25	kg/ VKT	Assumed 282 waste trucks per day and 20 construction trucks per day. Average trip of each truck on unpaved roads is 2 km. Total of 604 km total travelled per day.	283.9	83.9

Equipment	Default TSP Emission Factor	Default PM_{10} Emission Factor	Unit	Application	TSP Emission Rate (kg/hr)	PM_{10} Emission Rate (kg/hr)
Dump Truck – travelling on unpaved roads with mitigation (Level 2 watering)	0.975	0.2895	kg/ VKT	Assumed 282 waste trucks per day and 20 construction trucks per day. Average trip of each truck on unpaved roads is 2 km. Total of 604 km total travelled per day.	85.2	25.2
Bulldozer on waste and bulldozer construction	4.10	2.05	kg/h/veh	Two bulldozers 9 hours per day. Assumed half the rate of a bulldozer on ground as includes watering	2.13	0.52
Wind Erosion of unsealed surfaces	0.4	0.2	kg/ha/hr	Assuming stockpiles of various sizes located around the site and intermediate cover area	-	-

9.5 Dust dispersion modelling

Potential dust impacts were modelled with the significant proposed construction and operational sources of dust. Dust modelling was undertaken with consideration to the Approved Methods to determine the concentration of dust (PM_{10}) over a 24 hour period. Modelling was conservative as dust depletion was not considered in the modelling. Dust depletion allows material to be removed from the plume as it is deposited on the ground surface, and if no depletion is modelled it would result in an overestimate of the predicted dust concentrations.

9.6 Predicted dust impacts

The predicted maximum (100th percentile) 24 hour dust impact of the proposal at the seven sensitive receptors are shown in the Table 9-1. This maximum dust impact is only predicted to occur one day a year. The average background dust level at the EPA monitoring station in Liverpool for the year 2012 was less than 20 ug/m^3, meaning that cumulative dust impacts exceeding the criterion (50 µg/m^3) are very unlikely. The dust predictions were also undertaken very conservatively as dust depletion from the plume was not considered, which would reduce the predicted dust impact.

Table 9-1 Predicted maximum dust impact 24 hour PM_{10} µg/m^3

R1 – Engadine	R2 – Bardon Ridge	R3 – Menai	R4 – ANSTO West	R5 – ANSTO Motel	R6 – Gandangara	R7 – Gandangara North
15.2	7.5	12.1	27.0	20.3	17.3	13.4

10. Mitigation measures

10.1 Overview

The odour sampling program conducted found that the landfill batters and two larger sources on the intermediate cover area to be the significant source of odour generated onsite. Reducing odour from these two areas therefore is the most effective way to reduce the overall odour levels onsite.

SITA is actively managing and reducing the odour from site, as reflected by the decreased number of odour complaints received in the past two years. The gas extraction system is also being expanded and this is expected to reduce fugitive landfill gas emissions significantly.

The reprofiling of the LHRRP would better facilitate stormwater runoff and thereby reduced leachate generation would have less potential to reduce the efficient performance of the landfill gas extraction system.

Mitigation measures have also been developed for the GO facility and the ARRT facility.

10.2 Voluntary Planning Agreement and Operations Environmental Management Plans

A summary of the odour management strategy and potential improvement measures considered by SITA are provided below and are tied into a proposed Voluntary Planning Agreement (VPA) with SSC in accordance with the requirements of the EP&A Act. The Minister for Planning would consider the VPA along with the Development Application (DA) and EIS and would be the consent authority for the proposal. All SITA entities (SembSITA, WSN Environmental Solutions and SITA Australia) and SSC would be signatories to the VPA.

Under the VPA, SITA is committing to meet a number of environmental commitments in terms of actions it would take based on the site's environmental performance. Revised OEMPs have been developed as part of the EIS preparation for the:

- LHRRP (SITA 2014a)
- Proposed ARRT facility (SITA 2014b)
- Relocated GO facility (SITA 2014c)

A separate EMP is also prepared for the post-closure activities at the LHRRP (SITA 2014d).

The above mentioned OEMPs and EMP form part of the VPA. These OEMPs would be updated following the proposal's determination, to reflect any additional requirements from the conditions of consent.

As an additional level of safeguard, *Schedule 1D – Environmental Undertaking and Reporting* of the VPA prescribes the external audit process that applies to the LHRRP with one of the key issues addressed being odour. Schedule 1D details the reporting requirements and there is a significantly higher level of rigour associated with the data reporting for this proposal in comparison with standard industry practice.

