October 2017

ALKINA HOLDINGS PTY LTD

Great Southern Landfill Works Approval Supplementary Information

Submitted to:
Alkina Holdings Pty Ltd
PO Box 419
MORLEY BC WA 6053

REPORT

Report Number. 1777197-026-R-Rev0

Distribution:

Alkina Holdings Pty Ltd
Department of Water and Environmental Regulation

Golder Associates

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1.0 INTRODUCTION

On 21 July 2017, Golder Associates (Golder) submitted a Works Approval application (WAA) (W6077/2017/1) to the Department of Water and Environmental Regulation (DWER) on behalf of Alkina Holdings Pty Ltd (Alkina). The WAA (Golder, 2017a) was for the construction and operation of Great Southern Landfill (GSL), a Class II lined landfill, designed to accept putrescible waste.

During the application assessment process, DWER requested a meeting with Golder. On 6 October 2017 a meeting was held between DWER Officers Lauren Fox and Rebecca Kelly, and Golder representatives Jaclyn Ennis-John and Liza Du Preez. During this meeting additional information was requested to assist in the assessment of the application. The information required by DWER is discussed in the next section.

2.0 SUMMARY OF RESPONSES

Table 1 summarises the information requested by DWER and Golder's responses.

Table 1: Summary of responses to DWER queries

DWER Comment	Summary of Golder/Alkina Response	Attachment Reference
That the documentation provided as part of the WAA is updated to address the following:		
Refer only to documentation which forms part of this application and include all documentation referred to in the application.	Documentation that forms part of the WAA (Golder, 2017a) has been summarised in Section 3.0 of this report and appended.	Refer to Section 3.0 of this report and appendices.
Clarify what is being proposed as part of this application by clearly stating what Alkina Holding Pty Ltd is committing to with regards the construction and operation of the landfill.	The information presented in this report provides an overall summary of the Project.	Refer to the following sections of this report: ■ Section 4.0 summarises the key characteristics of the Project. ■ Section 5.0 summarises the environmental impact assessment and management. ■ Section 6.0 summarises emissions and proposed controls ■ Section 7.0 summarises rehabilitation controls.
Provide all relevant modelling, monitoring and drawings which were relied upon for the proposal.	All relevant modelling, monitoring and drawings have been appended to this report.	Monitoring has been summarised in Section 6.0 and modelling and drawings have been appended.
DWER has noted a number of discrepancies between individual documents submitted. Please ensure all documentation provides consistent information and remove any inaccuracies. DWER can provide further detail on this aspect, if required.	The information presented in this report provides an overall summary of the Project and clarifies some of the discrepancies that may have been presented previously. This document is a summary of the Project, and should be read in conjunction with the core documentation prepared specifically for the GSL Project, listed in Section 3.0. All values in this report are correct and supersede any differing values in the WAA documentation.	Documentation that forms part of the WAA (Golder, 2017a) has been summarised in Section 3.0 of this report and appended.

DWER Comment	Summary of Golder/Alkina Response	Attachment Reference
Include a stability assessment, with sufficient supporting information to demonstrate that the proposed landfill design is suitable (or otherwise) for the location. The assessment should incorporate the risk of seismic and flood events.	A revised stability assessment has been included in the Design Report (Golder, 2017).	Refer to Section 11.6 of the Design Report (Golder, 2017).
Include a landfill gas management plan, which includes all proposed landfill gas infrastructure and is supported by modelling data, as appropriate.	Please refer to the following landfill gas management documentation: ■ *Allawuna Landfill, York – Landfill Gas Assessment* (Golder, 2015e). ■ Section 11.6 of *Great Southern Landfill Facility, Lot 4869 Great Southern Highway, Shire of York. Great Southern Landfill Management Plan.* (Alkina, 2017a).	Refer to: ■ Section 11.6 of *Great Southern Landfill Facility, Lot 4869 Great Southern Highway, Shire of York. Great Southern Landfill Management Plan.* (Alkina, 2017a). ■ *Landfill Gas Assessment (Golder, 2017r)*
Please clarify whether the risk assessments undertaken (including numerical modelling) have incorporated the proposed leachate recirculation rates indicated in the application and provide additional information, as appropriate.	Section 11.5 – Leachate collection system of the Design report (Golder, 2017) has been revised to include this information.	Refer to Section 11.5 of the Design report (Golder, 2017).
There does not appear to be a document which provides a comprehensive overview of the proposal. As such, a document is requested, which:		
Provides an outline of the proposed landfill, including all key siting and design specification elements which are relevant to the control of potential emissions during both the construction, operational and post-closure management phases.	Section 4.0 provides an outline of the proposed landfill, including all key siting and design specification elements that are relevant to the control of potential emissions during both the construction, operational and post-closure management phases.	Refer to Section 4.0 of this report.
For each potential emission identified, detail the controls designed to reduce the risk of the emission occurring/impacting on a sensitive receptor. The information should be sufficiently comprehensive to facilitate a determination on the appropriateness of such controls.	Sections 5.0 and 6.0 summarise potential emissions and the controls designed to reduce the risk of the emission occurring/impacting on a sensitive receptor.	Refer to the following Sections of this report: ■ Section 6.0 – Environmental Impact Assessment and Management ■ Section 6.0 – Emissions and Proposed Controls.
Highlights uncertainty and includes contingencies, as required.	Sections 5.0 and 6.0 summarise Project contingencies.	Refer to the various contingencies sections presented in Section 6.0.
Clearly references supporting appended documents, as required.	References to supporting documentation have been made throughout this report and a comprehensive list of supporting documentation is provided in Section 3.0.	Refer to the list in Section 3.0. These documents have also been appended to this report.

3.0 SUPPORTING DOCUMENTATION

A comprehensive investigation was conducted for the former SUEZ Allawuna Farm Landfill project (the same site), previously approved by then Department of Environment Regulation (DER) in March 2016. The Allawuna Farm WAA and supporting technical studies remain in the public domain and provide a benchmark for the standards/expectations of regulators to approve such a proposal.

As part of the GSL Project submission, Golder conducted due diligence assessments of all the previous studies carried out for Allawuna and re-assessed the landfill design. In Golder's opinion the original principles and philosophies in general still hold true. Some minor amendments to the design were however necessary to suit Alkina's operational practices and subsequent developments in the regulatory approach to approval applications.

For the DWER's reference, Table 2 presents a comprehensive list of:

- The documentation prepared and submitted to DWER for the Allawuna Farm Landfill Project
- The documentation reviewed and compared to the GSL Project as part of the due diligence.
- Differences between the two projects (where present, written in green text)
- The documents that have been revised for the GSL Project.

Table 3 presents a comprehensive list of all documentation prepared specifically for the GSL Project.

All documentation listed in Table 2 and Table 3 is supporting documentation referred to during the preparation of the WAA and this report. All listed reports are appended to document number 1777197-028-L-Rev0 for reference with the exception of the Allawuna Farm management plans and risk assessments.

Table 2: Supporting documentation for Great Southern Landfill Project

Documentation Prepared for Allawuna Farm Landfill Project (2015)	Review Status and Additional Comments	Related/Revised 2017 Document
Specialist Studies		
■ Bowman (2015). *Risk Assessment – Construction Activities for Allawuna Farm* Landfill. Bowman and Associates Pty Ltd (Bowman) Perth WA. ■ Bowman (2015). *Risk Assessment – Landfill Operational Activities for Allawuna Farm Landfill.* Bowman and Associates Pty Ltd (Bowman) Perth WA.	Technically reviewed for suitability against design. Superseded by a revised risk assessment.	■ Golder (2017e). *Alkina Holdings Pty Ltd Great Southern Landfill Desktop Environmental and Social Risk Assessment.* 1777197-009-R-Rev0. July 2017. Golder Associates Pty Ltd (Golder) Perth WA. ■ Golder (2017f). *Alkina Holdings Pty Ltd Great Southern Landfill Construction Health and Safety Risk Assessment.* 1777197-010-R-Rev0. July 2017. Golder Associates Pty Ltd (Golder) Perth WA. ■ Golder (2017g). *Alkina Holdings Pty Ltd Great Southern Landfill Operations Health and Safety Risk Assessment.* 1777197-011-R-Rev0. July 2017. Golder Associates Pty Ltd (Golder) Perth WA.
■ Bowman (2015a). *SITA Allawuna Landfill – Dust Management Plan*. 150428. Bowman and Associates Pty Ltd (Bowman) Perth WA. ■ Bowman (2015b). *SITA Allawuna Farm Landfill – Noise Management Plan*. 150729. Bowman and Associates Pty Ltd (Bowman) Perth WA. ■ Bowman (2015c). *SITA Allawuna Farm Landfill – Odour Management Plan*. 1507/09. Bowman and Associates Pty Ltd (Bowman) Perth WA. ■ SITA (2015a). *Landfill Gas Management Plan – Allawuna Farm Landfill*. March 2015. SITA WA.	Technically reviewed for suitability against design. Superseded by one overarching environmental management document.	Alkina (2017a). Great Southern Landfill Facility, Lot 4869 Great Southern Highway, Shire of York. Great Southern Landfill Management Plan. July 2017. Alkina01_Rev0. Alkina Holdings Pty Ltd (Alkina), Perth WA.
Bowman (2015d). *SITA Community and Stakeholder Consultation Record*. 2012. Bowman and Associates Pty Ltd (Bowman) Perth WA.	Technically reviewed for suitability against design. Superseded by a revised Stakeholder Engagement Strategy.	Golder (2017h). Alkina Holdings Pty Ltd Great Southern Stakeholder Engagement Strategy. 1777197-017-R-Rev1. July 2017. Golder Associates Pty Ltd (Golder) Perth WA. Golder Associates Pty Ltd (Golder) Perth WA.
ENV (2012). *Allawuna Landfill Vegetation and Fauna Assessment*. J112235. October 2012. ENV Australia Pty Ltd. Perth WA.	Technically reviewed for suitability against design. Deemed suitable for use.	Golder (2017n). Works Approval Application – Desktop Assessment Supporting Flora and Fauna Information. 1777197-020-M-Rev0. July 2017. Golder Associates Pty Ltd (Golder) Perth WA.

Documentation Prepared for Allawuna Farm Landfill Project (2015)	Review Status and Additional Comments	Related/Revised 2017 Document
Envall. (2015). *Revised Assessment of Odours from Proposed Allawuna* Landfill. L2172 March 2015. Environmental Alliances Pty Ltd (Envall). Perth WA.	Technically reviewed for suitability against design. Deemed suitable for use.	Golder (2017j). Works Approval Application Great Southern Landfill – Review of Noise, Odour and Dust Assessments and Management Plans for Approved Allawuna Landfill. 1777197-004-M-Rev0. July 2017. Golder Associates Pty Ltd (Golder) Perth WA.
Environmental Alliances Pty Ltd (2015). *Revised Assessment of Odours* from *Proposed Allawuna Landfill*. 26 March 2015.	Technically reviewed for suitability against design. Deemed suitable for use.	Golder (2017j). Works Approval Application Great Southern Landfill – Review of Noise, Odour and Dust Assessments and Management Plans for Approved Allawuna Landfill. 1777197-004-M-Rev0. July 2017. Golder Associates Pty Ltd (Golder) Perth WA.
Shawmac. (2013). *Allawuna Landfill Development Great Southern Highway* Traffic *Impact Statement.* 1307031. October 2013. Shawmac Consulting Civil & Traffic Engineers, Risk Managers.	Technically reviewed for suitability against design. Deemed suitable for use.	GTA Consultants. (2017). York Landfill (Due Diligence) Traffic Impact Statement Addendum. June 2017. GTA Consultants, WA.
Golder Studies/Reports		
Golder (2015a). *Allawuna Farm Landfill, Geotechnical Investigations for Landfill* Development. 147645033-008-R-Rev0. March 2015. Golder Associates Pty Ltd (Golder) Perth WA.	Technically reviewed for suitability against design. Deemed suitable for use.	Golder (2017i). Works Approval – Supporting Geotechnical Information. 1777197-003-M-Rev0. July 2017.
Golder (2015b). *Stability Analysis and Liner System Integrity Assessment for Landfill Development*. 14765033-012-R-Rev0. March 2015. Golder Associates Pty Ltd (Golder) Perth WA.	Technically reviewed for suitability against design. Superseded by a revised design report. Increased separation distance between waste and groundwater through amending sump invert to be 2.0 m above maximum estimated groundwater table. Cell configuration changed to seven cells. Cell 1 and 2 configuration not changed.	■ Golder (2017b). *Design report Great Southern Landfill Cell 1, Cell 2 and Ancillary Works*. 1777197.019-R-Rev2. October 2017. Golder Associates Pty Ltd (Golder) Perth WA.
Golder (2015c). *Allawuna Landfill Hydrogeological Site Characterisation Studies*. 14765033-009-R-Rev0. March 2015. Golder Associates Pty Ltd (Golder) Perth WA.	Technically reviewed for suitability against revised design. Revised as suitable and updated with recent groundwater data (2 rounds).	Golder (2017k). *Hydrogeological Site Characterisation Great Southern Landfill.* 1777197-008-R-Rev1. September 2017. Golder Associates Pty Ltd (Golder) Perth WA.

Documentation Prepared for Allawuna Farm Landfill Project (2015)	Review Status and Additional Comments	Related/Revised 2017 Document
Golder (2015d). *Allawuna Farm Landfill Surface Water, Groundwater and Leachate Management Plan.* 147645033-015-R-Rev0. March 2015. Golder Associates Pty Ltd (Golder) Perth WA.	Technically reviewed for suitability against design. Deemed suitable for use. Superseded by a revised Surface water Management Plan.	Golder (2017l). *Great Southern Landfill Site – Desktop Review – Surface Water Management*. 1777197-007-M-Rev0. July 2017. Golder Associates Pty Ltd (Golder) Perth WA.
Golder (2015e). *Allawuna Landfill, York – Landfill Gas Assessment*. 147645033-010-L-Rev0. March 2015. Golder Associates Pty Ltd (Golder) Perth WA.	Technically reviewed for suitability against design. Deemed suitable for use. Landfill gas generation peak production rate timeline has changed due to project different tipping rates.	Golder (2017e). Al*kina Holdings Pty Ltd Great Southern Landfill Desktop Environmental and Social Risk Assessment.* 1777197-009-R-Rev0. July 2017. Golder Associates Pty Ltd (Golder) Perth WA.
Golder (2015f). *Allawuna Farm Landfill Topsoil Handling and Sedimentation* Management. 147645033-0190R-Rev0. March 2015. Golder Associates Pty Ltd (Golder) Perth WA.	■ Technically reviewed for suitability against design. Deemed suitable for use. ■ Controls integrated into Site Management Plan.	Golder (2017q). *Great Southern Landfill Site – Desktop Review – Topsoil Handling and Sediment Management*. 1777197-029-M-Rev0. October 2017. Golder Associates Pty Ltd (Golder) Perth WA.
Golder (2015g). *Allawuna Farm Landfill Technical Specification for the Construction of Cell 1, Cell 2 and Ancillary Works*. 147645033-016-R-Rev0. March 2015. Golder Associates Pty Ltd (Golder) Perth WA.	Technically reviewed for suitability against design. Superseded by a revised Technical Specification. Conformance testing frequency for geosynthetic materials amended.	Golder (2017c). *Great Southern Landfill Technical Specification for Construction of Cell 1 and Ancillary Works*. 1777197-012-R-Rev1. September 2017. Golder Associates Pty Ltd (Golder) Perth WA.
Golder (2015h). *Allawuna Farm Landfill Construction Quality Assurance Plan for the Construction of Cell 1, Cell 2 and Ancillary Works*. 147645033-018-R-Rev0. Golder Associates Pty Ltd (Golder) Perth WA.	Technically reviewed for suitability against design. Superseded by a revised QAP.	■ Golder (2017d). *Great Southern Landfill Construction Quality Assurance Plan for the Construction of Cell 1 and Ancillary Works.* 1777197-013-R-Rev1. September 2017. Golder Associates Pty Ltd (Golder) Perth WA.
Golder (2015i). *Allawuna Landfill Works Approval Reconciliation with the EPA Victoria BPEM.* 147645033-013-R-Rev0. March 2015. Golder Associates Pty Ltd (Golder) Perth WA.	Not included in new application. No longer relevant due to change in regulatory approach	Not required.

