Risk Assessment

Closed Landfills Southern Grampians Shire

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Barwon South West Waste and Resource Recovery Group

Prepared by:

EHS Support

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Acronyms

AMP	Aftercare Management Plan
BPEM	best practice environmental measures
BSWWRRG	Barwon South West Waste and Resource Recovery Group
CSM	conceptual site model
EP Act	Environment Protection Act 1970
EPA	Environment Protection Authority
GED	general environmental duty
GW	groundwater
km	kilometres
LFG	landfill gas
m	metres
PC PAN	Post Closure Pollution Abatement Notice
PIW	prescribed industrial waste
RFQ	request for quotation

Executive Summary

EHS Support Pty Ltd ("EHS Support") was engaged during late August 2019 by the Barwon South West Waste and Resource Recovery Group (BSWWRRG) to undertake a risk assessment of a number of closed landfills within several municipalities across the Barwon South West region.

This project was funded by the Local Government Waste Forum's Local Government Program.

This report presents the findings of the risk assessment undertaken at seven (7) closed landfill sites within the Southern Grampians Shire. These sites are located in **Balmoral, Coleraine, Glenisla, Branxholme, Dunkeld** (2 sites)**,** and **Penshurst**.

The risk assessment of the seven Southern Grampians former landfill sites has found a differing level of risk associated with each of the sites, with one site (Coleraine) requiring consideration for rehabilitation in the short term. A summary of the risk ranking determined for each of the sites is presented as follows:

- Coleraine risk ranking (A): the site poses a risk and requires the development and implementation of a rehabilitation and aftercare management plan.
- Balmoral, Branxholme, and Dunkeld Old risk ranking (B): the sites pose a potentially significant risk and requires monitoring and development of an aftercare management plan.
- Dunkeld Tip and Penshurst risk ranking (C): the sites pose some risk and requires the development of an aftercare management plan.
- Glenisla risk ranking (D): the site poses limited risk but requires the near-term development of an aftercare management plan.

Details of specific recommendations are included within the Recommendations section of this report.

There is currently no aftercare management policy at Council and it is recommended that this policy be developed possibly by BSWWRRG to provide a uniform approach across the region. A component of this policy should include the development of aftercare management plans for each of the sites; regular inspections and contingency actions to address site issues.

It is recommended that Council maintains a register of all of the closed landfills within the Shire, and that an environmental audit overlay (or similar overlay such as an Environmental Significance Overlay), is applied across each of the sites. This will ensure that any future planning provisions for the sites and adjacent sites, have regards to the residual contaminated nature of each of the sites.

It is recommended that internal provisioning of adequate funds be maintained to address the management actions described above, and that this provisioning be periodically updated to account for any changed conditions, regulatory guidance, and/or developing needs at the sites.

It is recommended that BSWWRRG and Council engages with EPA to advise it of Council's aftercare management approach toward meeting the forthcoming General Environmental Duty obligation under the new Environment Protection Act which will come into effect in July 2020.

1 Introduction

EHS Support Pty Ltd ("EHS Support") was engaged during late August 2019 by the Barwon South West Waste and Resource Recovery Group (BSWWRRG) to undertake a risk assessment of a number of closed landfills within several municipalities across the Barwon South West region.

This project was funded by the Local Government Waste Forum's Local Government Program.

The request for quotation (RFQ) that was initially issued by BSWWRRG has guided the approach and scope of work undertaken by EHS Support.

This report presents the findings of the risk assessment undertaken at seven (7) closed landfill sites within the Southern Grampians Shire. These sites are located in **Balmoral, Coleraine, Glenisla, Branxholme, Dunkeld** (2 sites)**,** and **Penshurst**

A map showing the distribution of the assessed sites is presented in **Figure 1, attached** and aerial photographs of the site locations are provided in **Appendix C**.

2 Background

As noted in the RFQ, the BSWWRRG is a Statutory Authority established under Section 49C of the Environment Protection Act 1970 (EP Act). It is the link in the region between state and local governments, industry and the community for recycling and waste management. BSWWRRG is responsible for facilitating an integrated approach to regional waste planning and supporting the delivery of waste management and resource recovery services.

BSWWRRG is responsible for the Barwon South West region, which extends from Geelong in the east to the South Australian border and includes the councils of Queenscliff, Greater Geelong, Surf Coast, Colac Otway, Corangamite, Southern Grampians, Warrnambool, Moyne and Glenelg.

The Barwon South West Waste and Resource Recovery Implementation Plan was approved in July 2017. Priority action 8.2 of the Implementation Plan states that BSWWRRG will "liaise with councils and EPA regarding the development of strategies for closed landfills".

