March 2015

SITA AUSTRALIA

Works Approval Application Supporting Document – Allawuna Landfill

Submitted to:
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REPORT

Report Number. 147645033-013-R-Rev0

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Golder Associates

Executive Summary

SITA Australia (SITA) proposes to establish the Allawuna Landfill in the Shire of York. The proposed landfill would be a licensed Category 64 prescribed premises, receiving up to an estimated 250 000 tonnes per annum of Class II waste predominantly from the Perth metropolitan area.

The Allawuna Landfill is proposed to replace SITA's Shale Road Landfill at South Cardup which is nearing capacity.

The proposed site is environmentally sound, located off the Swan Coastal Plain with favourable geology, existing land use, surface water, groundwater, and on-site buffer distances. The proposed development was referred to the Environmental Protection Authority (EPA) for consideration and a determination of 'not assessed' was returned in July 2013 (Appendix T). The EPA does not consider the potential environmental impacts of the development significant enough to warrant its formal environmental review.

The low-permeability clayey materials underlying the proposed landfill area are of particular benefit, as they limit the flow of surface water into the groundwater beneath the site.

The design of the landfill infrastructure, Cell 1 and Cell 2 has been carefully tailored to suit the topography and geology of the site. Infrastructure has been located to minimise the number of trees that must be cleared and to limit the impact on the remainder of the farm, which will continue to be used for agricultural purposes.

This document describes the management procedures SITA will employ to control emissions from the site. Landfill gas, dust, odour, noise, water, litter, fuel and chemical storage have been considered with design features and management procedures established to mitigate environmental impact in these areas.

The quality of the environmental protection systems to be installed at the site as part of the construction of the landfill cells is confirmed through the supporting Technical Specification for Construction of Cell 1 and 2 (Appendix M) (Construction Specification). The Construction Specification describes the material quality standards, quality control procedures and reporting mechanisms to be followed during construction to make sure the designed landfill works as intended, protecting the surrounding environment from harm.

The design of the facility is compliant with the Victorian EPA 2014 *Best Practice Environmental Management: Siting, Design, Operation and Rehabilitation of Landfills* Guideline (Vic-BPEM), the currently endorsed standard for the construction of landfills in Western Australia.

SITA has established a surface water and groundwater monitoring program at the site to aid future reporting and provide a comprehensive baseline dataset for comparison.

The proposed Allawuna Landfill is an environmentally sound development with emissions that can be managed through the Department of Environment Regulation (DER) prescribed premises licence process. SITA requests that the DER consider this application and grant a Works Approval for the establishment of the Allawuna Landfill.

Glossary and Definitions

Term	Definition
Advection	The transport of a fluid or sediment due to the fluids bulk motion
Aerobic Decomposition	The break-down of biodegradable organic materials by microorganisms in the presence of oxygen
site	The proposed site of the Allawuna Landfill
AHD	Australian Height Datum
Allawuna Farm	The existing Allawuna Farm
Anaerobic Decomposition	The break-down of biodegradable organic materials by microorganisms in the absence of oxygen
Airspace	The volume of a new landfill cell that may have waste and cover material placed in it, while still maintaining appropriately stable external waste batters and sufficient work area for receiving waste deliveries
AVRA	Avon Valley Residents Association
BOM	Bureau of Meteorology
Technical Specification	A technical document describing the materials, procedures and standards for the construction of Cells 1 and 2
CEC	Cation Exchange Capacity
CQA	Construction Quality Assurance
DER	Department of Environment Regulation
DFES	Department of Fire and Emergency Services
Diffusion	The transport and distribution of a dissolved species due to a concentration gradient in their carrying medium (typically air or water)
Disease Vector	An organism which may transmit infections from one host to another
DoW	Department of Water
DSEWPAC	Department of Sustainability, Environment, Water, Population and Communities
EPA	Western Australian Office of the Environmental Protection Authority
EP Act	*Environmental Protection Act 1986* (Western Australia)
EPBC Act	*Environmental Protection and Biodiversity Conservation Act 1999* (Federal)
Airspace	The volume of a new landfill cell that may have waste and cover material placed in it, while still maintaining appropriately stable external waste batters and sufficient work area for receiving waste deliveries
Flare	A device used to safely burn landfill gas, converting its constituent methane into carbon dioxide
GCL	Geosynthetic Clay Liner
Geotextile	A permeable fabric material used to separate, filter, reinforce, protect or drain soil
Golder	Golder Associates Pty Ltd
Groundwater	The water found in the subterranean zone below the water table
ha	Hectares
HDPE	High Density Polyethylene
km	Kilometre/s
Landfill Gas	A mixture of predominantly carbon dioxide and methane, with trace amounts of other volatile organic compounds, released by the decomposition of putrescible material in a landfill.

Term	Definition
Leachate	Water that is released by decomposing waste, has come into contact with decomposing waste or has come into contact with other leachate
Licence	Authorisation issued by the DER under part V of the *Environmental Protection Act 1986* to operate a prescribed premise. The DER Licence imposes operating conditions on the Licence Holder.
L/ha/day	Litres per hectare per day
LLDPE	Linear Low Density Polyethylene
m	Metre
M	Million
m^2	Square metre/s
m^3	Cubic metre/s
mm	Millimetre
m/s	Metres per second
m AHD	Elevation (metres) above the Australian Height Datum
MSDS	Materials Safety Data Sheet
NATA	National Association of Testing Authorities
NGERS	National Greenhouse and Energy Reporting System
PDWSA	Public Drinking Water Source Area
Permeability (Hydraulic Conductivity)	A measure of the ease with which fluids may move through a porous media (expressed as a velocity)
SAT	State Administrative Tribunal
SEAVROC	South East Avon Voluntary Regional Organisation of Councils
SITA	SITA Australia Pty Ltd
site	The proposed site of the Allawuna Landfill
Stormwater	Surface water runoff generated by rain events
Subgrade	The compacted soil material under the landfill liner
Swan Coastal Plain	The region bound by Moore River, the Gingin Scarp, the Darling Scarp, The Whicher Scarp, Eagle Bay and the Indian Ocean Shoreline
t/a	Tonnes per annum
Topography	The contours, grades, elevations and slopes of the Earth's surface
the Shire	Shire of York
Vic-BPEM	Victorian Best Practice Environmental Management Landfill Guidelines 2014
WAA	Works Approval application
Weighbridge	A large balance calibrated and certified to weigh vehicles
WJDAP	Wheatbelt Joint Development Assessment Panel
Works	All activities required to establish the Allawuna Landfill, including the construction of Cell 1 and Cell 2

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1.0 INTRODUCTION

SITA Australia Pty Ltd (ABN 70 002 902 650) (SITA) is a leading multinational waste, recycling and resource recovery service provider. SITA is certified for the management of Environment (ISO 14001), Health and Safety (AS 4801) and Quality (ISO 9001). SITA currently operates a landfill at Shale Road, South Cardup within the Shire of Serpentine Jarrahdale. The landfill, which currently accepts approximately 250 000 tonnes (t) of Class II waste annually, commenced operations in September 1999 and is approaching the end of its life. It is estimated that at current waste acceptance rates the landfill will be exhausted in 2016 and will be capped and landscaped for recreational purposes.

In May 2009 SITA commenced investigations to identify a new landfill site and following detailed investigations of 19 potential sites in the Shires of Gingin, Boddington, Toodyay and York, SITA entered into agreement with the owners of Lots 4869, 5931, 9926 and 26934 Great Southern Highway, Saint Ronans – Allawuna Farm, to purchase the property conditional upon receipt of all necessary approvals for the proposed landfill.

A Works Approval application (WAA) titled Works Approval Submission: Construction and Operation of Allawuna Farm Landfill, dated January 2014, was previously submitted to the Department of Environment Regulation (DER). However, following discussions with the DER, the previous WAA was withdrawn. Following further subsurface investigations at the site and additional design work, this report has been prepared to support SITA's WAA for the proposed landfill at Allawuna Farm.

SITA engaged Golder Associates Pty Ltd (Golder) to prepare the WAA for the Project.

The revised application is for development of the first two cells (Cell 1 and 2) of the proposed landfill. However, this application outlines investigations and design work for the whole of the landfill which will involve six cells to be filled over a period of approximately 20 years (based on a waste acceptance rate of approximately 250 000 t/a).

2.0 BACKGROUND INFORMATION

2.1 Overview

SITA makes a considerable contribution to resource recovery in the Perth metropolitan area and endeavours to achieve ambitious waste recycling targets however landfills remain an essential component of SITA's waste management hierarchy. Furthermore, population growth and the closure of existing landfills on the Swan Coastal Plain necessitate new landfill facilities for disposal of wastes that cannot be reused or recycled.

In line with the directive of the Department of Environment Regulation (DER) to locate any new landfill developments off the Swan Coastal Plain, SITA has chosen a site in the Shire of York for the development of the Allawuna Landfill.

The site has been presented to the Environmental Protection Authority (EPA) under Part IV of the *Environmental Protection Act 1986* (EP Act), where the EPA determined the proposal as 'not assessed,' as the potential environmental impact of the proposal is not so significant to warrant the EPA's assessment. From an environmental perspective, the proposed site is an ideal location for a putrescible landfill.

The establishment of the landfill will support the South East Avon Voluntary Regional Organisation of Councils (SEAVROC) Strategic Waste Management Plan, which calls for the investigation and establishment of a regional landfill for the shires of York, Beverly, Brookton, Cunderdin and Quairading. The Allawuna Landfill could potentially receive waste from these shires.

The proposed Allawuna Landfill will be constructed as a Class II lined landfill, designed to accept putrescibles wastes. The facility will incorporate a composite liner system to contain the leachate generated by the waste mass for appropriate treatment on site.

This WAA pertains to the development of the first two landfill cells and supporting infrastructure at the site however it also outlines investigations and design work for the whole of the landfill which will involve six cells. An overview of the total landfill development is provided in Section 2.2 with layout and design drawings provided in Appendix A, B and C.

Construction activities at the site will be phased to distribute capital expenditure and minimise environmental impacts. It is expected that at least two compliance reports will be required over the development of Cell 1 and Cell 2. The first report will address the completion of Cell 1a, 1b and the site infrastructure, supporting a Licence application. The second report will confirm construction compliance for Cell 2a and Cell 2b. Another Works Approvals will be sought as required for the development of Cell 3 and beyond.

In designing the facility and developing this submission document the following environmental factors have been considered:

- Separation distances to sensitive land uses
- Potential impacts during both construction and operational phases
- Vegetation and fauna in the works area
- The geotechnical stability of the final landform
- Flow of surface water and groundwater from the site
- Performance of the proposed composite lining system
- The volume, quality and management of landfill leachate
- The volume and management of landfill gas
- Potential odour impacts on sensitive receptors
- Potential noise impacts on sensitive receptors, and
- Post closure site rehabilitation and management.

SITA has also engaged in a rigorous program of community and stakeholder engagement, identifying concerns and expectations regarding the landfill development and responding appropriately (Appendix L).

2.2 Overview of Landfill Development Sequence

The Allawuna Landfill facility will accept between 150 000 and 250 000 tonnes of waste per annum (t/a). At this stage the facility will operate for approximately 20 years, dependent on achieved filling and compaction rates. The landfill will have a lifetime capacity of approximately 5.6 million cubic metres (m^3).

The site will be divided into six primary cells, which will in turn be subdivided to assist in stormwater management during operation.

During the life of the landfill soil materials will be required for several purposes, which include cell construction, daily cover and final cover. A materials estimate was carried out to assess the total volume of materials over the life of the site. This estimate has shown that additional material will be required in excess of what is available within the landfill footprint. Materials will therefore be obtained from three borrow areas identified on the site. The location of the proposed borrow areas is indicated in Drawing D104 in Appendix A. Development of the borrow areas will commence in approximately year 10. Up until that time materials will be borrowed from adjacent cells for either construction purposes or cover material.