Table 3: Documentation prepared specifically for Great Southern Landfill Project (2017)

Type of Study	Documentation
Specialist studies	■ Alkina (2017a). *Great Southern Landfill Facility, Lot 4869 Great Southern Highway, Shire of York. Great Southern Landfill Management Plan*. July 2017. Alkina01_Rev1. Alkina Holdings Pty Ltd (Alkina), Perth WA. ■ Alkina (2017b). *Great Southern Landfill Facility, Lot 4869 Great Southern Highway, Shire of York. Great Southern Landfill Asbestos Management Plan*. July 2017. Alkina02_Rev0. Alkina Holdings Pty Ltd (Alkina), Perth WA. ■ GTA Consultants. (2017). *York Landfill (Due Diligence) Traffic Impact Statement Addendum.* June 2017. GTA Consultants, WA.
Golder studies/ reports	■ Golder (2017a). *Application for Concurrent Works Approval and Licence, Great Southern Landfill Alkina Holdings Pty Ltd* . 1777197-015-L-Rev0. July 2017. Golder Associates Pty Ltd (Golder) Perth WA. ■ Golder (2017b). *Design report Great Southern Landfill Cell 1, Cell 2 and Ancillary Works*. 1777197.019-R-Rev2. October 2017. Golder Associates Pty Ltd (Golder) Perth WA. ■ Golder (2017c). *Great Southern Landfill Technical Specification for Construction of Cell 1 and Ancillary Works*. 1777197-012-R-Rev1. September 2017. Golder Associates Pty Ltd (Golder) Perth WA. ■ Golder (2017d). *Great Southern Landfill Construction Quality Assurance Plan for the Construction of Cell 1 and Ancillary Works.* 1777197-013-R-Rev1. September 2017. Golder Associates Pty Ltd (Golder) Perth WA. ■ Golder (2017e). Al*kina Holdings Pty Ltd Great Southern Landfill Desktop Environmental and Social Risk Assessment.* 1777197-009-R-Rev0. July 2017. Golder Associates Pty Ltd (Golder) Perth WA. ■ Golder (2017f). Al*kina Holdings Pty Ltd Great Southern Landfill Construction Health and Safety Risk Assessment.* 1777197-010-R-Rev0. July 2017. Golder Associates Pty Ltd (Golder) Perth WA. ■ Golder (2017g). Al*kina Holdings Pty Ltd Great Southern Landfill Operations Health and Safety Risk Assessment.* 1777197-011-R-Rev0. July 2017. Golder Associates Pty Ltd (Golder) Perth WA. ■ Golder (2017h). *Alkina Holdings Pty Ltd Great Southern Stakeholder Engagement Strategy*. 1777197-017-R-Rev1. July 2017. Golder Associates Pty Ltd (Golder) Perth WA. Golder Associates Pty Ltd (Golder) Perth WA. ■ Golder (2017i). *Works Approval – Supporting Geotechnical Information*. 1777197-003-M-Rev0. July 2017. ■ Golder (2017j). *Works Approval Application Great Southern Landfill – Review of Noise, Odour and Dust Assessments and Management Plans for Approved Allawuna Landfill.* 1777197-004-M-Rev1. October 2017. Golder Associates Pty Ltd (Golder) Perth WA. ■ Golder (2017k). *Hydrogeological Site Characterisation Great Southern Landfill.* 1777197-008-R-Rev1. September 2017. Golder Associates Pty Ltd (Golder) Perth WA. ■ Golder (2017l). *Great Southern Landfill Site – Desktop Review – Surface Water Management*. 1777197-007-M-Rev0. July 2017. Golder Associates Pty Ltd (Golder) Perth WA. ■ Golder (2017m). *Application for a Section 11/17/21A Permit to Interfere with Bed and Banks Alkina Holdings Great Southern Landfill Project*. 1777197-024-L-Rev0. October 2017. Golder Associates Pty Ltd (Golder) Perth WA. ■ Golder (2017n). *Works Approval Application – Desktop Assessment Supporting Flora and Fauna Information.* 1777197-020-M-Rev0. July 2017. Golder Associates Pty Ltd (Golder) Perth WA. ■ Golder (2017o). *Application for a Clearing Permit (Area Permit) Form C1 Alkina Holdings Great Southern Landfill Project.* 1777197-025-L-Rev0. October 2017. Golder Associates Pty Ltd (Golder) Perth WA. ■ Golder (2017p). *Works Approval Application – Desktop Assessment – Supporting Heritage Information.* 1777197-006-M-Rev0. July 2017. Golder Associates Pty Ltd (Golder) Perth WA. ■ Golder (2017q). *Great Southern Landfill Site – Desktop Review – Topsoil Handling and Sediment Management*. 1777197-029-M-Rev0. October 2017. Golder Associates Pty Ltd (Golder) Perth WA. ■ Golder (2017r). *Great Southern Landfill Site – Desktop Review – Landfill Gas Assessment*. 1777197-030-M-Rev0. October 2017. Golder Associates Pty Ltd (Golder) Perth WA.

4.0 GREAT SOUTHERN LANDFILL – KEY CHARACTERISTICS

This information in this section has been summarised from the following reports, which should be referred to for more detail:

- *Design Report Great Southern Landfill Cell 1, Cell 2 and Ancillary Works* (Golder, 2017b).
- *Great Southern Landfill Technical Specification for Construction of Cell 1 and Ancillary Works* (Golder, 2017c).
- *Great Southern Landfill Construction Quality Assurance Plan for the Construction of Cell 1 and Ancillary Works* (Golder, 2017d).

The GSL is to be comprised of a total of seven (7) cells operating in stages. The total footprint of the GSL cells is 36 ha. The layout of the proposed cells and ancillary works are shown in Figure 1.

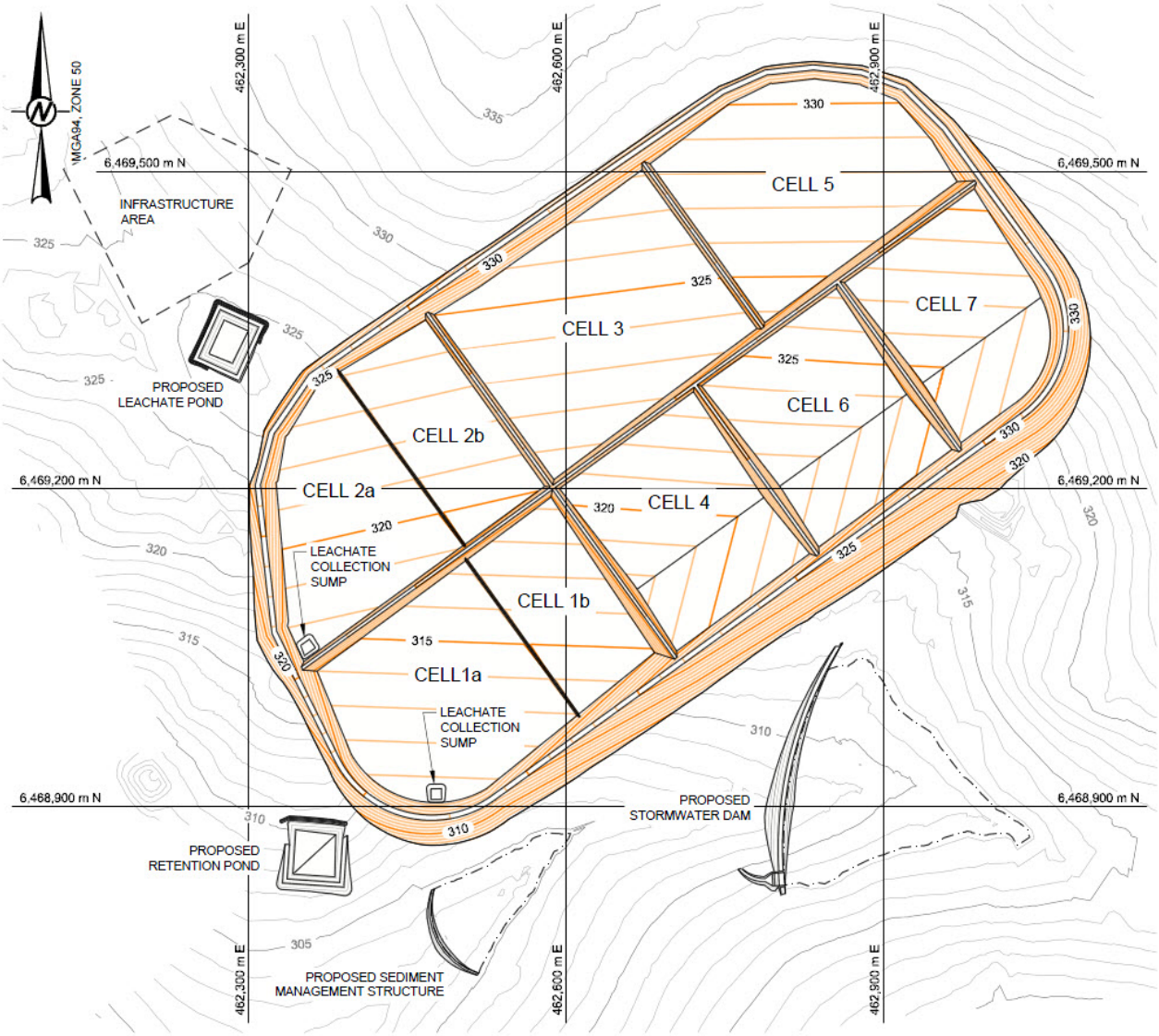

Figure 1: Layout of GSL cells and ancillary works

The GSL cells and structures that are part of the design presented in Golder (2017b) are presented and highlighted in Figure 2 with further details presented in the Drawings [7] (Golder, 2017b).

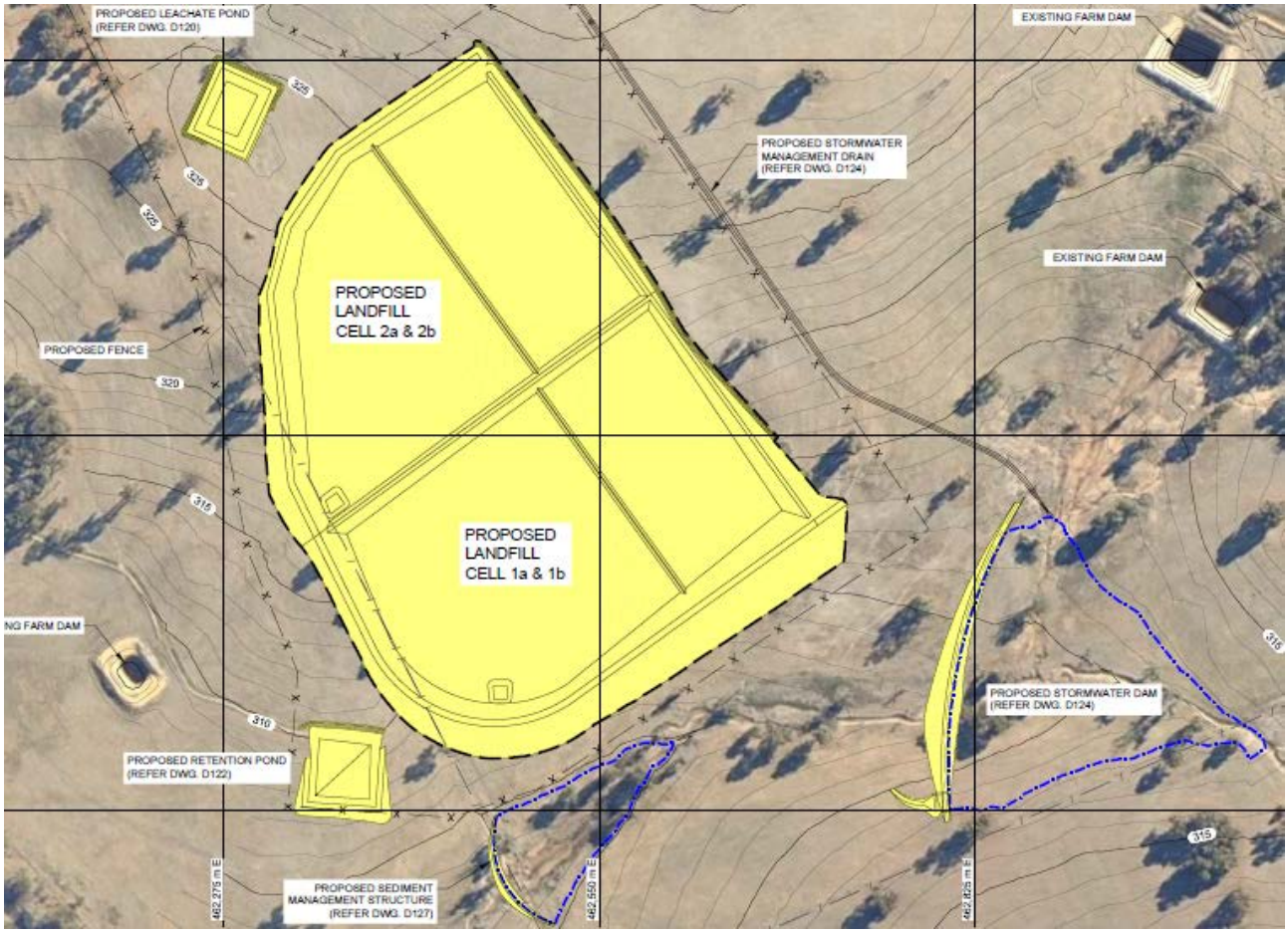

Figure 2: Site Layout – Cell 1, Cell 2 and ancillary works

Footprint areas are summarised in Table 4.

Table 4: Footprint areas

Structure	Total Footprint (ha)
Cell 1	7.9
Cell 2	6.1
Leachate pond	0.34
Retention pond	0.43
Stormwater dam embankment	0.36
Stormwater dam (maximum pond surface area when full).	2.6
Sediment management structure embankment	0.06
Sediment management structure (maximum pond surface area when full)	0.08

The WAA (Golder, 2017a) covers the construction and operation of Cells 1 and 2.

A summary of the key project characteristics, including all key siting and design specification elements is provided in Table 5.