The overall project initiated by BSWWRRG has been undertaken in three separate stages, consisting of:

- Stage 1: identification of sites to be included in the study;
- Stage 2: initial basic risk assessment undertaken in accordance with EPA's Local Council Self-Assessment Tool for Closed Landfill Environmental Risk (Publication 1671); and
- Stage 3: further risk assessments on selected higher priority sites, based on the outcome of the Stage 1 and 2 works. The Stage 3 work is the subject of this report.

A total of 88 closed Council landfills were identified across the region as part of the Stage 1 work undertaken by BSWWRRG. Of these 88 former landfills, 32 landfills were not subject to the original screening level risk assessment, as the sites had already undergone (or were undergoing) a detailed risk assessment, were subject to an EPA regulatory notice, or were not accessible. In addition, one Council opted not to participate in the study, and therefore an additional seven sites were excluded from the study. This resulted in BSWWRRG undertaking investigations that have resulted in an initial cataloguing of closed landfills across the region, and an initial determination was made (by BSWWRRG), of the risk associated with 49 of these landfills. These 49 sites are located across seven municipalities. As an outcome of the basic risk assessment, BSWWRRG prioritised a number of the sites for risk management. It is noted that BSWWRRG has aimed to ensure that sites from all participating councils were addressed as a part of the further assessment in order to ensure the councils which contributed financially to the study were represented in the outcomes of the study.

The objectives defined by BSWWRRG for this assessment were to:

- Assist the councils to better understand the risks associated with closed landfills;
- Prioritise closed landfills for further action based on level of risk posed to the surrounding environment;
- Provide councils with recommended actions for managing and mitigating risks, including indicative costs for implementation; and
- Develop a schedule for future re-assessment of closed landfills, where required.

Based on the listing of the priority sites identified by BSWWRRG, EHS Support has undertaken an assessment of seven sites for the Stage 3 works within the Southern Grampians Shire Council.

3 Regulatory Setting

EPA Legislation, Policy and guidance in relation to the operation and management of landfills is currently contained in a number of specific documents, which have been developed as EPA's requirements evolved through regulatory reform, and noting that the management and regulation of landfills across Victoria varies widely. The key guidance documents relevant to closed landfills are summarised as follows:

- Publication 674 (November 1999), *Rehabilitation of Landfills Exempt from Licensing*. This document was developed for application at municipal landfills that served populations of less than 5000 people, and which were identified for closure under the respective regional waste management plan. Guidance is provided in relation to site capping (to minimise infiltration, and adequately shed water) and aftercare management, including periodic site inspection and record keeping. It is noted that the final landform should be compatible with proposed end uses of the site, or must blend in with the surrounding area.
- Waste Mana*gement Policy (Siting, Design and Management of Landfills*, No. S264, Gazette 14 December 2004): this Policy sets the overarching framework and objectives for how EPA regulates landfills. In relation to closed landfills, under Clause 16(4) the Policy states that once a licensed landfill site has closed, the Environment Protection Authority (EPA) will require, through a notice, the occupier of the site to undertake ongoing aftercare until such time as the site does not pose a risk to human health or the environment, as determined by the Authority. EPA has undertaken a program of issuing Pollution Abatement Notices on closed landfills, and has historically focussed on more recently closed landfills, or those landfills presenting the higher risk to the environment.
- Publication 788.3 (August 2015), *Siting, design, operation and rehabilitation of landfills*. This document sets out the best practice environmental measures (BPEM) that are to be taken into consideration of any works approvals or licensing of existing and new sites, as well as in the design and construction of landfill cells, and in the rehabilitation of landfills. An important component of the BPEM is the consideration of buffer distances between landfills and receptors - both from the perspective of the siting of new landfills, and also for development of land uses in proximity of landfills.

  Publication 788.3 also includes criteria for defining a 'Low Risk Rural Landfill', which is relevant for this study. Low Risk Rural Landfills are defined in this guideline as landfills which meet several criteria related to: buffer zones; low waste volumes; depth of landfill in relation to groundwater; quality of background groundwater; and financial assurance requirements. If a landfill qualifies as 'low risk rural landfill' under these guidelines, then a lesser standard of rehabilitation is required than otherwise stipulated in these guidelines.
- Publication 1323.3 (September 2016), *Landfill licensing*. This document provides guidance to assist landfill operators and EPA appointed environmental auditors with ongoing environmental management of landfills and with gaining EPA approval for construction of new landfill cells at existing landfills. It is understood that some of the landfills within the 33 assessed were formerly licensed by EPA.