The materials estimate is presented in Table 1 below.

Table 1: Materials Estimate Summary (all quantities in cubic metres)

Cell No.	Airspace	Life (years)*	Daily Cover**	Final Cover	Fill required or Cell Construction	Cut obtained from Cell Excavation
1	781 000	2.8	78 000	39 000	93 000	82 000
2	968 000	3.5	97 000	52 000	15 000	158 000
3	872 000	3.1	87 000	35 000	4 000	210 000
4	1 308 000	4.7	131 000	72 000	155 000	41 000
5	695 000	2.5	70 000	41 000	26 000	69 000
6	1 016 000	3.7	102 000	76 000	245 000	1 000
Totals	***5 640 000***	***20.3***	***565 000***	***315 000***	***538 000***	***561 000***

Total material volume required	*Total material volume available within landfill footprint*
1 418 000	*561 000*
Material volume to be obtained from borrow areas	
857 000	

Notes: *Based on 250 000 t/a

**Based on use of alternative cover in conjunction with soil cover

2.3 Permitting and Approvals Timeline

Table 2: Permitting and Approvals Timeline

Date	Stakeholder	Summary
March 2012	Shire of York	SITA informed the Shire of York of its intentions to develop the Allawuna Landfill and entered into an agreement with the owners of Allawuna Farm to purchase the property subject to approval and commence detailed investigations.
July 2013	Environmental Protection Authority (EPA)	Bowman & Associates referred the Allawuna Landfill to the EPA – *EPA Referral Document: Allawuna Landfill (*Bowman & Associates, 2013). In July 2013, EPA advised the Project was "Not Assessed – Public Advice Given." (EPA, 2013, document no. A584547, refer to Appendix T).
December 2013	Shire of York	SITA lodged an Application for Approval to Commence Development under the Shire of York (the Shire) Town Planning Scheme No 2 (the proposed Allawuna Landfill is located on land zoned General Agriculture under the Shire of York Town Planning Scheme No.2).
April 2014	Wheatbelt Joint Development Assessment Panel (WJDAP)	The Application was referred to and refused by the Wheatbelt Joint Development Assessment Panel (WJDAP) at its meeting held 14 April, 2014. SITA exercised its rights under the *Planning and Development Act 2005* and on 16 April, 2014, lodged an application for review with the State Administrative Tribunal (SAT).
January 2014	Department of Environmental Regulation (DER)	Bowman & Associates submitted a Works Approval application (WAA) (Bowman & Associates, 2013).

Date	Stakeholder	Summary
November 2014	DER	SITA and Bowman & Associates withdrew the WAA. SITA engaged Golder to undertake further and more detailed site investigations, particularly with regard to groundwater and sub-soil conditions.
Early April 2015	DER	Submission of new WAA.

2.4 Location and Ownership

Table 3: Allawuna Location and Ownership Details

Element	Description
Allawuna Landfill Location	Toward the western edge of the Shire of York, Western Australia (Figure 1). The property is known as Allawuna Farm and is described as Lots 4869, 5931, 9926 and 26934 in Certificate of Title Vol 285, Fol 78A, Great Southern Highway, Saint Ronans in the Shire of York. Allawuna Landfill will be located on the southern side of Great Southern Highway approximately 80 km by road from SITA's transfer stations at Welshpool and Lansdale and 20 km west of the York Townsite. A proposed landfill footprint and prescribed premise boundary is provided in Figure 2.
Proponent	SITA is a subsidiary of Suez Environment, a leading multinational waste, recycling and resource recovery service provider. **SITA Contact Details** **Name**: John Jones **Position**: National Technical Landfill Manager **Site address**: Lots 4869, 5931, 9926 and 26934 Great Southern Highway, Saint Ronans **Postal address**: SITA Australia, 116 Kurnall Road, WELSHPOOL WA 6106 **Telephone**: +61 428 257324 **Email**: john.jones@sita.com.au

Figure 1: Proposed Site Location

Figure 2: Proposed Landfill Footprint and Site Boundary

2.5 Project Objectives

Table 4: Project Objectives and Scheduling

Element	Description
Objective	To obtain Works Approval for the proposed Allawuna Landfill (initial works comprising development of the first two landfill cells and establishment of associated site infrastructure).
Summary of operation	■ Class II lined landfill designed to accept putrescible wastes ■ The total footprint of the proposed AFL will be approximately 36 ha or 2.4% of the total site area. The initial prescribed premise boundary, for development of the first two landfill cells and associated infrastructure and internal access roads, will encompass an area of approximately 42.7 ha. ■ The total volume of the landfill over its operational lifetime is estimated to be approximately 5.6 million (M) cubic metres (m^3). The volume of Cell 1 and Cell 2 will be 1.75M m^3.

Element	Description
	■ Anticipated rate of filling of landfill approximately 150 000 and 250 000 t/a. ■ The base of the landfill will have a minimum clearance of at least 2 m from the maximum estimated winter groundwater level. ■ Six main cells with sub-cells to optimise stormwater and leachate management (WAA is for the first two cells). ■ Three borrow areas comprising a total of 20 ha will be developed, commencing from approximately Year 10 onwards (this will not be required for construction of cells 1 and 2). ■ The maximum height of the capped landfill will be 350.5 m AHD.
Schedule	Construction of the Allawuna Landfill is proposed to commence October to November 2015 or as soon as approval is granted by relevant regulators.
Landfill life	It is anticipated the Allawuna Landfill will commence operations in 2016 and is proposed to operate for approximately 20 years, dependent on achieving filling and compaction rates. The landfill will have a lifetime capacity of approximately 5.6M m^3. Cell 1 and Cell 2 will have a capacity of approximately 1.75M m^3.

3.0 COMPLIANCE WITH LEGISLATION AND OTHER APPROVALS

A summary of relevant environmental approvals are outlined in Table 5.

Table 5: Environmental Approvals for Allawuna Landfill

Agency	Approval
EPA	Allawuna Landfill was referred to the EPA by Bowman & Associates in 2013 – *EPA Referral Document: Allawuna Landfill (*Bowman & Associates, 2013). In July 2013, EPA advised the Project was "Not Assessed – Public Advice Given." (EPA, 2013, document no. A584547). Refer to Appendix T.
DER	This document serves as the supporting information for the WAA. A separate licence application will be submitted to the DER following completion of works and submission of the Works Approval Compliance document. Golder anticipates the Allawuna Landfill will be licensed under Prescribed Premises Category 64. Any clearing of native vegetation will be undertake in accordance with the Environmental Protection (Clearing of Native Vegetation) Regulations 2004.
Shire of York/ WJDAP	Since submission of a Planning Application for the Allawuna Landfill to the Shire of York in December 2013 SITA has progressed a number of matters relating to the proposed landfill, including: ■ Preparation of a Fire Management Plan ■ Completion of detailed site investigations, particularly into groundwater and sub-soil conditions.
Department of Water	SITA will apply for a section 11/17/21A bed and banks permit under the *Rights in Water and Irrigation Act 1914* prior to construction commencing at the site.

4.0 EXISTING ENVIRONMENT

Table 6: Summary of the Existing Environment

Element	Description
Climate	The Allawuna Landfill site is located on the Darling Range, characterised by Mediterranean climate of hot, dry summers and cool, wet winters. York weather station data accessed in February 2015 (BOM, 2015) recorded a: ■ Mean maximum temperature of 34.2°C in January and a mean minimum temperature of 3.6°C in July. ■ Average annual maximum temperate of 25.6°C and an average annual minimum temperate of 9.6°C. ■ Based on the rainfall data assessment, the average annual rainfall for the Allawuna Landfill site over the period 1931-2014 was 599 mm with annual rainfall showing a relatively high level of inter-annual variability ranging from a minimum of 286 mm (2010) to a maximum of 998 mm (1955). ■ The estimated annual average evaporation loss for the site is 1813 mm (Class A-pan) ■ The rainfall intensity for a 1:20yr, 24hr and 1:100yr, 24hr Average Recurrence Interval events are 3.4 mm/hr and 4.6 mm/hr respectively.
Geotechnical attributes	A number of geotechnical field investigations have been undertaken at the proposed landfill site as part of the design studies. These investigations included: ■ Cone penetration testing ■ Test pit field investigations ■ Material properties testing, including compaction characteristics, hydraulic conductivity and dispersive potential. The typical regolith profile encountered at the site is shown in Table 7 below.

Table 7: Typical lateritic regolith profile encountered.

Thickness (m)	USCS*	Description
0.2-0.4	-	■ **Topsoil**
0.5-1.0	GC/SC	■ **Clayey GRAVEL (GC)**; fine to medium grained gravel (red-brown pea-sized), rounded to sub-rounded particles, pale brown, with low plasticity fines. The material was generally moist and of loose consistency. ■ **Clayey SAND (SC)**; fine to coarse grained sand, pale brown or yellow with some white and red staining, low to medium plasticity fines. The material was generally moist and of loose consistency.
0.0-1.3	GC/SC	■ **DURICRUST – Clayey GRAVEL/clayey SAND (GC/SC)** weakly to moderately cemented material with pisolites were observed in some of the test pits.
0.5-5.5	SC/CI	■ **Silty Clayey SAND/Sandy Silty CLAY (SC/CI)**; fine to coarse grained sand to medium plasticity clay, yellow and white or only white with red staining reducing at depth (mottled and bleached zone), extending to depths below 4.0 m. The material was generally moist to wet and of very stiff consistency.

*USCS – Unified Soil Classification System

Element	Description
	The results of the geochemical laboratory testing indicate that: ■ The soil material appears to be from circum-neutral (pH ≈ 6) (with EC below 40 µS/cm) to acidic (pH below 5.5 with higher EC). ■ The average CEC of the material is approximately 3, which is at the low end of the typical range for kaolinite (between 3 meq/100 gr and 15 meq/100 gr). ■ The ESP and SAR are above 6% and 3, respectively. This implies that the *in situ* soil is classified as sodic and potentially dispersive. However the material's propensity to disperse under a rainfall/runoff event is considered to be low because the propensity of the material to swell and become mobile is reduced by the low CEC value. The results of the geotechnical laboratory testing indicate that: ■ The saturated hydraulic conductivity of samples compacted to 95% SMDD at OMC at 20°C using tap water is generally below 1×10^{-9} m/s. However, using 50 000 ppm NaCl solution, the permeability increased by approximately one order of magnitude (1×10^{-8} m/s). The results of the geotechnical investigations are detailed in the Geotechnical Investigations for Landfill Development Report in Appendix D.
Geology and soils	The geological description of the area is based on information obtained from the Perth 1:250:000 Geological Series map and shows interpreted granite as bedrock but in reality it is substantially obscured by the regolith profile. The site has predominantly porphyritic granite beneath the footprint of the landfill, with patches of laterite and colluvium on the north-eastern side of Thirteen Mile Creek, while the laterite is indicated on the south-western side of the creek. The residual regolith profile is laterally variable due to the details of weathering of parent rock types however the overall weathered residual profile is consistent with a classical lateritic profile. For example, coarse grain quartz rich zones within the granite may weather to generate a quartz sand dominated profile in the upper portions of the profile, while finer grained zones in the parent granite would result in silt dominated profile. Feldspars within the parent rock weather to kaolinite clay such that the original amount of feldspar in the rock may govern the amount of clay within the profile. The clay colloids (particles) can be quite mobile in the groundwater environment such that with prolonged flushing with seasonal rainfall and groundwater movement, the residual profile can become quartz sand rich, within a matrix of clay of varying percentages. A detailed description of the regional geology is presented in the Geotechnical Investigations for Landfill Development Report in Appendix D.
Hydrology	A catchment map showing the flow of water resources in the vicinity of the proposed Allawuna Landfill development is presented in the Surface Water, Groundwater and Leachate Management Plan in Appendix E. The site is not within a Prescribed Drinking Water Supply Area and is not within the Mundaring Weir Catchment Area (the Mundaring Weir catchment divide is approximately 1 km to the west of the proposed landfill footprint. Allawuna Farm was selected in part because of its location in the Spencers Brook water catchment, being very close to the headwaters and catchment divide. Allawuna Farm is characterised by a dividing valley containing the Thirteen Mile Brook watercourse. The stream order and travel distances for the connection of Thirteen Mile Brook to the Avon River are summarised in Table 8.