Table 5: Key characteristics

	Key Characteristics
Great Southern Landfill	■ Category 64 ■ Class II landfill ■ Acceptance of 150 000 to 250 000 tonnes per year. ■ Life of operation – 28 years ■ Lifetime capacity – 5.6 M m^3
Landfill Cells 1 and 2 (Lined)	■ Airspace capacity of 1.78 M m^3 ■ Cell 1 – operational design life of 4 years at a landfill utilisation rates of 200 000 tpa. ■ Cell 2 – operational design life of 5 years based on the same utilisation rates. ■ Cell 1 and Cell 2 combined footprint is approximately 39% of the final GSL footprint. ■ The main components of Cell 1 and 2 design are the: ▪ Subsurface drainage system. ▪ Subgrade. ▪ Geosynthetic lining system. ▪ Leachate collection system and ▪ Embankments: Perimeter embankments and cell division bunds.
Subgrade	A compacted 500 mm subgrade base that is to be constructed with a final surface slope of approximately 3 % towards the leachate sump and lined with a geosynthetic liner system.
Liner	Geosynthetic liner system: the liner system consists of a geosynthetic clay liner (GCL) to be placed over the compacted subgrade, followed by a 2 mm thick High Density Polyethylene (HDPE) geomembrane and then a cushion geotextile. The leachate drainage layer is formed by aggregate and covered by a separation geotextile.
Cell embankments	■ Cell division bunds, to be constructed with side slopes 1:2 (V:H) and nominal crest width of 5 m. ■ Perimeter embankment, to be constructed as part of the perimeter of the final GSL with side slopes of 1:3 (V:H) and minimum embankment crest width of 5 m. ■ Cell stormwater management bund to divert clean stormwater runoff away from the areas of operation within the cell, with a nominal height of approximately 500 mm.
Leachate Pond	A lined pond to be constructed upstream of the landfill and downstream from the proposed infrastructure area, to store the leachate collected and pumped from the leachate collection sumps.
Leachate Collection System	■ Side Wall Drainage layer: a leachate collection layer installed 2.0 m up the landfill side-walls to direct lateral leachate seepage towards the cell base leachate collection system comprising of a 300 mm thick leachate drainage aggregate layer. ■ Base Drainage layer: A 300 mm thick leachate drainage aggregate layer installed over the base of the landfill cell. The landfill base is designed with a surface slope of 3% towards a leachate collection sump and riser pipe. ■ Leachate collection pipes: a network of perforated leachate collection pipes is to be installed over the base liner, covered by the base drainage layer. ■ Leachate collection sump: the leachate collection pipe network directs leachate into a leachate collection sump and is located at the lowest elevation point within Cell and Cell 2. ■ In addition solid leachate pipes are installed with the intent of connecting it to the drainage systems for the future cells. Note that future cells will have an operational extraction point (sump) as well as a long term extraction point (connection to Cell 1 and 2 sumps)
Subsurface drainage system	■ Subsurface Drain Trenches: these groundwater interception trenches are to be excavated below the base of the perimeter embankment to reduce the impacts of the phreatic surface mounding beneath the cell floor. ■ Subsurface Drain Pipes and drainage materials: a network of perforated drainage pipes is to be installed in the trenches with the drainage materials. ■ Subsurface Drain Sump: the subsurface drain pipe network directs all subsurface flows into the drain sump at the lowest elevation point within this system. The collected flows are pumped from this sump into the Retention pond.

	Key Characteristics
Retention pond	A lined pond to be constructed in close proximity to the south corner of the GSL cells. This pond has been designed to store the subsurface water from the subsurface drainage system.
Stormwater dam	To be constructed on a creek line to store the stormwater runoff from the GSL upstream catchments areas. Clean stormwater runoff will be diverted to this pond during the operation of the landfill. The stormwater dam consist of an engineered fill for the key-in trench and main embankment, plus a designed spillway.

Sediment management structure	■ To be constructed downstream of the Stormwater dam and GSL, with free draining materials to collect sediments carried with the stormwater runoff from the site.
	■ The sediment control measures include:
	  ▪ Sediment fences.
	  ▪ Rock or sandbag check dams.
	  ▪ Sediment structure.

Stormwater diversion bunds	To be constructed with compacted general fill, to nominal heights of 500 mm and 1:2 (V:H) side slopes, to divert clean stormwater runoff away from possible sources of contamination. These are to be located around Cell 1 and 2, Leachate Pond, Retention Pond, Borrow Pits and any other structures that might require them during construction and operations. There are also stormwater diversion bunds used within the cells during operations.
Stormwater management drain	To be constructed as cut to fill trench to divert the stormwater surface runoff from the GSL upstream catchment areas away from the operational areas and into the Stormwater dam.
Landfill gas management system	■ The quantity of landfill gas generation for the landfill was initially estimated for waste placement rate of 250,000 tpa using GasSim. ■ Based on the modelling, the predicted total gas generation will peak at 1 661 m^3/hr (90^{th} percentile), approximately 21 years after commencement. ■ The gas generation assessment has been reviewed for an estimated waste placement rate of 200,000 tpa. With this reduced waste placement the gas peak will remain the same at 1 661 m^3/hr (90^{th} percentile), however, it will take longer for this peak to occur. The overall gas production for the landfill will remain the same. ■ Lateral and vertical wells will be progressively installed in the waste mass as the height increases. These will start being installed once the waste height has reached a minimum of 10 m above the base liner. These wells will continue to be installed at minimum 10 m height intervals. ■ The leachate drainage layer installation will extend 2 m (vertical) up the slope of the landfill as measured from the base of the landfill. ■ The remainder of the slope will be covered with a soil protection layer. This will be to prevent a preferred flow path for gas to escape the landfill. ■ As the final waste profile is progressively achieved, deep vertical wells (up to 20 m) will be installed on the surface. These wells will be installed at a spacing of 40 m to 50 m to allow for comprehensive coverage of the waste mass. In some areas this spacing will likely be reduced to improve extraction ability. The gas extraction wells will be piped to the gas management system (likely a flare) in the allocated landfill gas infrastructure location. There will be a condensate return pipe from the gas management infrastructure back into the landfill and connected into the leachate collection aggregate layer and/or adjacent waste mass. The gas extraction wells, connecting pipes and condensate return pipes will all be installed before the lined capping layer has been constructed so that there will be minimal penetrations through the capping layer. Where required, penetrations will all be located as close to the edge of the landfill as is reasonably possible. ■ A perimeter landfill gas manifold will be installed around the edge of the landfill to act as the main collector of gas running to the flare. All of the extraction wells will be connected to this manifold, and ■ To reduce the possibility of oxygen intake, there will be no gas extraction (drilled pipes) within 5 m of the sides of the waste mass or final waste profile. There will also be no gas well drilling closer than 5 m from the base and side slopes.

	Key Characteristics
Access Roads	■ The intersection of the site access road and Great Southern Highway (refer to Attachment B for location) will be upgraded to meet the requirements of Main Roads WA (MRWA). The design incorporates an eastbound overtaking lane and a westbound acceleration lane. ■ Additionally, a sealed access road from the highway intersection to the landfill development area will be constructed. The access 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. ▪ 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. ▪ Will be fenced to keep livestock and other fauna off the road. ▪ Will have a minimum 10 m wide vegetation/crop free area between fences. ▪ Fence will have emergency access gates installed periodically along its length.
Stream 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 (refer to Attachment B for location). The crossing will be constructed of reinforced concrete box culvert (RCBC) sections to the standard Main Roads WA specification.
Weighbridge	■ 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.
Hardstand	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.
Administration	■ The entry office will have a meeting room, lunch room and ablution facilities supplied from a potable water tank adjacent to the building. ■ 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.
Services	Underground power, water, leachate and data transfer conduits will be installed around the site.

5.0 ENVIRONMENTAL IMPACT ASSESSMENT AND MANAGEMENT

5.1 Overview

The information presented in the following sections is a summary of the information presented in the documentation listed in Section 3.0.

Potential environmental impacts during construction and operations will be managed in accordance with the following documents summarised in Table 6.

Table 6: Environmental management documentation

Document	Status	Description
GSL Desktop Environmental and Social Risk Assessment (Golder, 2017e)	July 2017	Document summarising the potential environmental and social risks/impacts, control measures and residual impacts for the key environmental and social factors identified for the project.
Construction health and safety risk assessment (Golder, 2017f)	July 2017	Document summarising the potential health and safety risks/impacts, control measures and residual impacts for the key health and safety factors identified for the construction of the project.
Operation health and safety risk assessment (Golder, 2017g)	July 2017	Document summarising the potential health and safety risks/impacts, control measures and residual impacts for the key health and safety factors identified for the operation of the project.

Document	Status	Description
Construction Environmental and Health and Safety Management Plan	Pending	The construction contractor will manage potential environmental impacts in accordance with the relevant environmental management specification which will include measures to manage: ■ Dust and noise ■ Surface water, groundwater and stormwater
Great Southern Landfill Management Plan (Golder, 2017h)	July 2017	A guide for the ongoing development and operation of GSL to: ■ Operate the facility in a safe and environmentally sustainable manner ■ Maximise the efficiency of the operation whilst minimising environmental impacts on the surrounding area ■ Provide clear direction to the facility operators on how to best develop, operate and close the landfill facility so as to optimise landfill availability, while minimising potential environmental impacts.
Great Southern Landfill Stakeholder Engagement Strategy (Golder, 2017i)	July 2017	Plan for Alkina to proactively engage with stakeholders during the works approval and concurrent license application period required by DWER.
DWER Works Approval and Licence	Pending	WAA submitted to DWER in July 2017 and application is currently being assessed.
Bed and Banks Permit	Pending	Application submitted to DWER in October 2017 and is currently being assessed.
Vegetation Clearing Permit	Pending	Application submitted to DWER in October 2017 and is currently being accessed.

5.2 Air

5.2.1 Existing environment

Table 7 summarises the separation distances (DER, 2015) as related to Class II or III putrescible landfill sites.

Table 7: Separation distances

Type of Facility	Threshold	Relevant Aspect	Distance (metres)
Class II or III putrescible landfill site	≥20 tonnes per annum	Gaseous, noise, dust, odour	1000

The nearest residential receptor is 1800 m north-east of the proposed landfill and therefore the extended buffer distance meets this separation distance requirement.

5.2.2 Potential impacts

Potential emissions/impacts to air from construction activities, adversely impacting air quality and therefore the health of site workers and fauna, and dust deposition to flora include:

- Emission of carbon dioxide from the operation plant and machinery.
- Dust emissions caused by:
  - Vehicle movements on unsealed roads
  - earthworks/clearing works
  - grading works
  - material loading/unloading
  - stockpiling activities and wind erosion of stockpiles of capping materials

Potential emissions/impacts to air from operations, adversely impacting air quality and therefore the health of site workers and fauna, and dust deposition to flora include:

- Emission of landfill gas impacting air quality
- Emission of landfill gas contributing to greenhouse gas emissions (from methane and carbon dioxide).
- Emission of carbon dioxide from the operation of plant and machinery
- Dust emissions caused by:
  - vehicle movements on unsealed roads
  - wind blowing the waste out of the active tipping face
  - progressive construction activities of new landfill cells, including development of borrow areas
  - spillage of waste and debris from trucks during transport and tipping
  - grading works
  - Material loading/unloading.

5.2.3 Controls

Controls to manage potential air emissions are summarised in Section 6.0.

5.2.4 Contingencies

The following excerpt has been taken from the Site Management Plan (Alkina, 2017a):

> *In the event that the regular dust monitoring identifies potential problems with the dust management activities, a revised response plan is to be implemented. This response plan is to incorporate the following:*
>
> - *Assess the location that has been identified as a problem and consider the possible cause(s).*
> - *Consider the impact of the problem(s).*
> - *If possible, rectify the problem (e.g. increased use of the water tanker).*
> - *If not possible to rectify the problem (e.g. dust from cover material handling), assess the likely impact on neighbouring properties and whether there are any contingency measures that could be implemented to minimise the impact (e.g. stop the activity or move further away from the site boundary), and*
> - *Consider amending the standard operating procedures if the current procedures are ineffective (e.g. increase stockpiled material at the active tipping area during low wind periods to allow for suspension of this activity during high wind periods).*

5.2.5 More information

For more information refer to the following attachments:

- *Great Southern Landfill Desktop Environmental and Social Risk Assessment* (Golder, 2017e).
- *Site Management Plan* (Alkina, 2017a).
- *Application for Concurrent Works Approval and Licence, Great Southern Landfill Alkina Holdings Pty Ltd* (Golder, 2017a).
- *Works Approval Application Great Southern Landfill – Review of Noise, Odour and Dust Assessments and Management Plans for Approved Allawuna Landfill.* (Golder, 2017j).

- *SITA Allawuna Landfill – Dust Management Plan* (Bowman, 2015a).

5.3 Landfill gas

5.3.1 Potential impacts

Potential landfill gas emissions/impacts from operations include emission of landfill gas:

- To air adversely impacting air quality and the health of site workers and fauna.
- Introducing an explosion risk.
- To air contributing to greenhouse gas emissions (from methane and carbon dioxide).

5.3.2 Controls

Controls to manage ground gas are summarised in Section 6.0.

5.3.3 Contingencies

Emission limits

The landfill gas action levels, beyond which the landfill gas contractor or the landfill operator will be required to undertake remedial action include:

- Landfill surface final cap = Methane ≥100 ppm
- Within 50 mm of penetrations through the final cap = Methane ≥100 ppm
- Landfill surface intermediate cover areas (no waste within next three months) = Methane ≥ 200 ppm
- Within 50 mm of penetrations through the intermediate cover = Methane ≥ 1,000 ppm, or
- Landfill gas flares = Methane and volatile organic compounds ≥ 98% destruction efficiency.

Landfill gas response plan

The regular monitoring of the landfill gas system provides insight into the system operations and analysis of the monitoring data would indicate that there is a potential problem with an element of the system. The following is a list of potential indicators:

- Lower combustion efficiency of the flare could indicate that there is a problem with the temperature of the flare burners
- Reduced gas flow rate would indicate a blocked gas pipe
- Elevated oxygen content would indicate problems with penetration seals or excessive vacuum in an area of the waste mass
- Decreased methane content would indicate decreased moisture content in the waste or it is stabilising
- Elevated temperature would indicate a subterranean landfill fire, and
- Elevated fugitive gas emissions would indicate problems with cap penetrations, ruptures in the cap lining system or insufficient gas extraction below the landfill cap.

In the event that the regular landfill gas monitoring identifies potential problems with the landfill gas management system, a response plan is to be implemented. This response plan is to incorporate the following:

- Assess the monitoring data to try and identify the possible cause(s)
- Assess how best to confirm the suspected possible cause(s)
- Consider the impact of the problem(s)

- If possible, rectify the problem (e.g. increase gas vacuum pressure)
- If not possible to rectify the problem (e.g. blocked gas extraction pipe), assess the likely impact on future landfill operations and whether there are any contingency measures that could be implemented to minimise the impact (e.g. install additional extraction well), and
- Consider amending the standard operating procedures if the current procedures are ineffective (e.g. change specification of the gas pipe).

It is not possible to develop a response plan that covers each likely eventuality and proposes feasible solutions to those possible scenarios. In the event that an issue is identified, the appropriate specialist is to be engaged to develop a specific remedial solution. Depending on the nature of the issue, the DWER may need to be involved in the process.

5.3.4 More information

For more information refer to the following attachments:

- *Great Southern Landfill Desktop Environmental and Social Risk Assessment* (Golder, 2017e).
- *Site Management Plan* (Alkina, 2017a).
- *Application for Concurrent Works Approval and Licence, Great Southern Landfill Alkina Holdings Pty Ltd* (Golder, 2017a).
- *Allawuna Landfill, York – Landfill Gas Assessment* (Golder, 2015e).
- *Design report Great Southern Landfill Cell 1, Cell 2 and Ancillary Works* Golder (2017b).
- *Landfill Gas Management Plan – Allawuna Farm Landfill* (SITA, 2015).

5.4 Noise

5.4.1 Existing environment

The WAA submitted by SUEZ is publicly available on the DWER website. The following information summarises the publicly available supporting noise information relevant to the GSL Project, as supported by Golder's Due Diligence Assessment (Golder, 2017j).