10.3 Agreed methodology for complaints

In addition, SITA and SSC have established an agreed methodology for assessing and actioning odour complaints. It would be reviewed every two years and at the request of any party, but any

changes to the agreed methodology would only be made by agreement between them. The complaint investigation and rectification process is included in Appendix S of the LHRRP OEMP (SITA 2014a).

In summary, this process would require a series of actions to be implemented should specified numbers of odour complaints be received about the LHRRP. The process is escalated to requiring an independent audit of the potential source/s of odour from the premises and SITA is committed to considering and implementing the findings of the audit in a timely manner, or actions as otherwise agree with Council and the EPA. A summary is provided below and the full details of this process are documented in the VPA.

- Complaints may be lodged with respect to the operation of the LHRRP by contacting SITA on 1800 ENV REP (1800 368 737), SITA through SITA's website, or to the EPA or Council. Council will notify SITA of any such complaint within 5 business days of receipt
- The Compliance Officer will investigate every Complaint lodged with SITA or referred to it by Council
- Following the investigation, the Compliance Officer will:
  - identify the cause of the complaint
  - determine whether SITA is meeting its obligations under the Agreed Methodology in relation to the relevant area of concern
  - recommend that corrective action be taken with respect to a complaint, if required; and
  - prepare and provide to Council such reports in relation to a complaint

If there are 15 or more complaints in any calendar month in relation to an individual area of concern, then:

- SITA will appoint an internal technical team to undertake a compliance audit of the LHRRP with respect to that area of concern in accordance with SITA's internal procedures and the agreed methodology
- following the investigation, the internal technical team will:
  - identify the cause of the issue in relation to the area of concern that was the subject of the Complaint
  - determine whether SITA is meeting its obligations under the agreed methodology in relation to that area of concern
  - recommend that corrective action be taken with respect to the causes of the complaint in relation to that area of concern, if required
  - prepare a report in relation to any complaint and provide a copy of that report to Council within the calendar month after the first month (known as the second month)
  - SITA will implement any reasonable recommendations made by the internal technical team within the calendar month after the second month (known as the third month).

If there are more than 20 Complaints in the calendar month after the third month (known as the fourth month) in relation to that area of concern, then:

- SITA will retain an external auditor to undertake a compliance audit of the LHRRP with respect to the area of concern in accordance with the agreed methodology

- SITA will direct the external auditor to prepare a report in relation to the causes of the complaint the subject of the external auditor's investigation within the calendar month following the fourth month
- SITA will provide Council with a copy of the external auditor's report as soon as reasonably practicable after receipt
- SITA will implement any recommendations made by (and within the timeframes set by) the external auditor in their report as to measures that could be adopted to address the cause of the complaint the subject of the audit
- If SITA considers that the recommendations made by the external auditor are not the most practical or cost effective means of addressing the cause of the complaint the subject of the audit, or that the time frames proposed by the external auditor are unreasonable or unrealistic, then SITA will issue a written notice to Council within 30 days of receipt of the external audit report that:
  - SITA does not intend to implement those recommendations; and
  - includes details of one or more alternative measures, including time frames for implementation
- If SITA issues a written notice, then at a date and time specified by Council, the parties will meet to discuss in good faith the alternative measures set out in the written notice, and SITA will implement those alternative measures that are agreed with Council (for the avoidance of doubt it is made clear that, in the event that SITA and Council do not agree on alternative measures then SITA will implement the recommendations made by the external auditor)
- SITA will prepare a report for Council on the measures taken by SITA to address the cause of the complaint the subject of the audit and, if it takes more than one month from the date of the audit report to effect measures to address any causes, will provide Council with monthly reports until implementation is complete (the first monthly report to be provided within one month after the date of the audit report).

10.4 Odour mitigation measures

A comprehensive list of prevention, mitigation and rectification measures have been identified and they are detailed in the LHRRP OEMP (SITA Australia, 2014a), ARRT Facility OEMP (SITA Australia, 2014b) and GO Facility OEMP (SITA Australia 2014c). The identified mitigation and rectification measures would be implemented as required and their exact details would be based on a case by case situation depending on the issue and technical solutions available at the time.

Examples of key measures that are included in the OEMPs are provided in the sections below.

10.4.1 Landfill reprofiling

The landfill gas extraction system would be extended to account for the reprofiling of waste. This is standard practice already in place at the site when each new lift of waste is placed on areas with an active gas extraction system. However in some areas and on a needs basis additional landfill gas extraction infrastructure would be installed and operated to effectively extract landfills gas from the landfilled waste and thereby minimise the potential for odourous emissions from the site.