<table>
<tr><th>Element</th><th>Description</th></tr>
<tr><td></td><td>
Table 8: Surface Water Stream Order
<table>
<tr><th>Watercourse</th><th>From</th><th>To</th><th>Length (km)</th><th>Total Length (km)</th></tr>
<tr><td>Mile Brook</td><td>Headwaters</td><td>Allawuna Creek Crossing</td><td>6.0</td><td>6.0</td></tr>
<tr><td>Mile Brook</td><td>Allawuna Creek Crossing</td><td>Property Boundary</td><td>3.4</td><td>9.4</td></tr>
<tr><td>Mile Brook</td><td>Property Boundary</td><td>Warranine Brook</td><td>1.7</td><td>11.1</td></tr>
<tr><td>Warranine Brook</td><td>Thirteen Mile Brook</td><td>Clackline Brook</td><td>20.2</td><td>31.3</td></tr>
<tr><td>Clackline Brook</td><td>Warranine Brook</td><td>Spencers Brook</td><td>6.1</td><td>37.4</td></tr>
<tr><td>Spencers Brook</td><td>Clackline Brook</td><td>Avon River</td><td>10.5</td><td>47.9</td></tr>
</table>

The proposed Allawuna Landfill site is located approximately 41.9 km upstream from the Spencers Brook/Avon River intersection.

Upstream of the development, near the Thirteen Mile Brook headwaters a Rivercare project partnership between the Department of Water (DoW) and the Talbot Brook Land Management Association has been working to restore riparian vegetation along the banks of Thirteen Mile Brook, with the aim of reducing sediment transport and improving water quality.

The area around the proposed landfill and site infrastructure will be contoured to drain into a stormwater dam. The dam will function as a site water source, a sediment control structure and as an extra containment barrier for contaminants, providing a further layer of protection for Thirteen Mile Brook.

Drainage and sediment control features of the site are presented in the Surface Water, Groundwater and Leachate Management Plan in Appendix E.
</td></tr>
<tr><td>Hydrogeology</td><td>Groundwater at the site is present as a predominantly phreatic (water table) aquifer that can be locally perched or semi confined, with some lateral variation, depending upon the point of observation within the residual profile. The conceptual hydrogeological model is presented in Figure 3.

Rain falling on sandier more permeable materials will infiltrate readily down to the water table whereas rain falling on clayeyer materials will infiltrate more slowly or perch on the less permeable material, possibly move laterally depending on the local groundwater gradient conditions. In this way after rainfall, some locations on the site may appear damp or boggy until the transient shallow groundwater level attenuates through a combination of infiltration and lateral migration.

Below the regolith profile, fresh bedrock provides a fractured rock setting where groundwater storage and movement is within fractures and defects within the rock.

A detailed description of the hydrogeological setting for the proposed landfill site is provided in the Hydrogeological Site Characterisation Studies Report in Appendix E.</td></tr>
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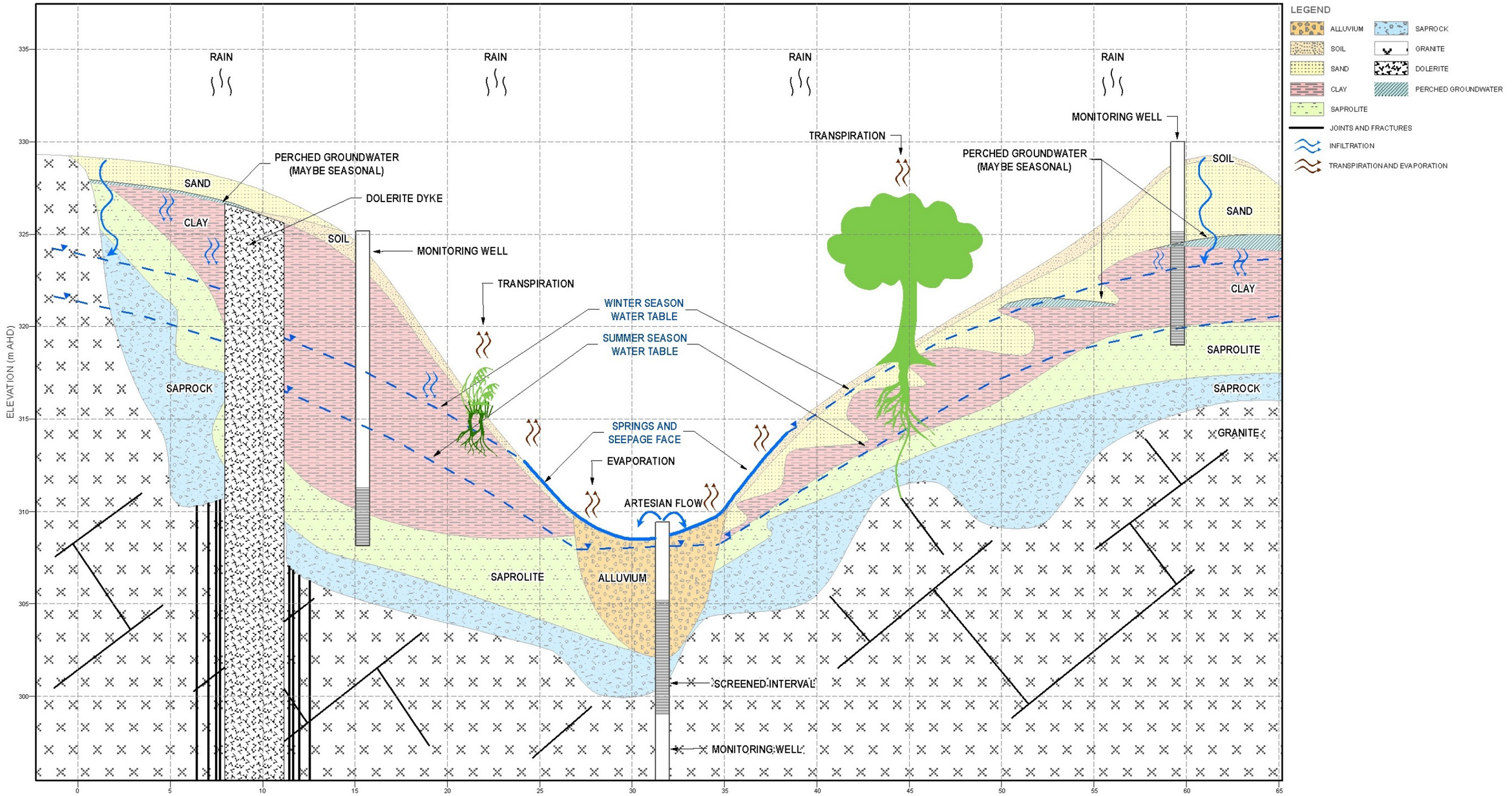


Figure 3: Conceptual Hydrogeological Section

Table 6: Summary of the Existing Environment *(continued)*

Element	Description
Groundwater levels	Twenty three groundwater monitoring bores have been established on the Allawuna Landfill site. A number of the bores have been installed in and around the Cell 1 and 2 development area to verify the depth of the groundwater beneath the proposed cells. Golder prepared an inferred contour plan of the groundwater table as can be seen in the Hydrogeological Site Characterisation Studies Report in Appendix E, Figure 3. This bores installed around the site and in and around the landfill footprint indicated that: ■ Groundwater levels across the site will generally be elevated at the end of winter in response to the infiltration of winter rains. ■ Groundwater levels will generally be at seasonal low at the end of summer as levels recede in the absence of recharge from rain. ■ This groundwater level fluctuation cycle has been exacerbated with the clearing of original vegetation for agricultural purposes, resulting in the development of dryland salinisation problems evident in the vicinity of the proposed landfill. ■ Groundwater levels based on winter measurements (19 August 2014) show groundwater flow is generally west towards Thirteen Mile Brook, which represents the local groundwater sink. ■ During periods of elevated groundwater level, groundwater will discharge into the creek, while during dry periods with lower groundwater levels, discharge into the creek may cease. ■ In dryer months when groundwater levels are seasonally low, recharge to the groundwater environment can also occur from surface water drainage in response to overland flow from rainfall. ■ Where the water table intersects the ground surface, seeps or springs will develop. This water joins the local surface water drainage system, discharging ultimately into Thirteen Mile Brook. ■ Two of the existing monitoring bores located close to the main creek that bisects the landfill footprint, were artesian (flowing) when inspected on 9 September 2014. The artesian flow reflects the groundwater potentiometric level being higher than the ground surface and/or locally semi confined conditions where the monitoring wells have intersected higher permeability horizons at depth, that reflect the higher groundwater elevations in the hills adjacent to the creek. Further information regarding the baseline groundwater monitoring study is provided in the Hydrogeological Site Characterisation Studies Report in Appendix E.
Groundwater chemistry	The groundwater quality data collected during the hydrogeological investigation for the proposed landfill indicates that: ■ The site has a low pH range of 3.2 to 5.6 (this is consistent with dryland salinity affected catchments throughout the Wheat Belt). ■ Groundwater Electrical Conductivity (EC) measurements are highly variable, ranging from 4 000 to 30 000 uS/cm. This variability is due to the varying flow paths and mixing histories of the individual waters sampled, with fresher water (lower EC measurements) reflecting more contact with recent infiltrating rainwater, whilst higher ECs may indicate mixing with groundwater exposed to stored salt because of rising water levels in response to clearing, or evaporative concentration processes near the ground surface. ■ Measured ECs in surface water in creeks on the site ranged from 9 000 to 14 000 uS/cm. The EC within the creek water will vary seasonally as a function of the amount of potentially salty groundwater discharging to the creek directly, and the amount of salt picked up by overland flow in response to rainfall events.