VICPAC (2015) modelled plant operations based on the expectant numbers of plant and operational hours for the site with results compared to the *Environmental Protection (Noise) Regulations 1997*. The noise investigation found that predicted noise levels at the nearest sensitive receivers were within the guideline limits for time of day during both the construction and operational phases of the landfill.

5.4.2 Potential impacts

Potential noise emissions from construction activities potentially adversely impacting site personnel, the community and fauna include:

- Operation of vehicles and other equipment.
- Construction works including earthworks, clearing and excavations.

Potential noise emissions from operations potentially adversely impacting site personnel, the community and fauna include:

- Operation of vehicles and other equipment.
- Ongoing operational works, including activities at proposed borrow areas (such as operation of vehicles and other equipment), capping, landfilling works, loading and unloading of waste etc.

5.4.3 Controls

Controls to manage noise are summarised in Section 6.0.

5.4.4 Contingencies

The following excerpt has been taken from the Site Management Plan (Alkina, 2017a):

> *In the event that the noise monitoring or complaints identify excessive noise emissions from site, a revised response plan is to be implemented. This response plan is to incorporate the following:*
>
> - *Assess the noise source identified as a problem and consider the possible cause(s).*
> - *Consider the impact of the problem(s).*
> - *If possible, rectify the problem (e.g. only move cover material when the site is not busy – only minimal vehicles moving around site).*
> - *If not possible to rectify the problem (e.g. site too busy and cover material needs to be moved), assess the likely impact on neighbouring properties and whether there are any contingency measures that could be implemented to minimise the impact (e.g. install sound suppressors on the dump truck and excavator).*
> - *Consider amending the standard operating procedures if the current procedures are ineffective (e.g. move cover material early in the morning as opposed to towards the end of the day).*

5.4.5 More information

For more information refer to the following attachments:

- *Great Southern Landfill Desktop Environmental and Social Risk Assessment* (Golder, 2017e).
- *Site Management Plan* (Alkina, 2017a).
- *Application for Concurrent Works Approval and Licence, Great Southern Landfill Alkina Holdings Pty Ltd* (Golder, 2017a).
- *Works Approval Application Great Southern Landfill – Review of Noise, Odour and Dust Assessments and Management Plans for Approved Allawuna Landfill.* (Golder, 2017j).
- *SITA Allawuna Farm Landfill – Noise Management Plan* (Bowman, 2015b).
- *Environmental Noise Assessment – Allawuna Landfill Environmental Noise.* (VICPAC, 2015).

5.5 Odour

5.5.1 Existing environment

The WAA submitted by SUEZ is publicly available on the DWER website. The following information summarises the publicly available supporting odour information relevant to the GSL Project:

Based on detailed modelling conducted by Environmental Alliances Pty Ltd (2015), all odour generated during the operation of the landfill (based on the proposed operational times, procedures and waste volumes) would be maintained well within the site boundary.

Golder's Due Diligence report (2017j) states:

> *There are a number of shortcomings in the odour assessment report. Remodelling based on the above recommendations may change the model outcomes (predicted odour concentrations) and possibly increase the potential odour impact from on-site operations. However, given the large separation distance from the on-site odour sources to the nearest sensitive receptors and the boundary of the site, an increase in the potential odour impact would not be expected to extend beyond the site boundary and not exceed the odour criteria at the nearest sensitive receptors.*

5.5.2 Potential impacts

Potential odour emissions from operations potentially adversely impacting site personnel, the community and fauna include:

- Emission of odour from waste within active landfill cells.
- Emission of odour from leachate and/or the leachate pond.

5.5.3 Controls

Controls to manage potential odour emissions are summarised in Section 6.0.

5.5.4 Contingencies

The following excerpt has been taken from Alkina (2017a):

> *In the event that odour monitoring or complaints identify excessive odour emissions from site, a revised response plan is to be implemented. This response plan is to incorporate the following:*
>
> - *Assess the odour source identified as a problem and consider the possible cause(s)*
> - *Consider the impact of the problem(s)*
> - *If possible, rectify the problem (e.g. change leachate pumping rates)*
> - *If not possible to rectify the problem (e.g. pumping rate is required to maintain the maximum 300 mm leachate level on the landfill liner), assess the likely impact on neighbouring properties and whether there are any contingency measures that could be implemented to minimise the impact (e.g. lower the leachate discharge pipe to below the level of the leachate to prevent aeration during pumping), and*
> - *Consider amending the standard operating procedures if the current procedures are ineffective (e.g. change leachate pumping schedule).*
>
> ***Emissions Limits***
>
> *Odour limits are subjective to individual tolerances and sensitivities and it is difficult to set a definitive odour value that can be readily measured on site. Hence, the emissions limits adopted for on-site monitoring by landfill staff is founded around "nil" odour, "noticeable" odour and "unreasonable" odour.*
>
> *Noticeable odour is a level of odour when it is first identified by the person undertaking the odour monitoring.*
>
> *Unreasonable odour is a level of odour that is deemed by the person undertaking the monitoring as being unreasonable. The level of what is deemed unreasonable is agreed by the site monitoring personnel based on the location of monitoring, location of the nearest receptor and the likely impact on the receptor.*
>
> *The DWER sets a target of 500 odour units emitted from a single source and this is used as the benchmark for third-party olfactory monitoring should it be undertaken.*
>
> *If, based on the adopted "noticeable" and "unreasonable" odour limits, there are still complaints received, then the limits are to be reassessed and lowered to manage complaints.*

5.5.5 More information

For more information refer to the following attachments:

- *Great Southern Landfill Desktop Environmental and Social Risk Assessment* (Golder, 2017e).
- *Site Management Plan* (Alkina, 2017a).

- *Application for Concurrent Works Approval and Licence, Great Southern Landfill Alkina Holdings Pty Ltd* (Golder, 2017a).
- *Works Approval Application Great Southern Landfill – Review of Noise, Odour and Dust Assessments and Management Plans for Approved Allawuna Landfill.* (Golder, 2017j).
- *SITA Allawuna Farm Landfill – Odour Management Plan* (Bowman, 2015c).
- *Revised Assessment of Odours from Proposed Allawuna Landfill*. (ENVALL, 2015).

5.6 Groundwater

5.6.1 Existing environment

The proposed landfill site is located in a small catchment containing an unnamed headwater tributary located on the eastern side of the valley that contains the northerly flowing, ephemeral, Thirteen Mile Brook, into which the tributary drains. The landfill footprint is located on the northern side of the tributary catchment and approximately 400 m north-east of Thirteen Mile Brook (Golder, 2017k).

The groundwater at the site has been identified as being brackish to saline and no potential beneficial use has been identified. There are no identified off site groundwater users and no groundwater dependant ecosystems close to the site (Golder, 2017k).

The hydrogeological setting of the landfill site, as summarised in the conceptual site model (Figure 8, attached) and, does not present characteristics that should give cause for concern that detrimental impacts to the environment or to other groundwater users may arise from the operations of the landfill. In the context of a source, pathway and receptor assessment, the key reasons for this are:

- **Source** (Landfill) – The landfill cell will be designed, engineered and operated (with appropriate monitoring and contingency protocols) to appropriate standards to avoid interactions between leachate and local and regional groundwater systems.
- **Pathway** (Groundwater Flow) – There exists a good understanding of the hydrogeological setting of the site, which can be demonstrated on the basis of the work carried out to date. The hydrogeology is fairly simple, comprising a saprolitic regolith profile overlying Archaean granitic and gneissic rocks, typical of the Yilgarn Block.
- **Pathway** (Groundwater Flow) – Given the relatively low hydraulic conductivity of the regolith profile and low hydraulic gradient at the site, the rate of transport of any contaminated groundwater off site is expected to be low.
- **Pathway** (Groundwater Flow) – There is an absence of palaeovalleys or other hydraulic pathways into areas of potential concern (for example drinking water catchments).
- **Receptor** – There are no sensitive environmental areas or registered groundwater users within the Thirteen Mile Brook catchment. The catchment is not pristine, having been significantly disturbed through agricultural activities.

5.6.2 Potential impacts

Potential emissions/impacts to groundwater from construction activities, adversely impacting groundwater quality include:

- Deterioration/contamination of groundwater quality caused by on-site spills (such as hydrocarbons, saline, septic system or other contaminated materials).

Potential emissions/impacts to groundwater from operations, adversely impacting groundwater quality include:

- Deterioration/contamination of groundwater caused by seepage of recycled leachate from the landfill cells and recycled leachate pond during their operation.
- Deterioration/contamination of groundwater caused by on-site spills (such as hydrocarbons, saline, septic systems or other contaminated materials).

5.6.3 Controls

Controls to manage potential emissions to groundwater are summarised in Section 6.0.

5.6.4 Contingencies

The following excerpt has been taken from Alkina (2017a):

> *In the event that there is landfill related contamination identified in the groundwater, this matter is to be reported to DWER and if deemed necessary, a response plan developed in agreement with DWER and other suitable experts.*

5.6.5 More information

For more information refer to the following attachments:

- *Great Southern Landfill Desktop Environmental and Social Risk Assessment* (Golder, 2017e).
- *Site Management Plan* (Alkina, 2017a).
- *Application for Concurrent Works Approval and Licence, Great Southern Landfill Alkina Holdings Pty Ltd* (Golder, 2017a).
- *Allawuna Landfill Hydrogeological Site Characterisation Studies* (Golder, 2015c)
- *Hydrogeological Site Characterisation Great Southern Landfill.* (Golder, 2017k).

5.7 Surface water

5.7.1 Existing environment

The proposed development site is located in the upper reaches of Thirteen Mile Brook, approximately 250 m to the south-west of the site and close to the catchment divide within the adjacent Six Mile Brook. Both watercourses ultimately drain to the Avon River. A small, ephemeral creek is located within the outskirts of the proposed development's footprint and flows into Thirteen Mile Brook. The proposed stormwater dam and sediment management structure will intersect this small ephemeral creek.

Refer to Golder (2017l) for a more in depth summary of rainfall, climate and hydrology.

Golder (2017m) submitted an Application for a Section 11/17/21A Permit to Interfere with Bed and Banks on 6 October 2017. The application is currently being assessed by DWER.

5.7.2 Potential impacts

Potential emissions/impacts to surface water from construction activities and operations, adversely impacting surface water quality include:

- Sediment and stormwater emissions to surface water, caused by stormwater, run-off and erosion.
- Deterioration/contamination of surface water caused by overtopping of leachate from onsite leachate/retention ponds during their operation.
- Deterioration/contamination of surface water caused by on-site spills (such as hydrocarbons, saline, septic systems or other contaminated materials).

5.7.3 Controls

Controls to manage potential emissions to surface water are summarised in Section 6.0.

5.7.4 Contingencies

The following excerpt has been taken from Alkina (2017a):

> *In the event that the regular monitoring, or other monitoring of the surface water bodies identifies contamination above background levels, a revised response plan is to be implemented. This response plan is to incorporate the following:*
>
> - *Identification of the elements that have exceeded the background levels. This potentially indicates the type of surface water management mechanism that has failed and resulted in the contamination.*
> - *Undertake a full inspection of the area upstream of the detected contamination to identify any system failures.*
> - *Rectification of the system failure but implementing a temporary solution as a quick fix until the area dries out sufficiently or if possible, implement a permanent solution in the first place.*
> - *Undertake further inspections further-afield to identify if the same problem is occurring elsewhere, and*
> - *Consider amending the standard operating procedures if the current procedures are ineffective (e.g. thicker intermediate cover in certain areas to improve erosion resistance).*

5.7.5 More information

For more information refer to the following attachments:

- *Great Southern Landfill Desktop Environmental and Social Risk Assessment* (Golder, 2017e).
- *Site Management Plan* (Alkina, 2017a).
- *Application for Concurrent Works Approval and Licence, Great Southern Landfill Alkina Holdings Pty Ltd* (Golder, 2017a).
- *Allawuna Farm Landfill Surface Water, Groundwater and Leachate Management Plan.* Golder (2015d).
- *Allawuna Farm Landfill Topsoil Handling and Sedimentation Management.* Golder (2015f).
- *Stability Analysis and Liner System Integrity Assessment for Landfill Development* (ref 14765033-012-R-Rev0), (Golder, 2015b).
- *Allawuna Landfill Hydrogeological Site Characterisation Studies* (Ref. 14765033-009-R-Rev0) (Golder, 2015c).
- *Application for a Section 11/17/21A Permit to Interfere with Bed and Banks Alkina Holdings Great Southern Landfill Project* (Golder, 2017m).

5.8 Waste

5.8.1 Potential impacts

Potential waste generated from operations potentially adversely impacting site personnel, the community, visual amenity, flora and fauna include:

- Windblown litter from:
  - Uncovered vehicles transporting waste into the facility
  - Waste tipping operations

  - Exposed surfaces of the landfill
  - Poor cover and/or compaction of the waste.
- Leachate.
- Landfill gas.
- Asbestos and other hazardous waste material causing health impacts to people or fauna.

5.8.2 Controls

Controls to manage leachate, landfill gas and litter are summarised in Section Table 1.

A site specific Waste Acceptance Manual will be developed. The manual will be used by landfill personnel as a reference for the day to day operations concerning receipt and management of hazardous waste at the landfill.

The acceptance and management of asbestos waste at the landfill will be undertaken in accordance with Asbestos Management Plan (Alkina, 2017b).

5.8.3 Contingencies

The following excerpt has been taken from Alkina (2017a):

Landfill gas

The regular monitoring of the landfill gas system provides insight into the system operations and analysis of the monitoring data would indicate that there is a potential problem with an element of the system. Table 8 summarises potential indicators of a fault in the landfill gas system:

Table 8: Potential indicators of fault in landfill gas system

Indicator	*Possible Cause*
Lower combustion efficiency of the flare	*There is a problem with the temperature of the flare burners.*
Reduced gas flow rate	*A blocked gas pipe.*
Elevated oxygen content	*Problems with penetration seals or excessive vacuum in an area of the waste mass.*
Decreased methane content	*Decreased moisture content in the waste or it is stabilising.*
Elevated temperature	*A subterranean landfill fire*
Elevated fugitive gas emissions	*Problems with cap penetrations, ruptures in the cap lining system or insufficient gas extraction below the landfill cap.*

In the event that the regular landfill gas monitoring identifies potential problems with the landfill gas management system, a response plan is to be implemented. This response plan is to incorporate the following:

- *Assess the monitoring data to try and identify the possible cause(s).*
- *Assess how best to confirm the suspected possible cause(s).*
- *Consider the impact of the problem(s).*
- *If possible, rectify the problem (e.g. increase gas vacuum pressure).*
- *If not possible to rectify the problem (e.g. blocked gas extraction pipe), assess the likely impact on future landfill operations and whether there are any contingency measures that could be implemented to minimise the impact (e.g. install additional extraction well)*

- *Consider amending the standard operating procedures if the current procedures are ineffective (e.g. change specification of the gas pipe).*

It is not possible to develop a response plan that covers each likely eventuality and proposes feasible solutions to those possible scenarios. In the event that an issue is identified, the appropriate specialist is to be engaged to develop a specific remedial solution. Depending on the nature of the issue, DWER may need to be involved in the process.