In addition, the following mitigation measures should be adopted for the reprofiling works:

- Reprofile the landform to provide a minimum of 5% slope (post settlement)

- The areas of the existing landfill (south of existing active landfill area) would be stripped back in segments with approximately 1 Ha of cover stripped in advance of the active tipping area. Of this area approximately 2,500 m^2 would be less than one day old to minimise the emission of odour from the stripped surface. At the commencement of each day's landfilling the stripped surface would extend to the landfilled waste over an area equivalent to the active tipping area. The stripped material would be available for reuse. Where areas of excessive soil fill over waste are identified, localised investigations are to be undertaken and additional capping or intermediate cover can be stripped back such that previously land filled waste is not exposed
- The depth of the strip back is described as follows:
  - Stripping back of the existing areas which are capped and revegetated would not expose previously landfilled waste
  - Stripping back of the existing areas of intermediate cover (south of the existing active landfilling area) would not expose previously landfilled waste
- Each morning equivalent to a day's waste disposal operations the stripped surface would be further stripped back to waste (to minimise the potential for the perching of leachate) and waste placed directly over this area. This would ensure there is no exposed waste during the night when the potential for odour issues off site is higher
- The stripping arrangement would continue to be examined to ensure that it can optimise the recovery of cover materials and not cause off-site odour complaints
- Re-testing of the rectified localised emission points, the v section, area south of the excavation stockpile and batters in 2015/16 to confirm odour modelling predictions

10.4.2 LHRRP

- Cover odorous wastes as soon as possible after delivery in accordance with the requirements of the site's environment protection licence
- Minimise the size of the active landfill face, taking into account the practicalities, safety, access, traffic management, etc.
- Inspect and monitor the capping layer regularly
- Train staff (internal and contractors) on odour management strategy and all relevant procedures
- Install and operate a landfill gas collection system progressively to minimise odour as a result of landfill gas seepage

10.4.3 GO Facility

- Conduct random monitoring and inspections of incoming vehicles to determine waste composition
- Order manures in accordance with production schedules and blend with compost only in favourable weather conditions at any given time
- Train staff (internal and contractors) on odour management strategy and all relevant procedures

- Only allow up to 40,000 tonnes of composting material to be stored on site (includes receival, shredding, active composting and maturation stage) at any one time at the western GO
- Measure oxygen and moisture content of compost (active phases) and control with aeration and moisture addition

10.4.4 ARRT facility

- Process waste daily
- Carry out composting at set periods of time, to set temperatures, oxygen levels and moisture levels to provide certainty that composted material has fermented properly and has stabilized
- Maintain the facility under negative pressure, ensuring odours do not escape the building
- Regular inspection of biofilters and maintenance of biofilter media
- Train staff (internal and contractors) on odour management strategy and all relevant procedures

10.5 Dust mitigation measures

Dust emissions during construction would be managed via a Construction Environmental Management Plan, and during operation via the OEMPs.

If dust is managed appropriately there would be minimal dust generation from either the construction or operation phases of the project. Current practices including use of water for dust suppression would continue.

A comprehensive list of prevention, mitigation and rectification measures have been identified and they are detailed in the LHRRP OEMP (SITA Australia, 2014a), ARRT Facility OEMP (SITA Australia, 2014b) and GO Facility OEMP (SITA Australia 2014c). The identified mitigation and rectification measures would be implemented as required and their exact details would be based on a case by case situation depending on the issue and technical solutions available at the time.

Examples of key measures that are included in the OEMPs are provided in the sections below.

10.5.1 LHRRP

- Do not undertake dust generating activities during adverse weather conditions
- Cessation of operations if unsafe (for example, during strong winds)
- Monitor monthly dust deposition at six boundary locations on site
- Limit vehicles to specified routes around the site and ensure speed limits are adhered to
- Use of dust suppression techniques such as watering to maintain moist conditions on exposed areas and unsealed roadways

10.5.2 GO facility

- Cover or enclose vehicles during transport around the site
- Spray windrows, final compost storage areas and loading areas, particularly prior to transportation and turning

- Cessation of operations if unsafe (for example, during strong winds)
- Operate water cart(s) on trafficable areas as required
- Undertake monthly dust deposition monitoring
- Clean machinery regularly
- Seal main site access and vehicle manoeuvring areas

10.5.3 ARRT facility

- Conduct all operating activities within the enclosed areas of the ARRT facility
- Cover or enclose vehicles during transport around the site
- Spray windrows, final compost storage areas and loading areas, particularly prior to transportation and turning
- Operate water cart(s) on trafficable areas as required

10.6 Reporting requirements

The VPA outlines an environmental and other reporting schedule. It requires quarterly reporting of odour as well as on a complaint basis. Key complaint reporting pertaining to odour onsite is listed in Table 10-1.