Element	Description
	Further information from baseline groundwater quality monitoring is provided in the Hydrogeological Site Characterisation Studies Report in Appendix E.
Flora	A comprehensive Level 2 flora investigation of the proposed landfill area was undertaken by ENV Australia (2012) (Appendix K). The proposed landfill footprint differs to that considered in the flora assessment, although not significantly. The results and conclusions contained in the 2012 Vegetation and Fauna Assessment Report remain valid for the proposed landfill. The key findings of the investigation were: ■ The area is dominated by cleared cropland (87%) with low fauna habitat value ■ The remaining area (13%) is a seasonally dry minor creekline, also with low fauna habitat value ■ No declared weeds, threatened or priority flora were identified at the site ■ The proposed development is likely to have minimal impact on the flora and fauna of the survey area and surrounds. The landfill has been specifically located to avoid clearing of any remnant bushland on the site. The scattered isolated Marri and Wandoo trees on the area have been carefully assessed and show no evidence of Black Cockatoo roosting or breeding. The site has been previously cleared for grazing and cropping and is currently cropped. In a regional context, there is a total of 44 300 ha of conservation reserve bushland adjacent to the site (Wambyn Nature Reserve 215.2 ha, St Ronans Nature Reserve 118.2 ha and Wandoo National Park 44 000 ha). The scattered native vegetation making up a proposed composite clearing area (4.16 ha) over the entire life of the landfill represents 0.009% of the Black Cockatoo foraging habitat in the region. The clearing of a small amount of parkland vegetation to establish the landfill, including a small section of bushland at the property entrance to upgrade the access road and scattered trees across the landfill footprint was referred to the Federal Department of Sustainability, Environment, Water, Population and Communities (DSEWPAC) to establish if it would be a controlled action under the *Environmental Protection and Biodiversity Conservation Act 1999*, with a potential to impact on Black Cockatoo populations. DSEWPAC advised the clearing of the vegetation will not be a controlled action. A copy of the advice is included in Appendix U. The remnant bushland at the north of the property, adjacent to the site entry is currently protected by a Conservation Covenant, issued by the Soil and Land Conservation Commissioner. A copy of the covenant is contained in Appendix U, clearly highlighting the areas reserved. Advice from the office of the Commissioner provided on 18 July 2013 confirmed that limited clearing for the widening of the site access road is acceptable and would not contravene the clearing restriction of the covenant. The remainder of the conservation covenant protected bushland will remain untouched.
Fauna	ENV Australia (2013) completed a Level 1 fauna survey of the proposed landfill development area (Appendix K). The proposed landfill footprint differs to that considered in the fauna assessment, although not significantly. The results and conclusions contained in the 2012 Vegetation and Fauna Assessment Report remain valid for the proposed landfill. The key findings of the fauna investigation were: ■ Both habitat types present in the study area are of low fauna habitat value

Element	Description
	■ A comprehensive Black Cockatoo (*Calyptorhynchus latirostris* and *Calyptorhynchus baudinii*) species specific assessment found minor evidence of foraging under 10 of the 144 scattered Marri and Wandoo trees ■ No evidence of roosting or breeding in any trees ■ The closest known Carnaby's Cockatoo roosting site is over 16 km away ■ No evidence of Graceful Sun Moth (*Synemon gratiosa*) habitat in the area. The clearing of the scattered Marri and Wandoo in the development area has been assessed as a 'not controlled action' by DSEWPAC.
Aboriginal heritage	A review of the Aboriginal Heritage Inquiry System (AHIS) in February 2015 found no registered Aboriginal Sites or Heritage Places within the proposed AFL site. The nearest registered Aboriginal Site is the Helena River (Site ID 3758) located approximately > 700 m to the east. In 2012, SITA contacted three Elders of the Local Aboriginal Community and met to discuss the development as part of the community and stakeholder consultation program. The Elders indicated that the location of the landfill and the surrounding development are not a place of significance for the local Aboriginal people. The historical path of Aboriginal people travelling from the Midland area to the York area is closer to the major water courses and away from the development site.
Social environment	Allawuna Farm has a total area of 1516 ha of which 75% has been cleared for farming. It is currently leased out for broad acre cropping having previously been used for both cropping and grazing. Save for a few pockets of bushland within the central portions of the site, the bulk of the remnant bushland lies south of the Highway, between the Highway and the main farmed area. The site is characterised by a central North-South valley containing a northward flowing creek, Thirteen Mile Brook. The site rises to the west and east from the Brook with a ridge bordering the eastern property boundary. Extensive areas of remnant vegetation lay between the landfill site and Great Southern Highway which in combination with the landform fully screen the landfill from the Highway. The northern portion of the landfill is screened from the property to the east by intervening remnant vegetation. Significant areas of remnant vegetation are located inside the eastern boundary, with only relatively small portions cleared, a portion of which is under crop. The land to the south of Allawuna Farm is uncleared remnant bushland. Wandoo National Park, a large flora and fauna reserve and State Forest, abuts the western edge of the property. A picnic area, Mt Observation, has been developed at the north-eastern portion of the reserve abutting the north-western paddock of Allawuna Farm. The picnic area is located 4.6 km north-west of the proposed landfill footprint. The land to the immediate north of the Highway has been substantially cleared for farming. The nearest residence is on the adjoining property to the east. The residence is located in the north-east of the property and is 1.9 km north-east of the landfill and fully screened from the landfill by the landform and intervening remnant bushland. The next closest residence is located 2.4 km from the proposed landfill footprint. Allawuna Farm is accessed directly from Great Southern Highway. Great Southern

<table>
<tr><th>Element</th><th>Description</th></tr>
<tr><td></td><td>Highway is a sealed major road and an approved Restricted Access Vehicle Route. The farm entry road is located centrally to a long straight providing good sight distances in both directions. Road access to the Allawuna Landfill will have minimal impact on existing residents while being well isolated, is fully screened from Great Southern Highway and buffered from impacting on any adjacent land owners or surrounding land uses.

There are 21 properties within 2.5 km of the site boundary. The owner of each property has been identified by SITA and special consideration given to ensure they remain informed as the landfill development process continues.

The landfill and associated infrastructure locations have been selected to provide appropriate buffer distances to the surrounding nature reserves, sensitive receptors, public use areas, surface waters and property boundaries.

Buffer distances, summarised in Table 9 are well in excess of DER recommendations for a Class II landfill and will minimise the impacts of the landfill on surrounding residents. Given the rural location of the landfill, future subdivision is unlikely. Regardless, the internal 600 m buffer on the property will be owned by the Proponent and easily maintained against any future development in the area.

Table 9: Buffer Distances
<table>
<tr><th>Buffer Description</th><th>Separation Distance (m)</th></tr>
<tr><td>Minimum DER requirement for sensitive receptor land use (e.g. subdivision) from putrescible landfill</td><td>500</td></tr>
<tr><td>Minimum DER requirement for single residence from putrescible landfill</td><td>150</td></tr>
<tr><td>Landfill to Lot Boundary</td><td>600</td></tr>
<tr><td>Landfill to Nearest Neighbouring Dwelling (single residence)</td><td>1900</td></tr>
<tr><td>Landfill to Mount Observation Picnic Area</td><td>4600</td></tr>
<tr><td>Landfill to Wandoo National Park</td><td>1000</td></tr>
<tr><td>Leachate Dams to Thirteen Mile Brook</td><td>270</td></tr>
<tr><td>Landfill to Thirteen Mile Brook</td><td>350</td></tr>
</table></td></tr>
<tr><td>Agriculture</td><td>The investigation regarding the suitability of the Allawuna Farm as a landfill site included a search to determine if any farming practices in the vicinity of the Allawuna site may be especially sensitive to the establishment of a landfill, or lose certification for their production process due to the development of the Allawuna site. A site may only be certified as organic or biodynamic by an approved certifying organisation, as regulated by the Federal Department of Agriculture, Fisheries and Forestry (DAFF). A site is classified as ‘organic’ where practices emphasise the use of renewable resources, conservation of energy, soil and water, recognition of livestock welfare needs and sustainable crop yields without the application of synthetic chemicals or artificial fertiliser. A site is classified as ‘bio-dynamic,’ where, in addition to organic farming principles, preparations are applied in accordance with the work of Rudolph Steiner (OIECC 2009).

Properties may be identified as a ‘sensitive site’ on the Department of Agriculture and Food WA (DAFWA) sensitive sites database. Landholders may voluntarily register as a sensitive site with DAFWA if the site undertakes aquaculture, biodynamic, horticulture, bee hive, organic, silviculture or viticulture processes. Sensitive site registration with DAFWA does not require organic or bio-dynamic certification from an approved certifying</td></tr>
</table>

Element	Description
	organisation. Two properties in the vicinity of Allawuna have been identified in the DAFWA sensitive sites database. One is listed as a bio-dynamic site and the other as an organic site. The property boundary of the bio-dynamic site is approximately 700 m from the Allawuna property boundary and 2.15 km from the proposed landfill footprint. The organic site is approximately 1.3 km from the Allawuna property boundary and 2 km from the proposed landfill footprint. Given the very large buffer distances between these properties and the landfill and the proposed management strategies for potential emissions at the landfill site, the Allawuna Landfill development is expected to have no impact on the organic or biodynamic sites identified. There are no specific guidelines relating to buffer distances between landfill activities and agricultural land use. SITA has undertaken to work with DAFWA to ensure that any food crops produced at the Allawuna property are uncontaminated through a combination of buffer distance separation, good management of landfill litter and leachate and, if appropriate, laboratory testing of crops.
Odour	Detailed odour modelling for the proposed landfill was undertaken by Environmental Alliances Pty Ltd (Appendix I). DER's criterion for acceptable odour impacts is 2.5 ou (Odour Units) sustained over a one hour period. The level of 2.5 ou is essentially the level of odour concentration at which 50% of persons do not detect any distinct or adverse odour. The model also calculated odour concentrations based on a more stringent short term criteria of 2 ou and 4 ou over a three minute average. The model generated odour contours based on: ■ An estimation of odour emissions rates from all odour-generating sources based on observed data at a landfill of similar waste type and volumes ■ A dispersion model to predict ambient odour levels over the course of a year given local climatic and wind conditions, and ■ Odour concentrations around the source of the odour and specifically the active landfill cell. The investigation found that for the proposed operational times, procedures and waste volumes, all odour generated would be maintained well within the site boundary including the more stringent 2 ou/3 min criteria being approximately 1.9 km from the nearest dwelling to the north-east. The EPA has concluded that a well-managed landfill is unlikely to cause odour impacts at the buffer distance achieved at the Allawuna Landfill and detailed modelling has confirmed that all threshold odour levels are contained well within the property boundary.
Noise	A comprehensive noise assessment was performed for both the construction and operational phases of the site by Vipac Engineers & Scientists Ltd (Appendix I). Plant operations were modelled based on the expected numbers of plant and operational hours for the site with the results compared to the *Environmental Protection (Noise) Regulations 1997* (EP Noise). The noise investigation found that predicted noise levels at the nearest sensitive receivers were within the guideline limits for times of day during both the construction and operational phases of the landfill development.

5.0 PROJECT DESCRIPTION

5.1 Overview

Table 10: Project Description

Element	Description
Site selection	The Allawuna Landfill site was selected as the optimal choice after assessment of nineteen potential sites within the Shires of Boddington, Gingin, Toodyay and York based on the following criteria: ■ Located off the Swan Coastal Plain ■ Land for sale (freehold), or possibly for sale, subject to approaching the owner ■ A large site to maintain ownership of buffer distances ■ Close to a main road for truck access ■ Realistic travel distance from SITA's Welshpool Transfer Station to the landfill ■ Located in an area where landfills are not explicitly prohibited. In addition, the Allawuna Landfill site was preferred as it: ■ Provides full control over extended buffers ■ Presents a low environmental risk ■ Is directly accessible from Great Southern Hwy ■ Is located west of the York town site (approximately 20 km west) ■ Provides extensive screening from the Great Southern Hwy ■ Is within a reasonable travel distance and time to/from SITA's Transfer Stations (approximately 80 km by road from SITA's transfer stations at Welshpool and Lansdale). SITA also investigated the potential for transporting waste by rail from its Welshpool Transfer Station to either the Allawuna Landfill site or a transfer site further afield. However the costs to completely redevelop SITA's existing infrastructure for this mode of transport and developing rail siding infrastructure at each end were prohibitively high and therefore not commercially viable. Additionally, and depending on the location of the waste receival siding, there was a risk that trucks would have to traverse the York town site to access the site. A copy of the confidential investigation matrix was provided in an email to the DER on 21 May 2013. The confidential matrix contains commercially sensitive information however it can be resubmitted to the DER if necessary.
Waste type and quantity	In accordance with the *Landfill Waste Classification and Waste Definitions 1996* (*as amended December 2009)* (DER, 2009) for a Class II landfill, the proposed Allawuna Landfill will receive the following types of waste: ■ Clean Fill: Material that will have no harmful effects on the environment and which consists of rocks or soil arising from the excavation of undisturbed material. ■ Type 1 Inert Waste: Non-hazardous, non-biodegradable (half-life greater than two years) wastes containing contaminant concentrations less than Class 1 landfill acceptance criteria but excluding paper and cardboard (paper and cardboard are biodegradable materials and are therefore considered as putrescible waste), and materials that require treatment to render them inert (e.g. peat, acid sulfate soils). ■ Putrescible Waste: Component of the waste stream likely to become putrid, including wastes that contain organic materials such as food wastes or wastes of animal or vegetable origin, which readily biodegrade within the environment of a landfill. ■ Contaminated solid waste meeting waste acceptance criteria specified for Class II landfills (possibly with specific licence conditions): Waste containing chemical substances or wastes at concentrations above background levels that present, or have the potential

Element	Description
	to present, a risk of harm to human health or the environment. ■ Type II Inert Waste (with specific licence conditions): Waste consisting of stable non-biodegradable organic materials such as tyres and plastics, which require special management to reduce the potential for fires. ■ Type I Special Waste: Waste which includes asbestos and asbestos cement products. ■ Type II Special Waste: Waste consisting of certain types of biomedical waste that are regarded as hazardous but which, with the use of specific management techniques, may be disposed of safely within specified classes of landfill. Waste types outside of these definitions will not be received at the Allawuna Landfill. The landfill facility is intended to accept between 150 000 and 250 000 t/a.