Leachate

The regular monitoring of the leachate system provides insight into the system operations and if there are any unusual changes in monitoring data, this could indicate that there is a potential problem with an element of the system. The following is a list of potential indicators:

- *Where there is a noticeable decrease in the quantity of leachate being pumped out of the leachate sump, this could indicate the following:*
  - *There is a blockage in the leachate aggregate or leachate collection pipe work. The longer the pump cycle, the further away from the sump the blockage has occurred. Very short pump cycles indicate a blockage around the leachate sump.*
  - *The pump is losing efficiency and needs to be replaced. This is typically associated with a longer than usual pump cycle.*
  - *The leachate extraction pipe has collapsed and there is reduced access down the pipe. This is easily confirmed by the removal of the leachate pump. If the pipe has collapsed, the pump is stuck.*
- *Where there is increased depth of leachate over the liner, this would indicate the following:*
  - *Problems with the pump float valves, or*
  - *Decreased pump efficiency, and*
  - *If there were a noticeable drop in the level in one leachate pond in comparison to another (so long as this is not associated with pumping differences), this would indicate a leak in the one pond. The larger the leak, the greater the comparative drop in leachate level.*

In the event that the regular leachate monitoring identifies potential problems with the leachate management system, a revised response plan is to be implemented. This response plan shall:

- *Assess the monitoring data to try and identify the possible cause(s)*
- *Assess how best to confirm the suspected possible cause(s)*
- *Consider the impact of the problem(s)*
- *If possible, rectify the problem (e.g. replace a pump)*
- *If not possible to rectify the problem (e.g. blocked leachate drainage aggregate), assess the likely impact on future landfill operations and whether there are any contingency measures that could be implemented to minimise the impact*
- *Consider amending the standard operating procedures if the current procedures are ineffective (e.g. damage to the leachate pond lining system).*

Should the ongoing monitoring of leachate quantities on site indicate that there is a gradual net accumulation of leachate over time, the following contingency actions are to be implemented:

- *Employ an additional staff member to concentrate solely on leachate management activities (increased treatment effort).*

- *Apply thicker intermediate cover over temporary closed areas to increase the retention of rainwater within the soil and hence, reduce leachate generation.*
- *Bring forward the timing of subsequent leachate pond construction, or*
- *As a last resort, tanker excess leachate off-site.*

From a day-to-day operational consideration, spare pumps (or readily available hire pumps), pipelines and fittings are kept on site so that in the event of a system breakdown, there are readily available items of equipment to ensure continuity of leachate management.

It is not possible to develop a response plan that covers each likely eventuality and proposes feasible solutions to those possible scenarios. In the event that an issue is identified, the appropriate specialist is to be engaged to develop a specific remedial solution. Depending on the nature of the issue, DWER may need to be involved in the process.

Litter

Blown from waste delivery vehicles

In the event that vehicles arriving on site are inadequately covered; the weighbridge operator advises the vehicle driver to improve the covering of the vehicle. This comment is recorded on the weighbridge docket. In the event of a second warning being issued, again the weighbridge docket is marked up, but in this case the responsible company is also to be advised. If the driver delivers a third unsuitably covered load, the head office is to contact the company to resolve the issue, typical resolution being:

- *Bar the driver from site*
- *Bar the vehicle from site*
- *The waste delivery company makes the appropriate changes to the vehicle to improve covering, or*
- *Other solutions that may be negotiated between head office and the waste delivery company.*

Blown from active tipping area during tipping of waste loads

Treatment options include:

- *Selecting waste tipping areas to best suit the ambient weather conditions*
- *Utilisation of litter screens in close proximity to the tipping vehicles*
- *Litter fencing around the active landfill area*
- *Removing litter from the litter screens and fences as soon as possible, but as a minimum at least every two days*
- *Collecting litter blown beyond the active landfill as soon as possible, but as a minimum on a weekly basis, and*
- *Collecting litter blown beyond the Lot boundaries as a minimum on a weekly basis.*

Blown from active tipping area during pushing and compaction of waste

Treatment options include:

- *Selecting waste tipping areas to best suit the ambient weather conditions*
- *Minimising the distance from where the waste vehicle tipped to the position of final waste placement*
- *Litter fencing around the active landfill area*

- *Removing litter from the litter screens and fences as soon as possible, but as a minimum at least every two days*
- *Collecting litter blown beyond the active landfill as soon as possible, but as a minimum on a weekly basis, and*
- *Collecting litter blown beyond the Lot boundaries as a minimum on a weekly basis.*

Blown from waste delivery vehicles departing site

Treatment options include:

- *Being aware of the vehicles that have the potential to cause litter from this source (walking floors, not tippers)*
- *Where possible, the inspection of the vehicles prior to departing the tipping area to ensure that the vehicle is empty*
- *Advising customers which vehicles are causing the problem and working with the customers to try and reduce/eliminate the problem*
- *Collecting litter blown down the internal access roads and also on Great Southern Highway, within the first kilometre of the site entrance, and*
- *Collecting litter blown beyond the Lot boundaries as a minimum on a weekly basis.*

Litter generation and the appropriate management thereof is an ongoing aspect of landfill operations. There is no reasonable way to completely prevent the generation of litter; hence, an active litter management plan and subsequent strategies are required at all times.

In the event that routine litter monitoring identifies excessive litter blowing beyond the active landfill area or litter blown beyond the Lot boundaries remains beyond the boundary for more than a week, a revised response plan is to be implemented. This response plan is to incorporate the following:

- *Assess the current litter management mechanisms and consider the possible cause(s)*
- *Consider the impact of the problem(s)*
- *If possible, rectify the problem (e.g. increased use of litter screens/increased use of litter collection personnel)*
- *If not possible to rectify the problem (e.g. extreme weather conditions), assess the likely impact on neighbouring properties and whether there are any contingency measures that could be implemented to minimise the impact (e.g. additional litter collections), and*
- *Consider amending the standard operating procedures if the current procedures are ineffective (e.g. use of additional litter screens/installation of more perimeter litter fencing).*

5.8.4 More information

For more information refer to the following attachments:

- *Great Southern Landfill Desktop Environmental and Social Risk Assessment* (Golder, 2017e).
- *Site Management Plan* (Alkina, 2017a).
- *Application for Concurrent Works Approval and Licence, Great Southern Landfill Alkina Holdings Pty Ltd* (Golder, 2017a).

5.9 Native vegetation

5.9.1 Existing environment

A comprehensive level 2 flora investigation and level 1 fauna survey was conducted by ENV (2012) in accordance with the scope and limitations outlined in the ENV (2012) report.

Golder (2017o) assessed that the results and conclusions contained in ENV (2012) remain valid for the proposed landfill.

The key findings of the investigation were:

- The area is dominated by cleared cropland (87%), with scattered Marri and *Eucalyptus wandoo* (Wandoo) with low fauna habitat value.
- The remaining area (13%) is a seasonally dry minor creekline lined with Eucalyptus wandoo (Wandoo) and *Eucalyptus rudis* (Flooded Gum) also with low fauna habitat value.
- No declared weeds, threatened or priority flora were identified at the site.
- Both habitat types present in the study area are of low fauna habitat value.
- 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 (*Calyptorhynchus latirostris)* roosting site is over 16 km away
- No evidence of Graceful Sun Moth (*Synemon gratiosa*) habitat in the area.
- The proposed development is likely to have minimal impact on the flora and fauna of the survey area and surrounds.

Golder (2017p) submitted an Application for a Clearing Permit (Area Permit) Form C1 on 9 October 2017. The application is currently being assessed by DWER.

5.9.2 Potential impacts

Potential impacts to native vegetation from construction activities and operations include:

- Disturbance to and/or clearing of vegetation as a result of construction activities.
- Introduction of weeds as a result of increased vehicle movement on site.

5.9.3 Controls

Controls to manage potential impacts to native vegetation include:

- The landfill has been specifically located to minimise clearing of remnant bushland on the project site. Limited clearing is required for a strip of bushland near the site entry and isolated trees.
- Vegetation will be cleared in accordance with the Native Vegetation Clearing Permit.
- Topsoil to a depth of 200 mm shall be removed from the landfill development area and stockpiled for future use (soil from cropping and non-cropping areas will be stockpiled separately). Topsoil will be deposited in rows no higher than 3 m and no wider than 15 m to aid the preservation of soil microbes.

- The stripping of topsoil will occur progressively, staged in a manner that follows the construction of the cells. Topsoil will be stripped to a depth of 300 mm across the footprint of each cell, an area of approximately 12.5 ha. Topsoil will be stripped whilst in a moist condition to prevent clodding or hard-setting due to the potentially high silt/clay content. Therefore, no stripping should take place immediately following prolonged rainfall or irrigation.
- Stockpiling will occur in a designated area north of the landform. Stockpiles will be limited to a height of 1.5 m with batter slopes of 1V:1H. Since topsoil material is deemed unsuitable as engineered fill, the stockpiles will remain in place until required for re-use in final capping or landscaping works. Topsoil will be stockpiled separately from any sub-soil materials (e.g. soil excavated from sub-soil drainage trenches) and clear signage erected. The surface of the completed stockpiles will be left in a "rough" condition to help promote water infiltration and minimise erosion prior to vegetation establishment.
- The stockpile area will be contained by a low temporary bund constructed from suitable fill material. A sediment-fence will be installed around the inside perimeter of the bund and between stockpile types (topsoil upper 50 mm; topsoil lower 200 mm; sub-soil) to prevent migration of eroded soil particles outside of the stockpile area and cross-mingling of soil types.
- Weed management measures including:
  - No green waste processing.
  - Application of adequate cover material.
  - Regular site inspections.
  - Weed eradication as required – small areas controlled by landfill operations staff, larger areas controlled by professional weed control company or with the assistance of neighbouring land owners.

5.9.4 More information

For more information refer to the following attachments:

- *Great Southern Landfill Desktop Environmental and Social Risk Assessment* (Golder, 2017e).
- *Site Management Plan* (Alkina, 2017a).
- *Application for Concurrent Works Approval and Licence, Great Southern Landfill Alkina Holdings Pty Ltd* (Golder, 2017a).
- *Works Approval Application – Desktop Assessment Supporting Flora and Fauna Information* (Golder, 2017n).
- *Application for a Clearing Permit (Area Permit) Form C1 Alkina Holdings Great Southern Landfill Project.* (Golder, 2017o)
- *Allawuna Landfill Vegetation and Fauna Assessment* (ENV, 2012).
- *Great Southern Landfill Facility, Lot 4869 Great Southern Highway, Shire of York. Great Southern Landfill Asbestos Management Plan*. Alkina (2017b).

5.10 Fauna

5.10.1 Existing environment

A comprehensive level 2 flora investigation and level 1 fauna survey was conducted by ENV (2012) in accordance with the scope and limitations outlined in the ENV (2012) report.

Golder (2017o) assessed that the results and conclusions contained in ENV (2012) remain valid for the proposed landfill.

The key findings of the investigation were:

- Both habitat types present in the study area are of low fauna habitat value
- 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.

5.10.2 Potential impacts

Potential impacts to fauna from construction activities and operations include:

- Disturbance to and/or clearing of native vegetation as a result of construction activities resulting in the reduction of fauna habitat.
- Disease vectors and vermin (including flies, mosquitoes, mice, rats, cats, foxes and birds) emanating from the landfill due to following practices, potentially posing a risk to public health:
  - Exposed food wastes
  - Windblown food waste
  - Access to voids in the waste mass due to poor cover or compaction
  - Still waters at the landfill.

5.10.3 Controls

Native fauna

Controls to manage potential impacts to native fauna include:

- Restrict clearing to the area stated in the Native Vegetation Clearing Permit.
- Maintain site fencing to keep larger animals away from the site.
- Utilise bird control measures such as anti-perch strips on buildings, acoustic bird scaring devices and other techniques, as required.

Vermin

The following excerpt has been taken from the Site Management Plan (Alkina, 2017a):

The following general preventative or corrective measures are available:

- *Regular pushing up and compaction of the waste.*
- *Application of adequate cover material.*
- *Progressive closure of completed landfill areas.*
- *Monthly inspections of the site undertaken to identify if there are any vermin present on and around the landfill. The monthly inspection is carried out by site operational staff.*

- *Should vermin be identified on site, the appropriate eradication procedures are undertaken (dependent on the vermin type). This involves professional pest controllers being utilised to manage the situation. Typically vermin could include:*

Rodents

The services of a specialist pest control contractor will be engaged to provide a pest prevention service for rodents. The contractor will visit the site approximately eight times per year to carry out inspections and servicing of bait boxes which will be installed around the site infrastructure and landfill footprint. The contractor will provide an inspection sheet for each site visit. The inspection sheets will be kept on file along with the following information:

- *Safety Data Sheets (SDS) for rodenticides used*
- *Details of operator training and qualifications, and*
- *Map showing the locations of all on-site bait stations.*

The following precautions will be employed to minimise the likelihood of the baiting system causing secondary poisoning of other species:

- *First generation warfarin-based anti-coagulant poisons will be employed, which have been shown to reduce the risk of secondary poisoning*
- *Rodenticides will be housed in clearly-marked and tamperproof bait stations that will be checked regularly for damage and replaced as needed*
- *Dead rodents will be removed as soon as they are discovered to prevent scavengers from ingesting them, and*
- *The storage and disposal of empty rodenticide containers will be conducted in accordance with the Guidelines for the safe use of pesticides in non-agricultural workplaces (2007) and AS 2507-1998 The storage and handling of agricultural and veterinary chemicals.*

Feral Cats

Feral cats pose a significant problem to native Australian wildlife and efforts to control populations have had varying success. They are present Australia-wide under all climatic extremes and in vastly different types of terrain. Landfills present an attractive habitat for feral cats due to the presence of food waste and possible prey.

The main methods for the control of feral cats have been summarised in Table 9.

Table 9: Control methods for feral cats

Method	Description
Exclusion	*Regular boundary fencing has failed to stop the spread of feral cats in a wide variety of contexts. Feral cats have been successfully prevented from climbing over netted fences that incorporate an electric wire mounted 15 cm from the top and 10 cm outwards from the fence. Non-electrified fencing should utilise a netted ceiling or curved overhang to prevent cats from climbing straight over the fence.*
Shooting	*Night shooting is an effective method for controlling feral cats due to their distinctive green eye-shine. Fox whistles have been used to great effect to attract feral cats for culling.*
Poisoning	*Fresh meat baits containing 1080 poison may be used to control feral cats under an Australian Pesticides and Veterinary Medicines Authority (APVMA) permit. It must be noted that only authorised persons can supply and use 1080 baits.*
Lures	*Audible recorded lures for feral cats mimic the distress call of a small animal and can be used to draw a predator to a bait or trap site.*
Trapping	*For true feral cats, leg-hold traps similar to those used for dingoes and foxes have proven to be quite effective. Semi-feral cats are easily trapped in wire 'treadle-type' box traps.*

GSL will engage the services of an appropriately qualified and experienced animal control contractor on an 'as needed' basis to ensure that feral cats do not become a problem at the landfill facility. It is envisaged that the contractor will conduct a site assessment and control program on a yearly basis (at minimum).

Birds

Birds are also classed as vermin and the common methods used to control them include:

- *Falcons*
- *Distress calls*
- *Blank-firing guns*
- *Trapping.*

If required, a specialist bird control contractor will be employed to implement and maintain the bird control measures on site. These measures will be based on the contractor's expertise and experience, and as such could be subject to change, depending on what is found to be the most effective measure. The main method to control birds on site will be the progressive covering of waste during operating days and to cover all waste in accordance with the VIC-BPEM for Landfills.

In addition to this, staff will carry out a visual checks for evidence of bird activity within the boundaries of the site on a daily basis. Details of these daily checks will be recorded on the daily check sheets and kept on site.