Table 10-1 Complaint reporting requirements

Reporting requirement	Frequency	Period	When to report	Comments
Less than or equal to 5 complaints per area of concern per month	Six monthly	Jan – Jun Jul – Dec	Within two months following the Reporting Period	Include number, type, location Comparison with previous year
Less than or equal to 5 complaints per area of concern per month	Monthly	Monthly	Within two weeks following the reporting period	Include number, type, location
Greater than 5 complaints per area of concern on any day	Per event	Daily	Following day	Include number, type, location Email notification to SSC's nominee and SSC general correspondence

11. Conclusions and recommendations

11.1 Conclusions

GHD has undertaken odour modelling using odour emission data obtained from a comprehensive landfill odour sampling program at the LHRRP and dust modelling using National Pollutant Inventory (NPI) published emission factors. The assessment shows that the total odour emissions from the site would decrease from the existing situation starting from the initial stage of the proposal due to the rectification of three larger odour sources identified during the site specific sampling program.

The proposed staging of the landfill will result in lowering the potential for odour impacts in the future by retaining the general proportion of capped and revegetated areas of the site and increasing these areas in time.

The proposed relocated and expanded GO facility would utilise aerated bunkers and breathable membrane covers on the active composting stage which would reduce the potential for odour. The new location for the GO facility is also located on the western side of the LHRRP, making it further away from the nearest sensitive receptors.

The proposed ARRT is a new source of odour which would be located on the western side of the site. All air including odour from the facility would be treated in a biofilter prior to being released into the environment. Air from the biofilter would be discharged through the biofilter air discharge portal to increase dispersion of odour into the atmosphere which would reduce the potential odour levels offsite even more.

Predicted odour levels for the proposal in 2021 (worst case year for potential odour impacts) comply with the odour criteria at all existing and proposed nearby sensitive receptors.

Provided the LHRRP is operated as per the OEMP (SITA Australia, 2014b), the proposal is considered appropriate from an odour perspective and would achieve the odour assessment criteria for the existing and proposed receptors.

Dust dispersion modelling shows that potential dust impacts from the proposal would not impact adversely on any surrounding dust sensitive receptors.

11.1.1 Meets identified objectives

This report addresses the SEARs requirements (section 1.6) and concludes that the proposal would meet the following objectives as identified in section 1.2:

- No significant impacts on the community or environment
- Achieving the 2 OU odour performance criteria cumulatively at the nearest residential receptor
- Improving site gas capture and destruction either by power generation activities or gas flaring as required

11.2 Recommendations

It is recommended that SITA continue to install additional dual gas / leachate wells to reduce the emission of odour from the batters, v section and rectangular area south of the existing excavation stockpile and assess the effectiveness of these works in late 2015 to early 2016 before considering other odour mitigation measures for these areas.

- Furthermore, the areas of the existing landfill (south of existing active landfill area) should be stripped back in segments with approximately 1 Ha of cover stripped in advance of the active tipping area. Of this area approximately 2,500 m^2 should be less than one day old to minimise the emission of odour from the stripped surface. The stripped material would be available for reuse. Where areas of excessive soil fill over waste are identified, localised investigations are to be undertaken and additional capping or intermediate cover can be stripped back such that previously land filled waste is not exposed.

The recommended depth of the strip back is described as follows:

- The existing areas which are capped and revegetated should be stripped back to a depth of no more than 1.3 m and not exposing previously landfilled waste
- The existing areas of intermediate cover (south of the existing active landfilling area) should be stripped back no more than 0.45 m and not exposing previously landfilled waste

For the stripped surface each morning an area equivalent to a day's waste disposal operations should be further stripped back to waste (to minimise the potential for the perching of leachate) and waste placed directly over this area. This would ensure there is no exposed waste during the night when the potential for odour issues off site is higher.

The stripping arrangement should continue to be examined to ensure that it can optimise the recovery of cover materials and not cause off-site odour complaints

This recommendation in regard to stripping of existing cover layers (and other odour controls) should also be linked to the VPA, with the VPA process being the governing mechanism to determine the strip back configuration and details.

In addition, it is recommended that SITA undertake retesting of the rectified localised emission points, the v section, the area south of the excavation stockpile and batters in 2015/16 to confirm odour modelling predictions.

12. References

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13. Limitations

This report: has been prepared by GHD for SITA Australia and may only be used and relied on by SITA Australia for the purpose agreed between GHD and the SITA Australia as set out in section 1.1 of this report.

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