5.2 Landfill Design

The primary design focus for the development of the Allawuna Landfill is environmental protection. The Vic-BPEM design features have been adapted to suit the Allawuna climate, topography, geology and existing environment. A combination of site characteristics, engineering design features and effective management strategies will minimise the risk of impact on the surrounding environment.

Table 11: Summary of Landfill Design

Element	Description
Design standard	The landfill has been designed to generally meet the requirements of the Vic-BPEM.
Basis of Design	The following criteria forms the basis of design for the landfill: ***Vic-BPEM Design Requirements:*** The minimum design requirements based on the Vic-BPEM include the following: ■ The site layout minimises environmental and health and safety risks ■ Maximum seepage from the landfill should be limited to 10 L/ha/day ■ The liner system should consist of at least 1.0 m of compacted clay with a hydraulic permeability of 1×10^{-9} m/s, in conjunction with a geomembrane liner, or an equivalent system ■ Groundwater quality should be maintained as close as practicable to background levels ■ The site should be geotechnically stable ■ The site should protect the beneficial uses of receiving waters and avoid any adverse environmental impact on surface and ground waters To meet these requirements the design objectives therefore were to: ■ Identify a site with a generally clayey environment ■ Identify a site where the groundwater has limited or no beneficial use ■ Design the landfill base to be a minimum of 2.0 m above the maximum estimated groundwater table ■ Limit the removal of rock or hard material ■ Achieve gradients on the landfill base that will facilitate drainage and removal of leachate ■ Provide a liner system that will meet the requirements of the Vic-BPEM ■ Provide stormwater management structures to separate clean upstream water from potentially contaminated run-off from the site

Element	Description
Site development	The overall site development works for the Works Approval Application include the following components: ■ Entrance roadway to the farm ■ Access road to the landfill site location ■ Stream crossing ■ Infrastructure (including administrative buildings, hardstand areas, weighbridge, electricity, pumping and piping infrastructure) ■ Landfill cell development (Cell 1 and 2) ■ Stormwater dam ■ Leachate pond ■ Retention pond ■ Sediment management structure ■ Stormwater diversion measures.
Landfill geometry	The landfill geometry and cell floor has been designed taking the following constraints into account: ■ Maximum estimated winter groundwater levels. Allowance has been made for a minimum 2.5 m separation, which allows for the 2.0 m unsaturated zone required in Vic-BPEM plus an additional buffer of 0.5 m to allow for uncertainties. ■ Maximum depth of soil excavation. This is based on the test pit data and is conservative along the upper reaches of the paddock in that test pits where no refusal on hard material was encountered is still taken as the maximum extent of soil excavation. Despite this, rock excavation may still be required in some areas and hence an allowance will be made in the excavation quantities to allow for this possibility. ■ Minimum gradients required to meet Vic-BPEM requirements (3% slope towards the sump). This is generally achieved, although the basal slope on Cell 2 is 2.7% to optimise the volume of material that can be excavated for re-use ■ Maximise excavation volume. The volume of soil excavation has been maximised as much as is practical with the intent to minimise the volume of material required from borrow areas outside the footprint of the landfill cell, while still adhering to the preceding constraints. The basal geometry as well as cut and fill extents for Cells 1 and 2 are shown on drawings D203 to D206 in Appendix B. The sections on drawings D207 and D208 in Appendix B indicate the relationship between the groundwater table, soil excavation depth and base (finished subgrade level) of the landfill for Cell 1 and 2.
Separation to groundwater	As described in the *Landfill geometry* section the landfill based has been designed to have a separation to groundwater of at least 2.5 m.
Liner system	Based on the geotechnical and geochemical test work the clayey material is not suitable for use a clay liner material due to the higher than BPEM-target permeability (when tested with a saline solution) and low CEC value. The clayey material can however be used in conjunction with a geosynthetic clay liner (GCL) to form a system with similar performance to a 1.0 m thick compacted clay liner. An assessment of the advective and diffusive behaviour of the proposed liner system (described below) versus a theoretical Vic-BPEM liner system was carried out.

<table>
<tr><th>Element</th><th>Description</th></tr>
<tr><td></td><td>
For evaluating advection, the assessment is based on simplified Darcian-permeability methods and is therefore intended to facilitate comparison only. Table 12 presents the BPEM guideline for basal liner systems in comparison to the proposed system. Note that non-containment components (e.g. geotextiles) have been omitted for clarity.

Table 12: Comparison of BPEM Guideline and Proposed Liner System

<table>
<tr><th>BPEM</th><th>Proposed System</th></tr>
<tr><td>Geomembrane liner</td><td>Geomembrane liner</td></tr>
<tr><td rowspan="2">Clay:
■ Permeability $K \leq 1 \times 10^{-9}$ m/s
■ thickness ≥ 1 m</td><td>Geosynthetic Clay Liner (GCL):
■ permeability range $1 \times 10^{-12} \leq K \leq 1 \times 10^{-11}$
■ thickness ≈ 1 cm</td></tr>
<tr><td>Clay:
■ permeability $K \approx 1 \times 10^{-8}$ m/s
■ thickness = 0.5 m</td></tr>
</table>

The objective of this assessment is to evaluate the performance of both systems in terms of advective flux. The following assumptions have been made for this assessment:

- Both systems are subject to a hydraulic head of 0.3 m
- Since the geomembrane is common to both systems it has been omitted from the calculations
- The potential for the geotextile carrier layers associated with the GCL to impede flow have been ignored (i.e. the GCL permeability is assumed constant, dependent only on the clay component)

Flow through the clay and GCL materials was estimated using Darcy's Law:

$$\frac{Q}{A} = q = K \cdot i / n_e$$

where q is the one-dimensional unit flux, K is the permeability, i is the hydraulic gradient acting through the layer(s), and n_e is the effective porosity of the clay (assumed to be 0.35). The flux through the proposed system is a function of GCL permeability, which may range from 10^{-11} to 10^{-12} m/s, depending on the product. Table 13 shows the comparison of fluxes through the systems.

Table 13: Comparison of flux through liner systems

<table>
<tr><th>System</th><th>1-D Flux (m/s)</th></tr>
<tr><td>BPEM</td><td>Clay: 3.7×10^{-9}</td></tr>
<tr><td>Proposed</td><td>GCL*: $8.9 \times 10^{-10} \leq q \leq 8.9 \times 10^{-9}$
Clay: 3.7×10^{-8}</td></tr>
</table>

*Flux of the liner system is controlled by the flux through the GCL component
</td></tr>
</table>

Element	Description

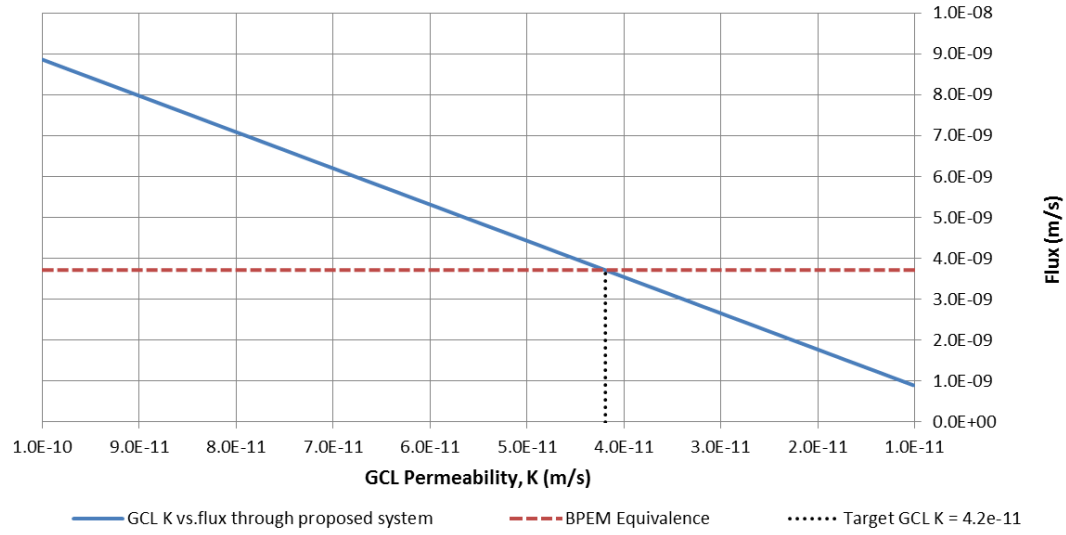


Figure 4: Flux through liner system as function of GCL permeability

The results presented in Table 13 indicate a GCL *K*-value of 4.2×10^{-11} or lower should be targeted for equivalence with the BPEM guidelines.
For diffusion the methods proposed by Qian et al (2002) have been used to estimate the diffusive flux ratio R_D of the two systems described in Table 12. R_D is given by Fick's law:

$$R_D = \frac{J_{D\ Proposed}}{J_{D\ EPA}} = \frac{D_P \cdot n_P \cdot t_E}{D_E \cdot n_E \cdot t_p} \leq 1\ for\ equivalence$$

Where J_D is the diffusive mass flux, *D* is the coefficient of diffusion associated with each material, *n* is the total porosity (assumed to be 0.5 for both systems) and *t* is the thickness. Adopting typical values in Qian et. al[1]. (2002) of *D* for GCLs and kaolin clays yields R_D=0.94, indicating equivalent diffusion properties under steady-state conditions.

Based on above assessment the main engineering components of the proposed composite liner system will therefore include the following (Refer to Drawing D107 in Appendix A):

- 500 mm thick compacted clayey material.
- Geosynthetic Clay Liner (GCL) to be installed over the base of the landfill cells and on the side slopes to help in limiting contaminant migration, water seepage and landfill gas migration.
- 2 mm thick High Density Polyethylene (HDPE) membrane liner will be placed directly above the GCL and will further limit contaminant and landfill gas migration.
- Non-woven geotextile cushion layer will be placed on top of the HDPE liner to serve as a protective layer, minimising the risk of damage or puncture during installation of the drainage layer and operation of the landfill.
- A 300 mm drainage layer will be laid on top of the cushion layer. Leachate collection pipes will be installed in the drainage layer.
- Non-woven geotextile layer will be placed on top of the drainage layer to serve as a separation layer from the waste.