Flies and Mosquitoes

The main mechanism for the controlling of fly infestation will be via the daily covering of waste, in accordance with the VIC-BEPM. If any area of the landfill appears to be suffering from an increased fly population, then additional cover will be applied to this area in the first instance. In the unlikely event that this control measure does not successfully control the fly population, fly spraying will be employed. The following precautions and procedures will be implemented in order to minimise the occurrence of secondary poisoning in the surrounding environment:

- *Spraying to be carried out by appropriately trained and qualified personnel equipped with the requisite personal protective equipment (PPE)*
- *Only the affected areas will be sprayed (i.e. the working face or the cover mats)*
- *Fly spraying will only take place in favourable weather conditions (i.e. wind speeds between 3 and 15 km/h, wind direction away from sensitive areas, no temperature inversion layer present and temperatures below 28°C), and*
- *Fly spraying will not take place in the vicinity of any watercourses.*

Details of any fly spraying undertaken will be recorded on the daily site condition report. Copies of operators' training qualifications and the SDS for any insecticides used will be kept in the on-site office.

Mosquitoes breed in standing water in natural and man-made wetlands, as well as a range of water-holding containers in human environments. They can breed in fresh, brackish and saline water conditions and different mosquito species have different habitat requirements.

There is the potential for mosquito breeding on site. The control of mosquitoes is primarily a function of limiting the breeding opportunities by limiting the extent of water bodies around the landfill site as well as limiting the vegetation growth within the water bodies.

There is an operational need to store water on site; hence, it is not possible to eliminate all water bodies; however, it is possible to eliminate vegetation within the storage ponds and dams.

Due to the chemical composition of leachate and the non-existence of vegetation within the leachate ponds, these ponds are not a source of mosquito breeding.

In the rare event that mosquitoes are identified as a problem on site, there are a number of management techniques that are to be used to reduce the breeding of mosquitoes and hence reduce exposure of people to mosquito bites. Approaches include physical, biological, chemical and cultural mosquito control.

5.10.4 More information

For more information refer to the following attachments:

- *Great Southern Landfill Desktop Environmental and Social Risk Assessment* (Golder, 2017e).
- *Site Management Plan* (Alkina, 2017a).
- *Application for Concurrent Works Approval and Licence, Great Southern Landfill Alkina Holdings Pty Ltd* (Golder, 2017a).
- *Works Approval Application – Desktop Assessment Supporting Flora and Fauna Information* (Golder, 2017n).
- *Allawuna Landfill Vegetation and Fauna Assessment* (ENV, 2012).

5.11 Traffic

5.11.1 Existing environment

The average weekly traffic volumes were sourced from the Main Road Western Australia (MRWA) website and are summarised in Table 10.

Table 10: Average weekly traffic volumes

Site No.	Road	Location	AWT	%HV	Data Date
51175	Great Southern Highway	West of Ashworth Road	1406	20.1%	07/06/2012

(GTA, 2017)

The Great Southern Highway, where the Allawuna access road (currently an unsealed access road) intersects, is an undivided single carriageway consisting of the following cross-section:

- 7.0 m wide seal
- 0.5 m wide sealed shoulders
- 1.0 m unsealed shoulder.
- 100 km/h is the posted speed limit.

GTA (2017) carried out a revised crash analysis using data over the previous five-year period from 2012 to 2016 for an approximate 1 km distance either side of the proposed access location on the Great Southern Highway. This analysis identified that six crashes occurred over this period, with no fatalities recorded. It is considered that there is no particular crash trend that may be exacerbated by the proposed access.

5.11.2 Potential impacts

Construction activities and operations will cause an increased traffic flow within the area due to vehicles accessing the site.

5.11.3 Controls

Controls to manage traffic include:

- Addressing the primary aspects of the haulage operation as they impact the Great Southern Highway, and motorists on the Highway including:
  - Vehicle and trailer type, size and general specifications including colour schemes.
  - Haulage vehicle operating schedules and turnaround times.
  - Driver rest and fatigue management procedures.
  - Vehicle litter clean down procedures and overall cleaning schedules.
  - Upgrading the intersection of Great Southern Highway and the landfill entry road to provide a through lane for eastbound vehicles and an acceleration lane for road trains exiting the site to Perth. The intersection will be designed and constructed to Main Roads WA requirements.

5.11.4 More information

For more information refer to the following attachments:

- *Great Southern Landfill Desktop Environmental and Social Risk Assessment* (Golder, 2017e).
- *Site Management Plan* (Alkina, 2017a).
- *Application for Concurrent Works Approval and Licence, Great Southern Landfill Alkina Holdings Pty Ltd* (Golder, 2017a).

- *York Landfill (Due Diligence) Traffic Impact Statement Addendum* (GTA Consultants, 2017).

5.12 Fire

5.12.1 Potential impacts

Operation of a landfill may potentially cause fire(s) on site within the landfill cells or surrounding area, potentially impacting air quality, the health of site workers, the community and fauna, vegetation and public safety.

5.12.2 Controls

Controls to manage the risk of fire include:

A site specific Fire Management Plan (FMP) will be developed which includes fire management, monitoring and contingency actions. The FMP details management measures appropriate to the scale and nature of the fire risk, including:

- Fire prevention.
- Site firefighting infrastructure available onsite, including water tanks, water tankers and stormwater dam.
- Fire response procedures.
- Firefighting equipment, such as a water truck.
- Storage of flammable materials.
- Maintenance of fire breaks.
- Under no circumstances is waste to be burnt on site.
- Appropriate compaction and covering of waste.
- Collection of litter from up against the litter fences.
- Not placing significant quantities of flammable material in a single area within the landfill (piles of tyres).
- Appropriate site security to reduce the likelihood of vandals entering the site.
- Sufficient stockpiles of cover material is maintained close to the active tipping area to facilitate rapid covering of the waste in the event of a fire.
- Minimum 50 kL of water is stored on site (in storage dam or designated storage tanks).
- The water tanker is always left full to be able to react immediately to a fire.
- Adequate training for site operating staff.

5.12.3 Contingencies

To be included in the site specific FMP.

5.12.4 More information

For more information refer to the following attachments:

- *Great Southern Landfill Desktop Environmental and Social Risk Assessment* (Golder, 2017e).
- *Site Management Plan* (Alkina, 2017a).
- *Application for Concurrent Works Approval and Licence, Great Southern Landfill Alkina Holdings Pty Ltd* (Golder, 2017a).

6.0 EMISSIONS AND PROPOSED CONTROLS

Table 11 summarises the emissions, discharges and proposed controls during design, construction and operation of the GSL.

Table 11: Emissions, discharges and proposed management controls

Source of Emission or Discharge	Emission or Discharge Type	Volume and Frequency	Proposed Design and Construction Controls	Proposed Operational Controls	Location
Working tip face	Odour	80 574 ou.m^3/s per year	Controls: ■ The landfill site is located 1.9 km from the nearest sensitive receptor (residence) and the intervening landform and vegetation provides an additional buffer minimising the risk of odour impacting the amenity of the surrounding environment. ■ Design and install a landfill gas management system to manage landfill gas odour. More information on the design and construction of the landfill gas management system is provided in Golder (2017b) and Golder (2017c) respectively. ■ Design and install a leachate management system to manage putrescible waste odour. More information on the design and construction of the leachate management system is provided in Golder (2017b) and Golder (2017c) respectively. ■ Maintain on-site buffers.	Controls ■ Cover the active landfill cell daily with 300 mm thick soil cover or alternative cover materials. ■ Progressively cover waste to limit oxygen availability and aerobic decomposition. ■ Immediately bury odorous waste loads. ■ Progressively cap landfill cells to contain landfill gas. ■ Maintain on-site buffers. ■ Cover waste with an inert sand/soil material at the end of every operating day to a minimum cover thickness of 150 mm. ■ Apply an intermediate cover material to a minimum depth of 300 mm for surfaces that are expected to remain exposed for a period of ninety (90) days or more. ■ Cover all loads arriving and departing the facility. ■ Investigate and respond to odour complaints received from the local community in accordance with a project specific Investigation Procedure. ■ Ongoing maintenance of temporary and permanently capped areas. ■ Operate the landfill gas capture system to manage landfill gas odour. ■ Engage a specialist contractor to manage and operate the landfill gas system in accordance with the controls listed in this table. ■ Effective and responsible leachate collection and management (immediately clearing any spillages and not allowing leachate to pond). Monitoring: ■ Manage landfill gas, leachate and odour in accordance with the Site Management Plan (Alkina, 2017a). ■ Daily odour monitoring of the landfill and surrounds by site staff via a ‘sniff test’. This test will be carried out in accordance with the United Kingdom Environmental Agency’s Guidance for H4 Odour Management. Staff will use an Odour Audit Tool to record the results of the odour monitoring. ■ The facility maintains a comprehensive complaints register, which is used as a gauge of success with regards to odour emissions management. ■ Formal, on-site odour monitoring by site staff consists of regular monitoring of the odour levels (nil, noticeable or unreasonable) at predetermined locations around the site and recording the monitoring event data, which as a minimum includes the following: ▪ Location ▪ Date ▪ Time ▪ Odour level (nil, noticeable or unreasonable) ▪ Odour type (unrelated to landfill activity, landfill gas, fresh waste, leachate) ▪ Weather conditions: ▪ Wind direction ▪ Wind speed (nil, low, mild, strong) ▪ Temperature (cold, cool, warm, hot) ▪ Name of person undertaking the monitoring. ■ As a minimum, odour monitoring locations include: ▪ Accessible points along the Lot 4869 property boundary ▪ 500 m from the landfill and leachate ponds ▪ At the Prescribed Boundary to the landfill site ▪ Immediately adjacent to all sources of odour: – Leachate ponds – Leachate extraction points – Landfill gas flare infrastructure – Penetrations through the landfill cap	Landfill footprint (Cells 1 & 2)
Leachate pond	Odour	16 682 ou.m^3/s per year			Leachate pond.

Source of Emission or Discharge	Emission or Discharge Type	Volume and Frequency	Proposed Design and Construction Controls	Proposed Operational Controls	Location
				– Active landfill tipping area – Areas of leachate recirculation – Daily and temporary covered areas. ■ The precise location of each monitoring point is influenced by the following: ▪ Predominant wind directions ▪ Site topography (including valley lines) ▪ Neighbouring residential properties ▪ Accessibility. ■ Staff members will be trained to monitor odour around the site; only one staff member undertakes the site monitoring at any one time. This training includes: ▪ Recognition of the different types of odour (unrelated to landfill activity, landfill gas, fresh waste, leachate) ▪ Recognition of the different emission limits of odour (nil, noticeable or unreasonable) ▪ Identification of the monitoring locations ▪ Factors influencing when and where monitoring is to occur ▪ Actions to be taken in the event of unreasonable odour being detected ▪ Data recording and record keeping. ■ Odour monitoring occurs on a weekly basis at the relevant down-wind monitoring points. Should this regular monitoring not identify any changes in odour levels, the monitoring frequency is to be extended; however, as a minimum, odour monitoring will occur on a monthly basis. ■ The timing of when the monitoring occurs on a particular day or at a particular location is to be determined to ensure that the worst-case odour scenario is monitored. This includes: ▪ Consideration of temperature inversion in winter ▪ Leachate ponds when leachate is being pumped into the ponds ▪ Areas of leachate recirculation when leachate is being recirculated ▪ When the wind speed is low. ■ To reduce the possibility that the person undertaking the monitoring gets desensitised, monitoring occurs from the furthest/least odorous locations first and then progress towards the nearer/more odorous locations. ■ All records of odour monitoring are retained as a database of odour performance on site.	
Construction phase: Operation of equipment/machinery and/or light vehicles, clearing works, etc.	Noise	Day average noise levels: ■ L_{A1}- 37 dBA ■ L_{A10}- 34 dBA ■ L_{Amax}- 40 dBA ■ L_{A1}- 48 dBA ■ L_{A10}- 42 dBA ■ L_{Amax}- 53 dBA ■ L_{A1}- 39 dBA ■ L_{A10}- 35 dBA ■ L_{Amax}- 42 dBA	Controls: ■ The landfill site is located 1.9 km from the nearest sensitive receptor (residence) and the intervening landform and vegetation provides an additional buffer minimising the risk of noise impacting the amenity of the surrounding environment. ■ Compliance with relevant sections of the *Environmental Protection Act 1986* and the *Environmental Protection (Noise) Regulations 1997*. ■ Identify and manage the operating hours of noise intensive machinery. ■ Restrict construction work hours in accordance with those listed in the *Environmental Protection (Noise) Regulations 1997* (EPNR). ■ Implement buffer zones or bund walls to provide acoustic screening where predicted noise impact would be above the guideline thresholds. ■ Train staff in the effective operation of plant and equipment. ■ Maintain equipment and its noise control instruments as per manufacturer's recommendations. ■ Maintain and display appropriate signage with a contact number to call in the event of a complaint from	Controls: ■ Compliance with relevant sections of the *Environmental Protection Act 1986* and the *Environmental Protection (Noise) Regulations 1997*. ■ Identify and manage the operating hours of noise intensive machinery. ■ Restrict operational work hours in accordance with those listed in the *Environmental Protection (Noise) Regulations 1997*. ■ Implement buffer zones or bund walls to provide acoustic screening where predicted noise impact would be above the guideline thresholds. ■ Train staff in the effective operation of plant and equipment. ■ Maintain equipment and its noise control instruments as per manufacturer's recommendations. ■ Maintain and display appropriate signage with a contact number to call in the event of a complaint from a member of the public. AH will record any complaints received; including the date, nature and outcome. ■ Investigate and respond to noise complaints in accordance with a project specific Investigation Procedure. Following complaints, the source of excessive noise and work practices may be modified or rescheduled to reduce or eliminate the risk of future events. ■ Onsite personnel will wear appropriate hearing protection if in close proximity to machinery for extended periods. ■ Enforce speed restrictions on the internal access roads. (60 km/h between Great Southern Highway and the right-angled turn in the access road and 40 km/h everywhere else) ■ Fit all heavy machinery and mechanical plant used on-site with acoustic panels and mufflers (exhaust silencers). ■ Regularly service all mobile plant and exhaust mufflers used onsite.	3060 Talbot West Road, Mount Observation Picnic Area 2974 Great Southern Highway, St Ronans 3462 Great Southern Highway, St Ronans
Operational phase Equipment and light vehicles, loading and unloading of materials, covering works, etc. (7 am – 7 pm)		Day average noise levels: ■ L_{A1}- No data ■ L_{A10}- 34 dBA ■ L_{Amax}- 40 dBA ■ L_{A1}- 47 dBA ■ L_{A10}- 41 dBA ■ L_{Amax}- 52 dBA ■ L_{A1}- 39 dBA ■ L_{A10}- 36 dBA			3060 Talbot West Road, Mount Observation Picnic Area 2974 Great Southern Highway, St Ronans 3462 Great Southern Highway, St Ronans