- Publication 1490.1 (January 2018), *Closed Landfill Guidelines*. This document provides guidance to assist landfill operators with rehabilitation and aftercare management requirements for closed landfills. The overall aim of this guidance is to ensure that the occupier of a closed landfill site undertakes ongoing aftercare until such time that the site does not pose a risk to human health or the environment. Within this guidance document, it details EPA's regulatory approach to closed landfills. The document states that EPA will assess whether a closed landfill should receive a Post Closure Pollution Abatement Notice (PC PAN) or, in some cases, receive a reformed PC PAN to replace an existing notice. The decision is based on:
  - Information gathered using desktop assessments of monitoring data.
  - Environmental audits.
  - Inspection records or other data requested from the current or former site occupier.
  - EPA conducting its own monitoring or requiring an audit of the closed landfill under Section 53V of the Environment Protection Act 1970 (the 'EP Act').

  EPA will generally only apply the *Closed Landfill Guidelines* to landfills previously licensed by EPA, however the *Environment Protection Act (1970)* and the provisions of the new *Environment Protection Amendment Act 2018* include powers for EPA to issue Notices (or Orders under the new Act) on premises which pose a risk to the environment.

- Publication 1671 (February 2018), *Local Council Self-Assessment Tool for Closed Landfill Environmental Risk*. This self-assessment tool has been developed by EPA for Councils to use to identify and understand the risks associated with closed landfills in their municipalities. A key outcome of this self-assessment is to identify whether EPA should be engaged to discuss the management of risks where they are identified. It should also be noted that the self-assessment tool seeks to identify risk on the basis of site setting, and also the extent of existing management (including landfill gas and groundwater monitoring, and aftercare management) of the sites. While the absence of existing management may lead to a conclusion, through the use of this tool, of a higher priority site, it does not necessarily suggest the presence of an existing risk associated with a site.

  The assessments undertaken by BSWWRRG for the closed landfills in this study was conducted in accordance with Publication 1671. This resulted in a relative risk ranking which was used to identify the key 33 landfill sites which required a more detailed risk assessment.

- Publication 1596.2 (January 2019), Calculation of financial assurance for landfills, prescribed waste management (PIW) and container washing. This guideline provides information to assist duty holders in the calculation of the financial assurance required as a condition of a licence or a works approval for landfills, prescribed industrial waste (PIW) management, container washing and PIW composting scheduled activities. Under section 67B of the *Environment Protection Act 1970* (the current Act), EPA may require duty holders to provide financial assurance as a condition of a licence or works approval. EPA can also require a financial assurance under a Pollution Abatement Notice.

  For public entities (such as local Councils) EPA will accept financial provisioning as a form of financial assurance. Financial provisioning is required to be reported within the entities financial statements. These financial statements must comply with the relevant accounting and financial reporting standards relating to accounting for landfill liabilities. Further guidance is provided Local Government Victoria guideline "Accounting for Landfills", which sets out principles-based guidance to assist councils to comply with the accounting standard and financial reporting requirements applicable to the costs of landfilling.

  Although EPA may not specifically require Financial Assurances for closed landfills which were not previously licensed (unless it is causing pollution and EPA issue a Notice), it is prudent for Councils to provision for future costs associated with closed landfills within their financial statements.

EPA also notes that it "*will continue to assess the risk of old closed landfills to determine if any additional works are required to minimise risk to human health and the environment. Where further works are required to be undertaken, a Post Closure Pollution Abatement Notice (PC PAN) will be issued to ensure that the works are undertaken. EPA regional staff are aware of landfills below the licensing threshold in their regions and may inspect these sites at any time. EPA only issues PC PANs to formerly licensed sites. Field staff will only issue a Pollution Abatement Notice if there is pollution occurring at the site.*" (https://ref.epa.vic.gov.au/your-environment/waste/landfills/victorian-landfill-register#Management).

EPA is currently (at the time of preparation of this report) updating its existing policies and guidance in line with the *Environment Protection Amendment Act 2018* (the Act), that has passed Parliament. The Act will come into force in July 2020, and EHS Support understands that EPA is aiming to consolidate guidance related to landfills into a single compliance code. While it is not expected that there may be significant changes to this guidance, it is noted that a key reform associated with the Act is the introduction of the general environmental duty (GED). The GED will focus all Victorians on preventing harm, and will require *people to undertake reasonably practicable steps to eliminate, or otherwise reduce risks of harm to human health and the environment from pollution and waste.*

Another new key provision of the Act is in relation to the Duty to Notify under Section 32. The Duty to Notify includes definitions and thresholds of what constitutes *notifiable contamination* under Section 37 of the Act (i.e. in which circumstances a person must notify EPA of contamination). Under the previous Environment Protection Act (1970), there was no duty to notify EPA of contamination, except in very limited prescribed circumstances, therefore this new provision may be relevant to these former landfills, in circumstances where the thresholds and definitions of notifiable contamination are met.