1 Qian, X, Koerner, R. M. & Gray, D. H. 2002. Geotechnical Aspects of Landfill Design and Construction, pp155-161

Element	Description
Capping system	The final landfill cap will achieve the following Vic-BPEM design criteria: ■ Provide a long-term stable barrier between the waste and the environment ■ Prevent the uncontrolled escape of landfill gas ■ Infiltration rate will not exceed 75% of the seepage rate through the base of the landfill, and ■ Provide land suitable for its intended after use. The proposed landfill cap will consist of the following components from bottom to top (refer to Drawing D107 in Appendix A): ■ 300 mm thick soil cover immediately above the last layer of waste ■ Geosynthetic Clay Liner (GCL) ■ Linear Low Density Polyethylene (LLDPE) geomembrane liner ■ Cushion geotextile layer, if required ■ Geocomposite drainage layer ■ 700 mm thick sub-soil layer, and ■ 300 mm topsoil/mulch layer.
Leachate management	A water balance analysis was undertaken using the Hydrologic Evaluation of Landfill Performance (HELP) model to estimate the leachate generation rates for year 1 to 7 covering the operational stages of landfill cells 1a, 1b, 2a and 2b. This included assessment of leachate generation resulting from rainfall infiltration through uncapped waste, rainfall seepage through the interim cap and from rainfall seepage through the final landfill cap areas. The landfill design incorporates a leachate management system that will consist of: ■ Leachate collection and header pipes on the floor of the cells, draining to a leachate extraction sump at the low point of the landfill site (refer to Drawings D220 to D225 in Appendix B). ■ Leachate will be pumped from the landfill cells to the leachate ponds from where it will be evaporated (refer to Drawings D226 and D227 in Appendix B). Should the capacity be exceeded leachate will be trucked off site and/or additional leachate ponds constructed to manage the volume of leachate, and ■ Leachate monitoring will be carried out by sampling from the leachate pond. The leachate pond liner system will be similar to the liner system for Cells 1 and 2 and will therefore include the following: ■ 500 mm thick compacted clayey material. ■ Geosynthetic Clay Liner (GCL) to be installed over the base of the pond and on the side slopes to help in limiting contaminant migration and water seepage. ■ 2 mm thick High Density Polyethylene (HDPE) membrane liner will be placed directly above the GCL and will further limit contaminant migration. For details regarding the methodology used to estimate leachate volumes, the estimated leachate generation rates during operation of the first two cells and the proposed leachate management strategy refer to the Surface Water, Groundwater and Leachate Management Plan in Appendix E.
Groundwater management	Subsurface seepage drains will be installed below the footprint of Cell 1. The extent of the seepage drains is based on: ■ The level at which the potentiometric water table daylights at the base of the paddock.

Element	Description
	■ Observed seepage zones that correlate to the extent of cropping in the paddock. The sizing and spacing of the subsoil drains are based on the peak estimated flow rate as presented in the Surface Water, Groundwater and Leachate Management Plan in Appendix E. A retention pond is proposed to contain the subsurface seepage until such time that it has been tested or assessed and identified for release to the environment or containment on site, if contaminated. As the quality of the water in the retention pond is generally expected to be uncontaminated the proposed liner system will include the following: ■ 500 mm thick compacted clayey material. ■ 2 mm thick High Density Polyethylene (HDPE) membrane liner will be placed directly above the GCL and will further limit contaminant migration. The location and details for the retention dam is indicated in Drawing D230 in Appendix B.
Landfill gas	The potential volumes of landfill gas to be generated from the proposed landfill have been estimated (refer to the Allawuna Landfill Gas Assessment Report in Appendix G). Modelling (GasSim) indicates a peak of approximately 1660 m^3/hour of gas production. The main engineering components of the proposed landfill gas extraction and treatment system will include the following: ■ Vertical, and possibly horizontal, gas extraction wells ■ Condensate traps, gas well heads and associated pipe required for the safe transfer of landfill gas from the gas extraction wells (these components will be installed after the completion of cells with landfill cap and will convey the gas to a flaring or an energy recovery facility), and ■ Provision of a flare after installation of gas extraction wells. An engine will be installed if future gas monitoring shows this to be a viable management option. For further information regarding proposed extraction and treatment of landfill gas at the landfill refer to the Allawuna Landfill Gas Management Plan in Appendix G.
Landfill cell development and staging	The landfill cells will be constructed using a staged methodology to distribute capital expenditure, limit the potential for infrastructure degradation and minimise environmental impacts. The approximate lifetime landfill design parameters are: ■ The total footprint of the proposed Allawuna Landfill will be 36 ha. ■ The total volume of the landfill over its operational lifetime is estimated to be approximately 5.6M m^3. ■ The maximum height of the capped landfill will be 350.5 m AHD (refer to Drawing D103 in Appendix A). Cell 1 has a plan area of 63 000 m^2 and an available fillable airspace of approximately 781 000 m^3. Cell 2 has a plan area of 55 000 m^2 and an available fillable airspace of approximately 968 000 m^3. The overall layout plan, design plans and sections for Cell 1 and Cell 2 earthworks can be seen on Drawings D202 to D208 in Appendix B.

Element	Description
Surface water management	The surface water drainage infrastructure at the Allawuna Landfill has been designed to prevent the interaction of stormwater and leachate. The stormwater dam is designed to capture surface runoff from the small catchment (approximately 159 ha) to the east of the landfill footprint. Runoff from the catchment was estimated using the Rational Method for loamy and lateritic soil catchments in the Wheatbelt region of Western Australia, as described in the Engineers Australia (1998) *Australian Rainfall and Runoff* flood estimate guidelines (see Appendix E). The stormwater dam will have an overflow channel capable of carrying a peak 1 in 100 year storm discharge into Thirteen Mile Brook. Refer to the Surface Water, Groundwater and Leachate Management Plan in Appendix E for further information regarding the proposed surface water management system components. In addition, design details of the proposed stormwater dam, spillway and discharge channel can be seen in section views on Drawings D240, D241 and D242 in Appendix B. Details regarding the sub-surface drainage system, including retention dam, are provided in Drawings D209 to D212, D230, and D231 in Appendix B. The location of the stormwater dam is indicated in Drawing D202 in Appendix B.

5.3 Landfill Construction

The initial construction works at the Allawuna Landfill site will include establishing site infrastructure (site access roads, office, weighbridge, parking, etc.), bulk earthworks, leachate dam and the construction of Cell 1 and Cell 2. SITA is working towards the milestones outlined in Table 14 below for the initial landfill construction works. Subsequent cells will be constructed as required, subject to DER Works Approval.

Table 14: Landfill Construction Milestones

Description	Commencement	Completion
Construction of great Southern Highway intersection upgrade	October 2015	November 2015
Construction of entry road, site infrastructure and Cell 1	November 2015	April 2016
Placement of waste in Cell 1 (commence landfill operation)	May 2016	May 2019
Construction of Cell 2	November 2018	February 2019
Placement of waste in Cell 2	March 2019	March 2022

The landfill construction works will be undertaken in accordance with the Technical Specification for the Construction of Cell 1 and 2 (Technical Specification), which is contained in Appendix M**,** and 'Issued for Works Approval' drawings (Appendix B). A separate construction specification document has been prepared to address construction requirements for the other associated landfill facility components, including roads, hardstands and services (refer to the Technical Specification Infrastructure in Appendix M).

Prior to commencing the landfill construction the Technical Specification and any other relevant specification and management plans will be revised to include any changes required to meet conditions set in the Works Approval.

Appropriate management practices will minimise disturbance to the surrounding area during construction of the Allawuna Landfill. Prior to commencing landfill construction works SITA will prepare a Landfill Construction Management Plan to address the on-site and off-site impacts of construction including but not limited to:

- Internal and external road works

- Staging of cell development
- Measures to be implemented to mitigate dust, machinery noise and other construction impacts
- Fuel and chemical management
- Contingency planning, and
- Emergency contacts.

SITA will provide a copy of the Landfill Construction Management Plan to Council and post a copy on its website. SITA will also provide a copy to Council suitable for posting on Council's website.

All construction works will also be subject to a rigorous Construction Quality Assurance (CQA) program, ensuring the constructed landfill and facilities are compliant with the approved specification (refer to the CQA Plan in Appendix M). Minor changes to the works will be documented and included in the CQA report, which will accompany the licence application for the constructed landfill.

Table 15: Summary of Landfill Construction

Element	Description
Staging of landfill cell development	The landfill will be constructed in a series of cells, each one with an approximate 3 to 4 year filling life. This Works Approval application is for the construction of Cell 1 and Cell 2 which will cover the first 6 to 7 years of landfill operation. Cell construction will commence in the upper section of the paddock, generally upstream of the seepage area identified during the hydrogeological investigation (Appendix E). Cell 1 will be constructed first, with an internal temporary stormwater management division bund which will divide the cell into two sub-cells, namely 1a and 1b, with an estimated filling period of 1.6 and 1.3 years respectively. Cell 2 (with a total life of 3.5 years) will be constructed in the same manner as Cell 1, with a temporary stormwater management division bund. In both cases the bund is removed prior to filling commencing in the adjacent sub-cell. Cells 1 and 2 will be constructed in the south-western portion of the landfill footprint. Subsequent cell development will occur towards the north-east of the first two cells in the order indicated in the Cell Layout Plan (Drawing D102 in Appendix A).
Cell 1 and 2 Construction	Cell 1 and 2 will be constructed in the following manner to allow for the removal of unsuitable materials where required: ■ Remove 200 mm topsoil ■ Remove 800 mm of unsuitable more permeable upper clayey gravel/clayey sand material through which recharge of the ephemeral water table occurs. ■ Excavation to -250 mm of finished subgrade level. ■ Proof rolling of the surface. ■ Removal of areas with sandy material to a maximum depth of -1.5 m below finished subgrade level. ■ Construct the embankment using general fill material. ■ Replace excavate areas and fill areas with clayey engineered material to -250 mm of finished subgrade level. ■ Rip and re-compact the entire basin and side slopes to a depth of 250 mm. ■ Place and compact 250 mm engineered clayey material to form a reworked layer with a total thickness of 50 mm. ■ Install geosynthetic liner system as shown on the drawings.