Source of Emission or Discharge	Emission or Discharge Type	Volume and Frequency	Proposed Design and Construction Controls	Proposed Operational Controls	Location
		■ L_{Amax}- 43 dBA	a member of the public. AH will record any complaints received; including the date, nature and outcome. ■ Investigate and respond to noise complaints in accordance with a project specific Investigation Procedure. Following complaints, the source of excessive noise and work practices may be modified or rescheduled to reduce or eliminate the risk of future events. ■ Onsite personnel will wear appropriate hearing protection if in close proximity to machinery for extended periods. ■ Enforce speed restrictions on the internal access roads. (60 km/h between Great Southern Highway and the right-angled turn in the access road and 40 km/h everywhere else) ■ Fit all heavy machinery and mechanical plant used on-site with acoustic panels and mufflers (exhaust silencers). ■ Regularly service all mobile plant and exhaust mufflers used onsite. ■ If noise from reversing beacons is identified as a problematic source, the reversing beacons are to be modified to reduce the noise volume or replaced with low frequency beepers/croakers that emit lower noise levels, but still comply with the necessary safety regulations.	■ If noise from reversing beacons is identified as a problematic source, the reversing beacons are to be modified to reduce the noise volume or replaced with low frequency beepers/croakers that emit lower noise levels, but still comply with the necessary safety regulations. Monitoring: ■ Noise monitoring will be undertaken once during the first three months of the operational phase of the facility. The objective of the monitoring event will be to confirm that the site is fully compliant with the ENPR and the monitoring events will be carried out in accordance with AS/NZS 1269.1:2005 Occupational noise management Part 1: Measurement and assessment of noise emission and exposure. ■ Additionally, the facility will maintain a comprehensive complaints register, which is to be used as a gauge of success with regards to noise emissions management. ■ In the event that there is a noise emission issue identified, further formal acoustics monitoring is to be undertaken by an independent third party to determine the extent of the problem and to propose appropriate improved noise management solutions.	
Landfill/landfill gas	Landfill gas	Landfill stage: Modelled output after first year of operation: ■ 32 m^3/hr (50^{th} percentile) ■ 36 m^3/hr (90^{th} percentile) Modelled output (max occurring 2041): ■ 1 548 m^3/hr (50^{th} percentile) ■ 1 661 m^3/hr (90^{th} percentile)	Controls: ■ Design and install an efficient landfill gas extraction and flare system to minimise landfill gas emissions to the environment. ■ Engage a specialist landfill gas contractor to design, install, manage and operate the extraction system. ■ Install the vertical wells at a spacing of 40 to 50 m to ensure that there is a comprehensive coverage of the waste mass. In some areas this spacing will likely be reduced to improve extraction ability. ■ Pipe the gas extraction wells to the gas management system (likely a flare) in the allocated landfill gas infrastructure location. There will be a condensate return pipe from the gas management infrastructure back into the landfill and connected into the leachate collection aggregate layer and/or adjacent waste mass. ■ Install the gas extraction wells, connecting pipes and condensate return pipes before the lined capping layer has been constructed so that there will be minimal penetrations through the capping layer. Where required, penetrations will all be located as close to the edge of the landfill as is reasonably possible. ■ Install a perimeter landfill gas manifold around the edge of the landfill to act as the main collector of gas running to the flare. All of the extraction wells will be connected to this manifold. ■ To reduce the possibility of oxygen intake, there will be no gas extraction (drilled pipes) within 5 m of the sides of the waste mass or final waste profile and no gas well drilling closer than 5 m from the base and side slopes.	Controls: ■ Operate an efficient landfill gas extraction and flare system to minimise landfill gas emissions to the environment in accordance with Alkina (2017a), the operating licence and Landfill Gas Management Plan. ■ Engage a specialist landfill gas contractor to manage and operate the extraction system. Monitoring: ■ The landfill gas contractor will undertake regular monitoring of the performance of the gas extraction and destruction system. The extent of monitoring will depend on the type of systems that the contractor installs. As a minimum, the following monitoring will be anticipated: ▪ Flare operation ▪ Gas flow rate ▪ Oxygen content ▪ Methane content ▪ Moisture content, ▪ Temperature. ■ The monitoring locations and frequency will be determined by the landfill gas contractor. ■ As determined by a landfill gas risk assessment of the site, there will be no external gas monitoring wells installed. ■ All monitoring of landfill gas emissions will occur on the landfill areas. The following minimum locations will be monitored for fugitive emissions: ▪ Landfill surface final cap – random monitoring around the capped surface ▪ Around penetrations through the capped surface ▪ Landfill surface intermediate cover area – random monitoring around the covered surface ▪ Around penetrations through the covered surface ▪ At the landfill gas flare. ■ The monitoring frequency is as stipulated in the facility operating Licence.	Landfill footprint (Cells 1 & 2)

Source of Emission or Discharge	Emission or Discharge Type	Volume and Frequency	Proposed Design and Construction Controls	Proposed Operational Controls	Location
Decomposing waste material	Leachate	■ Year 1-2: Total leachate generation volume of approx. 1500 m^3 ■ Year 4-5: Total leachate generation volume of approx. 1750 m^3	Controls: ■ Design and install a leachate collection system that will form part of the leachate management system for the GSL. The leachate collection system: ▪ Will intercept vertical and lateral leachate seepage occurring through the waste via a subsoil drainage system. ▪ Has three solid leachate header pipes in Cell 1 that penetrate the cell division bund on the north-east to allow for the extension of the leachate collection system during the construction of the proposed Cell 4, Cell 6 and Cell 7. ▪ Has two solid leachate header pipes in Cell 2, to later connect with Cell 3 and Cell 5. ▪ Has a Leachate Collection Sump located at the lowest elevation point within Cell 1 and Cell 2. The leachate collected at this sump will be emptied via pumping to the Leachate Pond. The leachate collection sumps assist with the requirement of maintaining the leachate levels within the landfill base to a maximum of 300 mm above the landfill liner, in accordance with the Vic BPEM recommendation. ▪ Is designed in general accordance with Vic BPEM. ■ Design and install a lined leachate pond to store leachate pumped from the leachate collection sump. ■ Develop a leachate management plan for the leachate pond prior to operation to capture the management strategy for the ponds. ■ Should the capacity of the leachate pond be exceeded, the retention pond can be used to contain leachate, for short periods not exceeding two weeks, as the liner systems for both ponds are similar. This would require the temporary placement of a pump and pipe to transfer leachate from the leachate pond to the retention pond. ■ More information on the design and construction of the leachate management system is provided in Golder (2017b) and Golder (2017c) respectively. ■ Design and install a geosynthetic liner system in Cells 1 and 2 (which will be receiving putrescible waste) and the leachate drainage layer is formed by aggregate and covered by a separation geotextile in accordance with Golder (2017b) and Golder (2017c). ■ Design and install a retention pond to receive water from the subsurface drainage system via pumping in accordance with Golder (2017b) and Golder (2017c).	Controls: ■ Operate and maintain the leachate collection system in accordance with Golder (2017b) and Golder (2017c). ■ Progressively pump and remove leachate from the sumps to an on-site leachate storage pond where collected leachate can then be managed passively through evaporation losses (or enhanced evaporative options). ■ Recirculate leachate into the landfill where excess leachate generation occurs (above the design capacity of the leachate management system) or, as an emergency measure, transferred off site for treatment at a licenced treatment facility. ■ Implement the leachate management plan for the leachate pond. ■ Should the capacity of the leachate pond be exceeded, use the retention pond to contain leachate for short periods not exceeding two weeks, as the liner systems for both ponds are similar. This would require the temporary placement of a pump and pipe to transfer leachate from the leachate pond to the retention pond. ■ Operate and maintain the geosynthetic liner system in Cells 1 and 2, leachate pond and retention pond in accordance with Golder (2017b), Golder (2017c) Alkina (2017a) and the operational Licence. ■ Implement the leachate management plan. ■ Minimum 500 mm freeboard to all leachate evaporation ponds. ■ Leachate contingency measures are summarised in (Alkina, 2017a). Monitoring: ■ Monitor leachate generation rates as the site develops to ensure that sufficient leachate storage capacity is available and that the leachate management strategy remains robust and effective over the life of the landfill. ■ To adequately gauge the leachate performance across the site, the following monitoring is undertaken: ▪ Depth of leachate in the leachate sump(s) – initially measured weekly, at the beginning and end of the day of measurement. This may be pushed out to monthly measurement if the monitoring indicates that the pump float valve system is adequately able to maintain the head of leachate at less than the maximum 300 mm above the landfill liner. ▪ Volume of leachate pumped out of the leachate sump(s) – measured continuously via a flow meter, but recorded weekly. ▪ Depth of leachate in the evaporation pond – measured monthly. ▪ Minimum pond freeboard calculated based on the monthly depth readings. ▪ Volume of leachate pumped into the leachate pond – measured continuously via a flow meter, but recorded weekly. ▪ Volume of leachate pumped out of the leachate pond – measured continuously via a flow meter, but recorded weekly. ▪ Quality of leachate in the sump – sampled as stipulated in the facility operating license. ■ Monitor the efficiency of the automated leachate extraction system to maintain the head of leachate on the liner to a maximum of 300 mm by measuring the depth of leachate in the leachate sump utilising an electronic measuring device inserted through one of the two spare leachate extraction pipes. Ideally this measurement is taken at the beginning of the day, before the automated system is switched on and then again at the end of the day. ■ After a short time of facility operations (provided that there is leachate to be pumped and measured), it is likely that the pump cycling capacity and the impact on the depth of leachate in the sump will become known and hence there is no need to regularly monitor the leachate depth in the leachate sump. In these circumstances, the sump is only to be measured and recorded on a monthly basis. ■ The leachate sump headworks also include a flow meter, which is used to monitor the quantity of leachate being pumped from the sump. This gives the facility operators data on the annual leachate quantity being generated within the landfill and also, by taking the readings on a weekly basis, confirms that the leachate pump is working.	Landfill Footprint (Cells 1 & 2)

Source of Emission or Discharge	Emission or Discharge Type	Volume and Frequency	Proposed Design and Construction Controls	Proposed Operational Controls	Location
Seepage of recycled leachate from the landfill cells and/or leachate pond/ retention pond.	Deterioration/contamination of groundwater quality	Undetermined – based on an actual occurrence (which is unlikely).	Controls: ■ Design and install a leachate collection system in accordance with Vic BPEM, Golder (2017b) and Golder (2017c). ■ Design and install a Geosynthetic liner system consisting of a geosynthetic clay liner (GCL) to be placed over the compacted subgrade base, followed by a 2 mm thick HDPE geomembrane and then a Cushion Geotextile. The leachate drainage layer is formed by aggregate and covered by a separation geotextile. ■ Design and install a Subsurface Drainage System consisting of a network of perforated pipes within a free draining seepage interception trench, located below the embankment toe under GSL cells to: ▪ Reduce the impacts of phreatic surface mounding beneath the cell floor. ▪ Prevent the pressurisation of the basal liner system from below. ▪ Reduce the accumulation of pore pressures in the embankment fill. ■ Develop a site specific water management plan which will describe: ▪ The maintenance and operation of the recycled leachate management infrastructure. ▪ The performance benchmarks for the recycled leachate pond. ▪ The appropriate escalation procedures for equipment malfunction, recycled leachate release, recycled leachate pond overfilling and extreme weather events. ▪ A groundwater monitoring program. ▪ A contingency plan should groundwater monitoring indicate evidence of potential contamination. ■ Position the landfill to take advantage of the clayey soil layer which acts as an additional level of protection for the groundwater system.	Controls: ■ Operate and maintain the leachate management system, geosynthetic liner system and subsurface drainage system in accordance with Golder (2017b), Golder (2017c), Alkina (2017a) and the operating License. ■ Manage recycled leachate through a hierarchy of minimising generation and effective capture, storage and removal. ■ Maintain recycled leachate head on the landfill liner at a maximum of 300 mm in accordance with the Vic-BPEM guidelines, industry practice and typical landfill licensing conditions. ■ Pump the collected recycled leachate into the recycled leachate pond for storage and evaporation. ■ Implement the site specific water management plan. Monitoring: ■ Engage a specialist contractor to conduct groundwater monitoring. ■ Groundwater monitoring conducted by a specialist contractor in accordance with conditions stipulated in the operating License. ■ Monitor and review subsoil drainage water management and storage requirements throughout the operation of the landfill facility. Additional retention pond storage capacity or variations to the water management plan will be carried out, if necessary, based on an analysis of the recorded data. ■ Monitor discharge water from the retention pond on an as needs basis.	Ground surrounding the landfill cells and/or leachate pond.

Source of Emission or Discharge	Emission or Discharge Type	Volume and Frequency	Proposed Design and Construction Controls	Proposed Operational Controls	Location
Overtopping of leachate and retention ponds/landfill cells.	Deterioration/contamination of groundwater and/or surface water quality.	Undetermined – based on an actual occurrence (which is unlikely).	Controls: ■ Design and install a leachate collection system that will form part of the leachate management system for the GSL in accordance with Golder (2017b) and Golder (2017c). ■ Design and install a lined leachate pond to store leachate pumped from the leachate collection sump in accordance with Golder (2017b) and Golder (2017c). ■ Develop a leachate management plan for the leachate pond prior to operation to capture the management strategy for the ponds. ■ Should the capacity of the leachate pond be exceeded, the retention pond can be used to contain leachate, for short periods not exceeding two weeks, as the liner systems for both ponds are similar. This would require the temporary placement of a pump and pipe to transfer leachate from the leachate pond to the retention pond. ■ More information on the design and construction of the leachate management system is provided in Golder (2017b) and Golder (2017c) respectively. ■ Design and install a retention pond to receive water from the subsurface drainage system via pumping. ■ Design and construct stormwater diversion bunds around the perimeter of the leachate pond to provide the target storage capacity, with stormwater diversion bunds on the upstream of the pond to minimise the amount of clean stormwater entering the pond. ■ Develop a site specific water management plan which will describe: ▪ The maintenance and operation of the recycled leachate management infrastructure. ▪ The performance benchmarks for the recycled leachate pond. ▪ The appropriate escalation procedures for equipment malfunction, recycled leachate release, recycled leachate pond overfilling and extreme weather events. ▪ A groundwater monitoring program. ▪ A contingency plan should groundwater monitoring indicate evidence of potential contamination. ■ Development of an operating strategy prior to the start of operations to provide framework for data collection and reporting.	Controls: ■ Operate and maintain the leachate management system in accordance with Golder (2017b),Golder (2017c), Alkina (2017a) and the operating License. ■ Implement the site specific water management plan. ■ Implement the leachate management plan for the leachate pond. ■ Manage recycled leachate through a hierarchy of minimising generation and effective capture, storage and removal. ■ Recirculate leachate into the landfill where excess leachate generation occurs (above the design capacity of the leachate management system) or, as an emergency measure, transferred off site for treatment at a licenced treatment facility. ■ Maintain recycled leachate head on the landfill liner at a maximum of 300 mm in accordance with the Vic-BPEM guidelines, industry practice and typical landfill licensing conditions. ■ Progressively pump and remove leachate from the sumps to an on-site leachate storage pond where collected leachate can then be managed passively through evaporation losses (or enhanced evaporative options). ■ Maintain a minimum500 mm freeboard to all leachate evaporation ponds to help prevent overtopping. ■ Minimum 1 m high perimeter bund surrounding the landfill to separate it from surface water. ■ At the interface between the active landfill area (flowing into the landfill) and the intermediate capped area (flowing out of the landfill), there is a minimum of a 500 mm earthen bund installed along the edge to prevent any accidental surface water runoff from the active landfill area flowing down the intermediate capped area and off the landfill. ■ Should the capacity of the leachate pond be exceeded, use the retention pond to contain leachate for short periods not exceeding two weeks, as the liner systems for both ponds are similar. This would require the temporary placement of a pump and pipe to transfer leachate from the leachate pond to the retention pond. Monitoring: ■ Routine inspections to monitor water level. ■ Monitor leachate generation rates as the site develops to ensure that sufficient leachate storage capacity is available and that the leachate management strategy remains robust and effective over the life of the landfill.	Leachate ponds/rentier ponds/ surface water.