4 Assessment Approach

The assessment has included the following stages:

- Review of the findings of BSWWRRG's application of the Local Council Self-Assessment Tool. This review was undertaken to assist in prioritisation of site inspections. A review of these previous findings was also used as the basis for discussion with BSWWRRG regarding its objectives for risk management of closed landfills in the region.
- Visits to each of the nominated sites was undertaken to obtain a firsthand understanding of the site settings, and to enable formulation of conceptual site models (CSMs) to support the risk assessment process. The CSMs considered the nature of each closed landfill including: surface integrity and landform; site environmental setting; proximity of sensitive receptors; and surrounding land uses. A generalised schematic description of the contaminant-pathway-receptor model associated with this approach is presented in **Appendix A**.
- During each site visit a photographic record and site observations were documented using a geo-referenced tablet-based form for subsequent use. The relevant photos notes are included in **Appendix C**.
- Gathering of information as required (beyond that already compiled by BSWWRRG as part of the self-assessment process) using the Visualising Victoria's Groundwater database (https://www.vvg.org.au/vvg_map.php) and the Victoria Unearthed database (https://www.environment.vic.gov.au/sustainability/victoria-unearthed).
- A desk-top assessment of the relative risk to the environment associated with each site based on the findings of the site visits and consideration of the initial assessment by BSWWRRG. Further discussion of the risk assessment approach is presented in **Section 5** below.
- Identification of site management requirements, with consideration of the outcomes of the risk assessment and also regulatory guidance. The assessment of site management requirements was also aimed at identifying sites requiring "immediate action" for priority focus by councils.
- Estimation of indicative costs of implementation of the identified site management recommendations.

5 Risk Assessment

The risk assessment of each of the sites was undertaken using a likelihood-consequence analysis approach as detailed in the EPA Publication 1321.2, *Licence Assessment Guidelines*. While noting the subjective nature of the approach, it was aimed to allow ranking of the sites for subsequent prioritisation and scheduling of site management actions.

Details of the developed likelihood-consequence criteria for this project are included in **Appendix B** at the end of this report.

The risk assessment approach also had regard to the various EPA guidance described in **Section 4**. On this basis, the primary focus of the assessment of each site was the consideration of risks posed to the surrounding environment by landfill gas (if any) and impacts to groundwater and surface water. Consideration was also given to the condition of each site, with respect to the landfill capping and associated risks (exposed waste, weeds, vermin, slope stability, etc), and also site security.

Based on the adopted risk assessment approach, each site was categorised by one of the following risk profiles:

- (A): site poses a significant risk and requires the development and implementation of a rehabilitation and aftercare management plan.
- (B): site poses a potentially significant risk and requires monitoring and development of an aftercare management plan – including potential rehabilitation.
- (C): site poses some risk and requires the development of an aftercare management plan.
- (D): site poses limited risk but requires the near-term development of an aftercare management plan.

For council planning considerations, the risk posed to potential land use and development was also generally addressed. In this regard, it is noted that closed landfills are considered to be contaminated sites – with associated regulatory requirements. The implications of this to councils was also considered as part of the risk assessment process.

6 Assessment Findings

6.1 Site Observations

The site visits were undertaken by EHS Support on 10 and 11 September 2019, in the company of Rod Van de Hoef (Southern Grampians Shire Council).

The field notes from the visits to each of the seven sites are included in **Appendix C**. Representative photographs of the site conditions, and of surrounding land use, were taken during the site visits and are also included in the field notes.

Aerial images of the sites were provided by Council subsequent to the time of the site visits. Copies of these images are also included in **Appendix C**.

Site-specific observations are noted further in the following sections.

6.2 Conceptual Site Models and Risk Profiles

The conceptual site models (CSMs) and risk profiles for each of the sites are described in the following sections. A generic CSM is presented in **Appendix A**, which shows the typical cross section of a closed landfill, inclusive of potential pathways for contaminant movement which may impact on the receiving environment.

6.2.1 Balmoral

The Balmoral site is located off Horsham Road approximately 500m north of Balmoral township. An access road leads to the site. It is located within a rural setting - with paddocks adjacent to the north, west, south and east of the site. The site is bordered by stands of trees. The nearest residential properties are located 400m to the west and northwest of the site.