Element	Description
	Refer to drawing D210 in Appendix B for typical construction sequence and drawings D207 and D208 in Appendix B for extent of fill materials.
Vegetation clearance	A small number of scattered remnant trees on the mostly cleared cropland will be cleared for the development. The proposed clearing was referred to DSEWPAC and identified as a not-controlled action, with negligible potential for impact on federally protected matters (Appendix U). The *Environmental Protection (Clearing of Native Vegetation) Regulations 2004* provide exemptions for clearing of less than 5 ha per financial year, provided the clearing falls within the prescribed criteria. In this case, less than 0.2 ha will be cleared to widen the site entry road (an exemption under Regulation 5, Item 12), and a number of isolated trees across the landfill and infrastructure area (an exemption under Regulation 5, Item 19).
Access road	The intersection of the site access road and Great Southern Highway will be upgraded to meet the requirements of Main Roads WA. The design approved by Main Roads WA incorporates an eastbound overtaking lane and a westbound acceleration lane. A sealed access road across the site, from the intersection with the highway to the landfill development area, will be constructed as part of the works. The road has been aligned to minimise disruption to cropping, minimise the removal of remnant vegetation, maintain a safe geometry for truck movements and align with an existing creek crossing. The road pavement will be minimum 4 m wide, sealed to an appropriate standard for regular heavy vehicle movements and include 1 m wide shoulders on each side. The access road will be fenced to keep livestock and other fauna off the road. The sealed access road will have a minimum 10 m wide vegetation/crop free area between fences. The access road fence will have emergency access gates installed periodically along its length. An overall layout of the access road can be seen on Drawings ALLA-003 and ALLA-004 in Appendix C. Details of proposed road works, and associated drainage, including road cross sections are provided in Drawings ALLA-005 to ALLA-019 in Appendix C.
Creek crossing	A dual lane creek crossing will be installed on the property across Thirteen Mile Brook to enable all weather vehicle access to the landfill. The crossing will be constructed of reinforced concrete box culvert (RCBC) sections to the standard Main Roads WA specification (refer to Drawing ALLA-019 in Appendix C). The relevant permit for the creek crossing will be obtained from the DoW in accordance with the requirements of the *Rights in Water and Irrigation Act 1914*. No creek crossing works will be undertaken without DoW approval.
Weighbridge and entry office	To the north-west of the landfill development area a 30 m long weighbridge certified to 100 tonnes will be installed for the weighing of incoming material, and where required, outgoing vehicles. The weighbridge will be controlled from an office positioned with a clear view of the site entry and departure road, able to easily control access to the site. The entry office will have a meeting room, lunch room and ablution facilities supplied from a potable water tank adjacent to the building. Drawing ALLA-020 in Appendix C shows the location of the weighbridge and entry office. The weighbridge layout plan and details can be seen in Drawing ALLA-023 in Appendix C.
Truck mud	A truck mud shaker will be constructed adjacent to the leachate dam (refer to Drawing

Element	Description
shaker	ALLA-024 and ALLA-025 in Appendix C). Trucks will drive over a rumble grid to remove debris from the tyres. Any water trapped in the mud shaker pit will be collected and treated for recycling or pumped into the leachate pond. Solid debris will be removed and disposed at an appropriately licensed facility.
Hardstand, contractor's office, car park, shed and equipment storage	A hardstand area will be established for the storage of equipment and movement of vehicles. Waste transfer road trains may be parked at the site overnight if required. Two demountable buildings will be installed for the landfill operations contractor, one containing ablutions and a shower and locker room, the other with an office and lunch room. Drawing ALLA-020 in Appendix C shows the configuration of the infrastructure area, including contractor's facilities. An area of the compound has been set aside for future landfill gas extraction infrastructure, which may include a flare and potentially electricity generators.
Water tanks and reticulation	One 100 000 L and one 150 000 L water tank will be installed at the infrastructure area. The 100 000 L tank will be used for storing non potable water for general site use. The 150 000 L tank will be reserved for fire-fighting use. Both tanks will be equipped with British Instant Coupling (BIC) outlets, compatible with Volunteer Bush Fire Brigade equipment. A stand pipe and pump for refilling water trucks will be located adjacent to the tanks.
Fuel consumption	A diesel powered generator will be installed in the designated future landfill gas flare or power area. The generator will be mounted on a concrete pad and surrounded by a 2 m wide gravel apron area to minimise fire risk. Any grasses areas within 30 m of the generator will be cleared or regularly trimmed to be maintained at less than 100 mm in height to minimise the fuel load. Power from the generator will be reticulated around the landfill site. A bunded fuel tank will be installed at the hardstand area to store diesel fuel for landfill plant and equipment. The fuel tank will be installed and commissioned in compliance with *Dangerous Goods Safety (Storage and Handling of Non-explosives) Regulations 2007.*
Services	Underground power, water, leachate and data transfer conduits will be installed around the site as shown on the Services Layout Plan (Drawing ALLA-029 in Appendix C).
Stormwater dam and drainage	A stormwater dam, utilising the clayey material obtained from the site, will be constructed to the south of the landfill. The stormwater dam will collect surface runoff from areas upstream of the landfill. This water will be used for construction purposes and for general landfill operations such as dust suppression. An access road along the southern toe of the landfill will access to the northern side of the stormwater dam. An appropriately sized overflow weir has been designed for the stormwater dam. The surface water drainage is designed to prevent the interaction of stormwater and leachate. Clean runoff is diverted around the landfill footprint to minimise the total volume of leachate that requires management. Appropriately sized culverts and drains will be used to control stormwater from the roads, embankments, hardstands, buildings and hill slopes at the site. Erosion protection measures such as check dams, rock pitching and sedimentation traps will be used to limit the flow of disturbed surface materials.

Element	Description
	Subsurface drainage will be constructed below the areas where fill material will be placed as well as in any visible seepage areas. A retention dam will be constructed to store water collected and pumped from the subsurface drains. Details of the stormwater dam, spillway and discharge channel are provided in Drawings D240, D241 and D242 in Appendix B. Details regarding the sub-surface drainage system, including retention dam, are provided in Drawings D209 to D212, D230, and D231 in Appendix B.
Borrow areas	Earthwork modelling has identified an imbalance in material required for construction, daily cover and capping, necessitating the recovery of additional materials from elsewhere within Allawuna Farm. It is projected that the additional materials will be required from Year 10 onwards. A total of 857 000 m^3 of material is required and will be recovered from three borrow areas in close proximity of the landfill and totalling approximately 20 ha in area (refer to Drawing D104 in Appendix A). The maximum depth of excavation of the borrow areas will be approximately 5 m, reducing to 0 m over the length of the excavation. 200 mm of topsoil from these areas will be stripped and stockpiled for re-spreading during rehabilitation. The borrow areas will be developed and rehabilitated sequentially and are expected to be suitable for cropping and grazing following rehabilitation. *The development of the borrow areas will commence from approximately Year 10 onwards and is not required for construction of Cells 1 and 2.*

5.4 Landfill Operation

Table 16: A Summary of Landfill Operations

Element	Description
Management of Operations	SITA has prepared, or will prepare, a number of management plans to address all aspects of the operation of the Allawuna Landfill in accordance with the expected licence conditions, including but not limited to: ■ Landfill operating hours ■ Receipt, vetting and recording of incoming waste ■ Waste placement and cover procedures ■ Leachate management ■ Gas extraction and management ■ Odour, noise, litter and vermin management ■ Groundwater and surface water monitoring and reporting ■ Fire management ■ Complaints register procedures ■ Cell capping and rehabilitation, and ■ Environmental management review. SITA will provide a copy of the relevant Allawuna Landfill management plans to Council and also post copies on its website, including:

Element	Description
	■ Waste Acceptance Manual (Appendix Q) ■ Landfill Gas Management Plan (Appendix G) ■ Emergency Procedures Guide and Contingency Plan (aka Landfill Management Plan, Appendix Q) ■ Fire Management Plan (Appendix R), and ■ Topsoil Handling and Sediment Management Plan (Appendix H). SITA will also provide electronic copies of operational management plans to Council suitable for posting on Council's website.
Waste acceptance	■ The majority of waste will originate from SITA's transfer stations at Welshpool and Lansdale. ■ Waste from other commercial collectors operating in the York region, or local government collections may also be accepted, subject to compliance with Class II waste acceptance criteria. ■ SITA waste will be transported by Restricted Access Vehicles (RAV) Class 2, Category 3 in a pocket road train configuration, with a maximum length of 27.5 m. ■ A fleet of eight road trains will be required and the trailers will be unmarked and fully sealed to prevent escape of litter and liquids. ■ When operating at maximum capacity one road train will depart the transfer station every 20 minutes with a return journey interval of approximately three hours, for a total of 24 deliveries per day. A small number of light vehicle movements for landfill staff entering and departing the site in the morning and evening will also occur. ■ SITA waste will be inspected and sorted at the transfer station prior to loading into the sealed trailers. Only waste that cannot be recycled and acceptable for the facility will be transported for deposition. ■ Waste from other clients will be inspected at the landfill and prior to disposal. There will be waste isolation areas to hold any non-conforming waste inadvertently received from third parties and procedures will be implemented to dispose of such wastes at an approved site. ■ Signs will be established that indicate the type of wastes permitted for acceptance. ■ Random verification inspections of delivered waste types will be performed on 1 in 10 vehicles and for every new customer or new origin of waste. ■ Each vehicle accessing the site to deposit waste will be weighed on entry and exit at the weighbridge. The mass of waste, type of waste and delivering vehicle will be recorded in a database. Refer to the Waste Acceptance Manual in Appendix Q for further detail regarding the proposed Allawuna Landfill waste acceptance protocols.
Waste placement	■ Waste placement and covering will be conducted in accordance with Vic-BEPM requirements (refer to the Waste Acceptance Manual in Appendix Q). ■ Cover material will be obtained and internal roads will be constructed from material excavated during cell construction or waste materials with appropriate properties for vehicle traffic such as builders' rubble, crushed concrete or shredded wood. ■ Effective compaction will be utilised to minimise long-term settlement and maximise the use of the available airspace. The compactor will make three to five passes over waste that has been placed in 500 mm layers. ■ Waste will be placed in lifts of not more than 2.0 m deep. Emplaced waste will be completely covered at the end of each day with a combination of 300 mm thick daily soil cover or an alternative cover system.

Element	Description
Leachate management	To minimise the amount of leachate produced, the landfill will be operated by keeping the exposed area of waste to a minimum with rehabilitation following shortly after completion of filling each cell. It is proposed that the landfill will be filled in sub-cell areas resulting in a high rate of rise and low risk of waste saturation before being capped. Other measures to reduce leachate generation will include: ■ Diversion of stormwater away from the active waste disposal area to reduce leachate generation ■ Progressive capping. For further information regarding the proposed leachate management strategy refer to the Surface Water, Groundwater and Leachate Management Plan in Appendix E.
Landfill gas management	Landfill gas will be collected and flared to convert the methane into the less harmful carbon dioxide. When a sufficient quantity and quality of landfill gas is being produced the gas may be used as fuel for electricity generation. For a detailed description of proposed landfill gas extraction, treatment and monitoring refer to the Allawuna Landfill Gas Management Plan at Appendix G.
Landfill cell capping and rehabilitation	As the cells of the Allawuna Landfill fill with waste to their final design levels they will be progressively capped to seal in landfill gas and prevent the infiltration of stormwater. The final capped landform will be constructed at a minimum gradient of 1:50 and a maximum gradient of 1:5 to facilitate drainage of stormwater while maintaining stability. The final capping will also include appropriate gas collection piping and survey markers to monitor landfill settlement. The finished and capped landfill surface will be progressively rehabilitated to become suitable for post closure land use, most likely pasture. If planting of native species is required the plants will be selected from an approved locally endemic species mix. Plants will be selected with root structures that do not pose a threat of penetrating the LLDPE geomembrane and GCL capping layers.
Water management	The surface water drainage infrastructure at the Allawuna Landfill, including the stormwater and retention dams, will be maintained and operated in accordance with Surface Water, Groundwater and Leachate Management Plan (Appendix E) and a site specific water management procedure to be developed for the landfill. Clean runoff will be diverted around the landfill footprint to minimise the total volume of leachate that requires management. Groundwater monitoring, to be defined in the water management plan, will be carried out through a number of monitoring bores upstream and downstream of the landfill footprint. Groundwater monitoring bores will be sampled and the water quality analysed every quarter.