Source of Emission or Discharge	Emission or Discharge Type	Volume and Frequency	Proposed Design and Construction Controls	Proposed Operational Controls	Location
Rainfall	Stormwater and sediment runoff to groundwater/ surface water.	Undetermined – based on an actual occurrence (water balance modelling has been conducted to design management infrastructure.	Controls: ■ Design and construct a Stormwater dam to store the stormwater runoff from an upstream catchment area of 200 ha in accordance with Golder (2017b) and Golder (2017c). ■ Design and install sediment management options onsite in accordance with Golder (2017b) and Golder (2017c) including: ▪ Sediment fences (temporary, constructed as required). ▪ Rock or sandbag check dams (temporary, constructed as required). ▪ Sediment structure: – Located downstream of the stormwater dam and upstream of the inflow confluence to Thirteen Mile Brook to minimise the release of sediment eroding from the landfill site to the downstream environment. – Designed to allow the bypass of extreme flood events.) – Designed to capture sediments that escape from the other sediment capturing systems on the site and prevent sediment from entering the Thirteen Mile Brook. ■ Design and install stormwater diversion drains to serve as the principal stormwater conveyance and surface runoff management system for the landfill site in accordance with Golder (2017b) and Golder (2017c). ■ Design and install stormwater diversion bunds to divert clean stormwater runoff away from the Cells, Leachate Pond and Retention Ponds.	Controls: ■ Operate and maintain the following infrastructure in accordance with Golder (2017b), Golder (2017c) and the operating License. ▪ Stormwater dam ▪ Sediment management options ▪ Stormwater diversion drains ▪ Stormwater diversion bunds. Monitoring: ■ Monitor the diversion drains to: ▪ Assess condition and efficiency ▪ Ensure drain is not filled with sediment ▪ Assess erosion in the invert of the drains. ■ Monitor the surface water drainage systems and capped surfaces and as a minimum, conduct a comprehensive inspection before the onset of winter rains and after extreme rain events. ■ Sample and analyse the surface water storage dam every six months (as a minimum) to ascertain the effectiveness of the surface water management system. ■ Measure surface runoff from the upstream catchment and variations in water storage within the stormwater dam to better quantify the potential yield of the catchment. ■ Monitor the surface water bodies around the site to assess and validate the reliability and effectiveness of the stormwater management system. ■ Continuously monitor flow and water level. ■ Conduct monthly and quarterly surface water monitoring and sampling of Thirteen Mile Brook.	Throughout the site

Source of Emission or Discharge	Emission or Discharge Type	Volume and Frequency	Proposed Design and Construction Controls	Proposed Operational Controls	Location
Construction activities including clearing, excavations, loading/ unloading of materials, stockpiling, grading works, wind, vehicle operations etc.	Dust emissions	Daily – volume based on a case-by-case basis.	Controls: ■ Water down unsealed trafficable areas at the commencement of each working day. ■ Using water trucks to supress dust on exposed stockpiles when required and maintaining a water supply on site for this purpose. ■ Where possible, delay activities that have a high potential for dust generation (excavation, unloading of material etc.) during adverse weather conditions where strong winds are blowing towards the nearby receptor to the north-east. ■ Limit the speed on the facility access road to 60 km/h and internal haul roads to 20 km/h ■ Cover all trucks entering and leaving to prevent windblown emissions. ■ Utilisation of a wheel wash for all trucks leaving the site. ■ Seal the landfill entry road from Great Southern Highway to the landfill site with bitumen. ■ Minimising the extent of clearing required for construction of infrastructure as far as is practicable. Monitoring: ■ Dust emissions are visually monitored on a continuous basis by site operations staff. ■ Physical monitoring of dust levels at four locations on the property will be undertaken. These locations will be at the property boundary in the direct line between the three closest receptors and the site and adjacent to the site infrastructure area. ■ The site will have equipment to monitor wind direction and temperature. A windsock will be installed on site to	Controls: ■ Water down unsealed trafficable areas at the commencement of each working day. ■ Using water trucks to supress dust on exposed stockpiles when required and maintaining a water supply on site for this purpose. ■ Deliveries containing dry and/or dusty materials will be wetted down during the waste placement process. ■ Limit the speed on the facility access road to 60 km/h and internal haul roads to 20 km/h. ■ Reducing dump heights to a maximum of 3 m wherever possible. ■ Cover all trucks entering and leaving to prevent windblown emissions. ■ Remove vehicle covers in the vicinity of the tipping face of the active cell only. ■ Maintain a comprehensive complaints register to gauge of success of management of dust emissions. Monitoring: ■ Day to day monitoring of dust will be conducted by visual means. ■ Physical monitoring of dust levels at four locations on the property will be undertaken monthly. These locations will be at the property boundary in the direct line between the three closest receptors and the site and adjacent to the site infrastructure area.	Entire site.

Source of Emission or Discharge	Emission or Discharge Type	Volume and Frequency	Proposed Design and Construction Controls	Proposed Operational Controls	Location
Operational activities including tipping, loading/unloading of materials, grading works, wind, vehicle operations etc.			indicate the wind direction and approximate wind strength. High wind speeds will be determined by the windsock's angle relative to the mounting pole and via the use of hand held anemometers. ■ Records such as date, time, wind patterns and atmospheric temperature will be kept regarding dust generation due to cultivation, harvesting, fire and other noticeable contributors to dust generation around the site. ■ The performance of the proposed dust suppression measures will be assessed by monitoring physical and visible dust arising from within the site. The list of monitoring measures proposed for the assessing performance is shown in Table 4 of the Site Management Plan (Alkina, 2017a). ■ The first trigger level to action dust management measures will be generation of visual dust. ■ The second trigger level, and cause for the facility to cease its activities, is when strong winds are forecast by the Bureau of Meteorology (in the range of 26 to 33 knots). Work will be reduced in the presence of strong winds and low humidity until a time when conditions become more favourable. If any dust is observed leaving the property boundary then work will cease immediately, the cause thereof will be investigated and actions will be taken to resolve the problem before regular site activity recommences.		Operating landfill cell, unsealed access roads, capped areas.

Source of Emission or Discharge	Emission or Discharge Type	Volume and Frequency	Proposed Design and Construction Controls	Proposed Operational Controls	Location
Active tipping face	Windblown litter within the site and/or beyond the landfill boundary	Undetermined – on a case-by-case basis.	Controls: ■ The landfill site is located 1.9 km from the nearest sensitive receptor (residence) and the intervening landform and vegetation provides an additional buffer minimising the risk of litter impacting the amenity of the surrounding environment. ■ Develop a Waste Acceptance Manual for the landfill. ■ Construct a 1.8 m high fence around the site perimeter.	Controls: ■ Implement a Waste Acceptance Manual for the landfill. ■ Use enclosed/sealed trailers to transport waste. ■ Maintain the 1.8 m high fence around the site perimeter. ■ Erect portable litter screens downwind of the active face. ■ Operate one active tipping face at any time. ■ Minimise the tipping face surface area. ■ Compact waste immediately following placement. ■ Water the active face on dry and windy days or as required. ■ Cover the active tipping area daily. ■ Promptly cover and cap completed cells. ■ All waste, including foodstuffs, shall be handled and disposed of in accordance with the relevant specification and applicable regulations. For example, separate labelled waste receptacles will be provided on site for temporary storage of waste types prior to removal for off-site reuse, recycling or disposal. Monitoring: ■ Conduct regular litter patrols around the active cell fence and site fence to collect windblown litter. ■ Maintain a complaints register. ■ Frequent inspections of the tipping face undertaken by the Site Manager. ■ Weekly inspection of the greater landfill site (within the Prescribed Boundary), Lot boundaries – beyond the site boundaries, including Great Southern Highway in the vicinity of the landfill entrance. ■ Monthly and periodic (following significant weather events) inspections to identify waste that has been washed away by stormwater or blown away from the tipping area. ■ Daily meteorological monitoring to assist with the planning and management of litter strategies. ■ Regular targeted inspections of the site boundary fences, specifically targeting ditches and access/haul roads. ■ Waste vehicle operators will be required to inspect their vehicles prior to leaving the site to ensure all doors are securely closed and no waste debris is left on the vehicle.	Entire site and surrounds.

7.0 REHABILITATION CONTROLS

7.1 Landform

The final landform at the top of waste for the site is shown in Figure 3. As landfill cells are completed it will be progressively capped to reduce infiltration and hence generation of leachate.

The objectives of the capping are as follows:

- Minimising infiltration of water into the waste, ensuring that the infiltration rate does not exceed the seepage rate through base of the landfill.
- Providing a long-term stable barrier between waste and the environment in order to protect human health and the environment.
- Preventing the uncontrolled escape of landfill gas.
- Providing land suitable for its intended after use.

The final capping design will be developed prior to commencing capping, but a conceptual capping system has been developed for the site, with the intent to achieve the above objectives. The conceptual capping detail is shown in Figure 4.

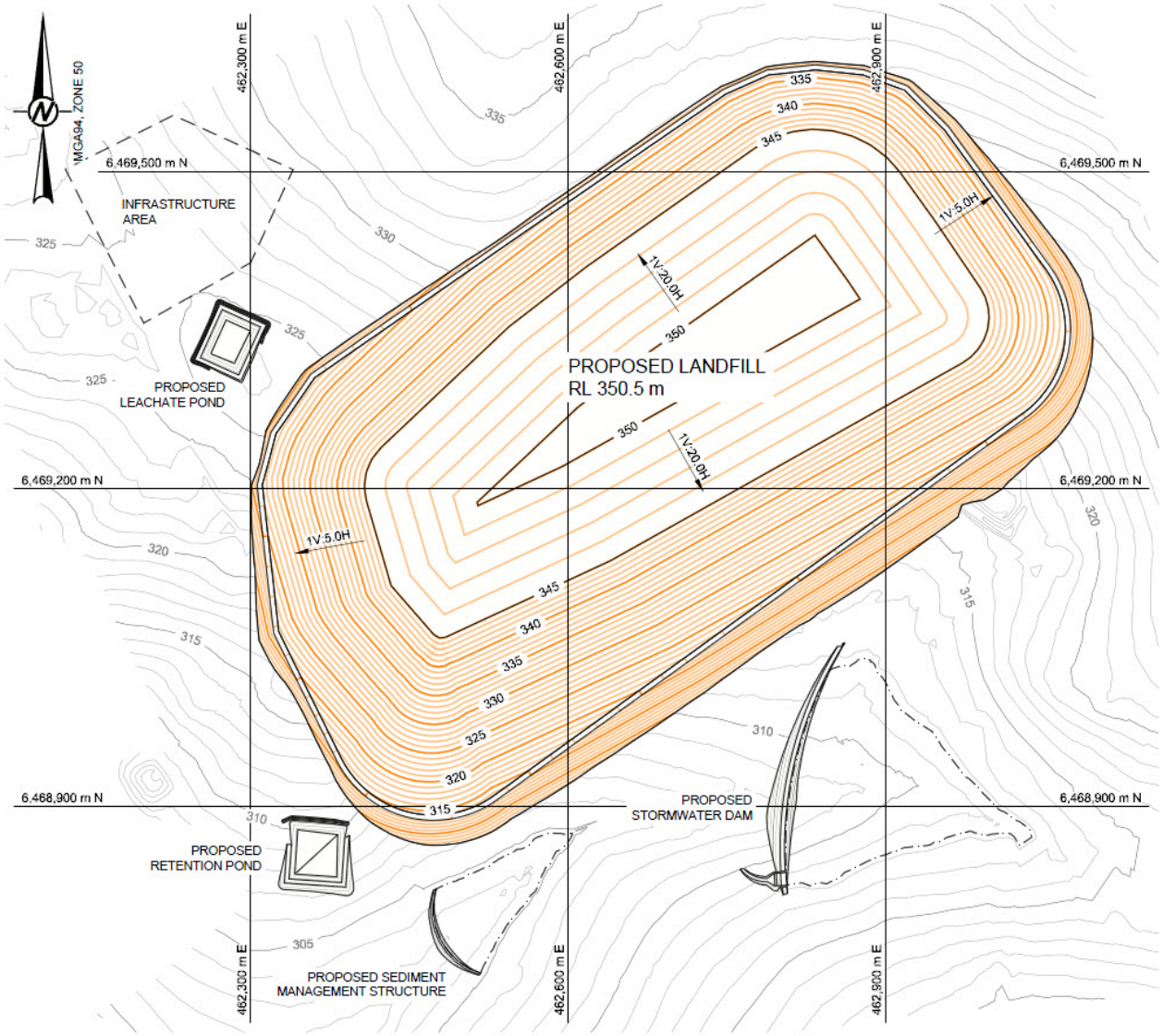

Figure 3: Final waste landform

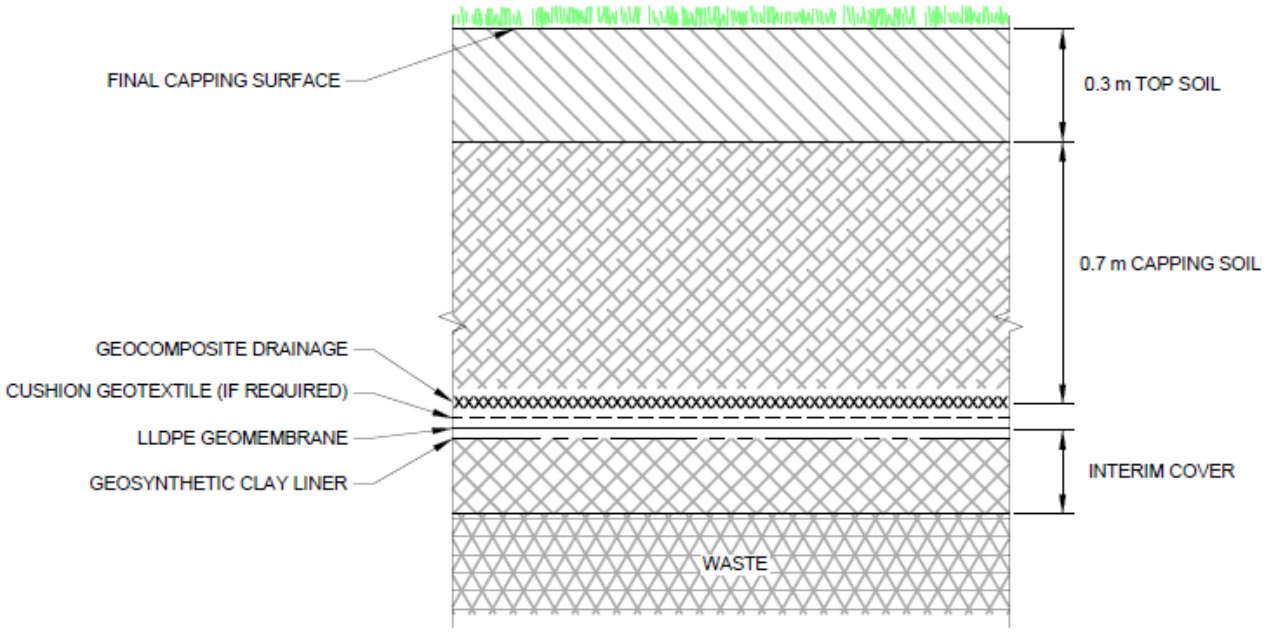

Figure 4: Conceptual final capping

7.2 Revegetation

For the minimisation of sedimentation post-closure, emphasis will be placed on re-vegetation of slopes and reinstatement of endemic soils to the surrounding area, as this will provide a more robust long-term mitigation measure than the continued reliance on control structures. The post-closure land use will be a return to grazing.

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