Site fencing and security	■ A 1.8 m high mesh, security fence with barbed wire will be erected around the perimeter of the landfill operations area to prevent unauthorised site access, capture windblown litter and prevent access by stock/other large animals.
	■ Contact details will be exchanged with neighbouring properties to maintain mutual vigilance for unauthorised access to the Allawuna Landfill site or neighbours.
	■ Unauthorised entry to the facility will be prevented through:
	  ▪ Site security fencing
	  ▪ Site access gates provided at the site entrance secured with suitable locks
	  ▪ Stopping all trucks/vehicles entering the site to deposit waste at the weighbridge

Element	Description
	▪ Locking gates outside of operating hours ▪ Only issuing gate keys to authorised personnel and the local fire brigade.
Services and utilities	■ The site is supplied with electric power and telecommunications from the public networks. ■ Water for construction and operation of the landfill will be sourced from the stormwater dam. Potable water will be sourced from rainwater collection tanks. ■ Sewerage and grey water will be directed to an on-site storage tank and leach drain system. The on-site storage tank will be emptied on a regular basis and transported to an appropriately licensed facility.
Traffic	The overall increase in traffic associated with the landfill is in the order of twenty four triple road trains and thirteen light vehicles, both inbound and outbound. A detailed Traffic Impact Statement (Appendix J) indicated that the increase in traffic resulting from the landfill will have minimal impact on traffic flows along Great Southern Highway.

6.0 STAKEHOLDER AND COMMUNITY CONSULTATION

Table 17: Summary of Stakeholder Consultation

Element	Description
Key stakeholders	■ DER ■ EPA ■ Shire of York ■ Shire of York residents ■ Main Roads WA ■ DoW ■ Fire and Emergency Services Authority ■ Aboriginal Stakeholders ■ Swan River Trust.
Presentations to DER	■ 16 September 2014: SITA, Bowman and Associates and Golder presented the Allawuna Landfill Project to the DER, summarising: ▪ SITA the company ▪ Allawuna Landfill project ▪ Indicative information regarding DER preliminary feedback. ■ 17 December 2014: SITA and Golder presented the Allawuna Landfill Project to DER summarising the following with respect to the WAA: ▪ Revised theoretical approach ▪ Additional geotechnical and hydrogeological studies ▪ Preliminary materials requirements ▪ Preliminary stability assessment ▪ Proposed timeline. ■ 29 January 2015: SITA and Golder presented the Allawuna Landfill Project to the DER summarising the following with respect to the WAA: ▪ Additional hydrogeological and borrow areas studies ▪ Revised landfill layout ▪ Cross sectional diagrams ▪ Liner and cap systems

Element	Description
	▪ Materials balance ▪ Conceptual stormwater and leachate management.
SAT mediation presentation	■ February 2015: SITA, Golder and Bowman and Associates presented the Allawuna Landfill project to various government and community stakeholders, including the Shire, WJDAP, DER, Department of Planning and the Avon Valley Residents Association (AVRA). The presentation contained the following project information: ▪ Geotechnical and hydrogeological investigations of the environmental setting ▪ Landfill layout ▪ Cross sectional diagrams ▪ Liner and cap systems ▪ Materials balance ▪ Stormwater and leachate management ▪ Summary of modifications ▪ Fire management ▪ Shire responsibility ▪ Benefit.
Media statement	■ February 2015: SITA released a holding statement summarising that planning continues on the Allawuna Landfill Project.
Flyer and public presentation	■ 2949 one page, double-sided, unaddressed flyers were mailed to all residents in the Shire of York 5-9 November 2012. The flyer contained a brief summary of the project, invitation to comment, contact details and an invitation to a public presentation held on the 19 November 2012. ■ The 19 November presentation was delivered by SITA at the York Town Hall before the monthly Council meeting. The presentation focused on the preliminary concerns and frequently asked questions that had been raised as part of the community consultation process to that point, with an open question and answer session afterwards (for 90 minutes.) ■ Over 300 community members attended, with a diverse range of viewpoints and concerns. The key issues of community interest were: ▪ The increase in traffic along Great Southern Highway ▪ Protection of the Mundaring Weir drinking water catchment ▪ Benefit of the project to the local community.
Website	■ A media release covering the environmental investigations and design features of the proposed development and a Frequently Asked Questions document that continues to be regularly updated as the project progresses to reflect the concerns of the community (and the design features that will mitigate concerns) has been uploaded to the SITA website.
Public display	■ A static display was erected at the York Town Hall with information on the company, their landfill management activities and the proposed landfill development. ■ A model of the composite lining system with waste, drainage, HDPE geomembrane and GCL sections was also put on display to demonstrate the function of the liner system.
Newspaper articles	■ During November 2012, information on the proposed Allawuna Landfill appeared in both the Avon Valley Gazette and the Avon Valley Advocate. ■ An article covering the York community response to the development was also published in the West Australian newspaper in December 2012.
Shale Road site tour	■ On 29 November 2012 residents of the York community were invited to participate in

Element	Description
	a free tour of the SITA Welshpool resource recovery centre and SITA's Shale Road Landfill in order to gain a better understanding of the proposal and the activities that will be taking place at AFL should the landfill be approved. ■ Despite over 30 people expressing an interest in attending at the Public Presentation, only five attended the site tour. ■ The tour consisted of: ▪ A drive along Great Southern Highway past the site ▪ A description of the proposed entrance road upgrade. ▪ A tour of the resource recovery and waste transfer operations at Welshpool ▪ the unloading of collection trucks ▪ Removal of recoverable resources ▪ Consolidation of waste into transfer trailers to be carted to landfill. ▪ A drive around the Shale Road landfill, highlighting the stormwater management infrastructure, capping and revegetation of completed cells, flaring of methane gas, activities on the tipping face, litter management systems, power generation from landfill gas and operation of the leachate evaporation ponds.
Site tour	■ Two tours of the proposed Allawuna Landfill site were conducted on the 15 February, 2013, with local residents collected from either the Town Hall or a road reserve near the site. Over the course of the day a total of 21 local community members were driven around the site. ■ The locations of the site infrastructure, weighbridge, leachate ponds, first landfill cell, stormwater dam and ultimate landfill footprint were marked out with colour coded survey pegs. Points of particular concern for the attendees were the management of leachate to prevent contamination of the downstream water catchment, the increased traffic associated with the site development, the impact of the site on the value of surrounding properties and alternative uses for the site other than as a landfill.
Ongoing consultation	■ SITA has supplied two briefing updates to community members describing the developments in the project since the Town Hall Meeting. ■ SITA will continue to maintain open communication with all interested parties throughout the approvals process and into the operational life of the facility. ■ SITA is currently developing a community reference group from a cross section of the local York population to represent the views, concerns and queries of the residents of the area.

7.0 POTENTIAL ENVIRONMENTAL IMPACTS AND PROPOSED MANAGEMENT MEASURES

7.1 Environmental Risk Assessment

An assessment of the environmental risk for the proposed works and operations was derived from:

- Information available describing the existing environment
- Descriptions of proposed works
- Landfill design studies
- Proposed operation methods.

The environmental risk assessment (included in Appendix N) identified the potential risks and impacts for each of the following environmental aspects:

- Groundwater
- Surface water
- Air quality
- Hydrocarbons and dangerous goods
- Flora
- Fauna
- Waste
- Fire
- Landfill gas
- Leachate
- Odour
- Noise
- Light, and
- Aesthetics.

Risk rankings were applied using a qualitative risk assessment process based on the *AS/NZS ISO 31000:2009 Risk Management – Principles and Guidelines.* The implementation of management measures were also assessed in terms of the hierarchy of hazard controls.

An assessment of the environmental risk of the proposed works on the environmental aspects resulted in the project being given a "low" risk ranking. However, this is condition to the development and implementation of the project specific management plans. The management measures are summarised in the Allawuna Landfill Environmental Risk Assessment (Appendix N).

7.2 Proposed Management Measures

7.2.1 Corporate Environmental Management

SITA has an Environmental Management System (EMS) supporting its Environmental Policy (Appendix S). The policy includes, but is not limited to, the following environmental objectives:

- Comply with relevant environmental laws and other compliance requirements
- Evaluate environmental risks to eliminate, control or reduce the risk of environmental impact, and
- Implement ongoing monitoring and inspection programs to prevent environmental damage and continually improve environmental performance.

SITA's EMS has been certified to the ISO 14001:2004 standard (Appendix S).

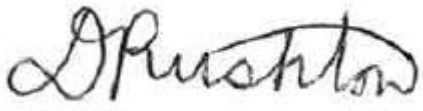
7.2.2 Project Environmental Management

The Allawuna Landfill will operate in accordance with the relevant landfill operational management plans, including those contained as appendices to this document. Collectively these management plans detail management measures appropriate to the scale and nature of the various environmental risks (refer to Appendix N for the full environmental risk assessment conducted for the Allawuna Landfill).

8.0 LIMITATIONS

Your attention is drawn to the document “Limitations”, which is included as Appendix W to this report. This document is intended to assist you in ensuring that your expectations of this report are realistic, and that you understand the inherent limitations of a report of this nature. If you are uncertain as to whether this report is appropriate for any particular purpose please discuss this issue with us.

GOLDER ASSOCIATES PTY LTD



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https://aupws.golder.com/sites/147645033alluwunafarmpeerreview/correspondence out/147645033-013 risk assessment and waa/147645033-013-r-rev0 waa supporting document.docx

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APPENDIX A

Allawuna Landfill Layout Plans and Sections

APPENDIX B

Allawuna Landfill Cell 1 and 2, Leachate Pond, Subsurface Drainage, Retention Pond and Stormwater Dam Construction Plans

APPENDIX C

Allawuna Landfill Infrastructure Construction Plans

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APPENDIX D

Allawuna Landfill Geotechnical Investigations for Landfill Development Report

APPENDIX E

Allawuna Landfill Hydrogeological Site Characterisation Studies Report and Surface Water, Groundwater and Leachate Management Plan

March 2015
Report No. 147645033-013-R-Rev0

Golder Associates

APPENDIX F

Allawuna Landfill Stability Analysis and Liner System Integrity Assessment Report

March 2015
Report No. 147645033-013-R-Rev0

APPENDIX G

Allawuna Landfill Gas Assessment Report and Landfill Gas Management Plan

APPENDIX H

Allawuna Landfill Topsoil Handling and Sediment Management Plan

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APPENDIX I

Allawuna Landfill Odour Assessment Report and Noise Assessment Report

March 2015
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APPENDIX J

Traffic Impact Statement

APPENDIX K

Allawuna Landfill Vegetation and Fauna Assessment Report

March 2015
Report No. 147645033-013-R-Rev0

APPENDIX L

Allawuna Landfill Community and Stakeholder Consultation Record

APPENDIX M

Allawuna Landfill Technical Specification for Construction of Cell 1 and 2, Technical Specification for Allawuna Landfill Infrastructure and Allawuna Landfill Construction Quality Assurance Plan

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APPENDIX N

Allawuna Landfill Environmental Risk Assessment

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APPENDIX O

Allawuna Landfill Construction and Operational Health and Safety Risk Assessments

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APPENDIX P

SITA Australia Environment Quality and Safety Management System Manual

APPENDIX Q

Allawuna Landfill Waste Acceptance Manual and Emergency Procedures Guide and Contingency Plan (also known as Allawuna Landfill Management Plan)

APPENDIX R

Allawuna Landfill Fire Management Plan

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APPENDIX S

SITA Australia Environmental Policy and ISO14001:2004 Certification

APPENDIX T

EPA Advice Regarding Environmental Protection Act Part IV Referral

APPENDIX U

Allawuna Farm Conservation Covenant Notice and DSEWPAC Advice Regarding Tree Clearing

APPENDIX V

Allawuna Landfill Works Approval Reconciliation with the EPA Victoria BPEM

APPENDIX W

Limitations

As a global, employee-owned organisation with over 50 years of experience, Golder Associates is driven by our purpose to engineer earth's development while preserving earth's integrity. We deliver solutions that help our clients achieve their sustainable development goals by providing a wide range of independent consulting, design and construction services in our specialist areas of earth, environment and energy.

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