The site is situated within gently undulating topography, with the land to the east consisting of low-lying floodplain. It is understood that original landfilling consisted of trench and fill, and which was subsequently covered. The site itself is undulating with elevated mounds within the southern portion.

The site was reportedly closed in the 1990s.

The site is currently used as a transfer station with a number of recycling bins located near the site entrance and that are used by local residents for waste separation.

There is a considerable amount of uncovered inert waste within the southern portion of the site. It is presumed that this waste has been deposited at the site subsequent to the closure of the former landfill, and since operation of the site as a transfer station.

The site is fenced with access restricted to limited times.

A summary of the site geology and hydrogeology and receptors (within 500m of the site) is presented in **Table 6-1** below:

Table 6-1 Hydrogeology and Receptors – Balmoral

Geology	Depth to Groundwater	Groundwater Category	Groundwater Usage in Proximity (<500m)	Other Receptors
Formation consisting of sand overlying sandstone	10-20m	C – potentially suitable for agriculture use (stockwatering)	No bores in proximity of site	Mathers Creek located 200m south of the site, and Glenelg River located 250m east of the site. Unnamed tributary of Glenelg River located 150m north of site. Residences located approximately 250m northwest of the site, with Balmoral township 500m to the south.

Table 6-2 below describes the risk aspects and associated considerations that have been incorporated for the Balmoral site as part of the likelihood-consequence risk assessment of the site, and the identification of a risk profile for the site.

Table 6-2 Risk Considerations - Balmoral

Risk Aspect	Comments
Landfill gas	There has been no monitoring of landfill gas at the site. Landfill gas is likely to have been generated, and given the time since closure may still be present within the landfill. The sandy nature of the subsurface soils surrounding the waste will not significantly restrict lateral migration of gas, however the distance to the nearest residence indicates a low risk associated with gas migration to sensitive receptors.
Landfill leachate and impacts to groundwater	There has been no monitoring of leachate or groundwater quality at the site. Landfill leachate likely to have been generated at the site and migrated downward toward the underlying groundwater. The existing vegetation cover across part of the site is likely to be acting as an evapo-transpiration barrier to minimise continued infiltration of rainfall into the underlying waste. The areas of exposed waste have the potential to result in leachate generation.
Contaminated surface water runoff	The existing vegetation and mounded nature of the site is likely to act in storage of rainfall with limited runoff away from the site. There is no surface water receptor in close proximity of the site.
Exposure to waste	There is considerable exposed waste at the site, but it appears to be inert and the site is fenced with limited access.
Regulatory Compliance	There is currently no aftercare management plan for the site.

With regard to the described conceptual model for the site, and the risk aspects, it is considered (with reference to the likelihood–consequence descriptors adopted for this assessment), "likely" that the impacts to groundwater may have occurred at the site, and that similarly, landfill gas migration away from the site may have occurred. The consequence associated with this likelihood is considered to be "moderate", particularly for groundwater.

On the basis of the likelihood-consequence assessment, the risk profile for the Balmoral site is considered to be (B) – and that the site poses a potentially significant risk and requires monitoring and development of an aftercare management plan – with particular focus on the management of the uncovered waste.

6.2.2 Coleraine

The Coleraine site is located on the southern side of Middle Hilgay Road approximately 5km southwest of Coleraine. It is located within a rural setting and is surrounded on all sides by paddocks, and the site itself is open to cattle grazing.

The site is located within a shallow valley and appears to have been led to the infilling of a gulley. Water flow within the former gulley appears to have been partially diverted via a channel along the northern edge of the closed landfill, but appears to have resumed subsurface flow within the gulley at the southwestern end of the landfill area. While the site has been capped and revegetated, there are local areas of uncovered waste that may have originated from dumping post closure of the site.

The site was reportedly closed in 1995. This site is fenced along its boundary with Middle Hilgay Road.

A summary of the site geology and hydrogeology and receptors (within 500m of the site) is presented in **Table 6-3** below:

Table 6-3 Hydrogeology and Receptors – Coleraine

Geology	Depth to Groundwater	Groundwater Category	Groundwater Usage in Proximity (<500m)	Other Receptors
Formation consisting of alluvium overlying sandstone	Possibly <5m within the gulley	C – potentially suitable for agriculture use (stockwatering)	No bores in proximity of the site.	The water course associated with the gulley in which the landfill is situated, and which potentially represents a tributary to Wannon River that is located 2km south of the site.

Table 6-4 below describes the risk aspects and associated considerations that have been incorporated for the Coleraine site as part of the likelihood-consequence risk assessment of the site, and the identification of a risk profile for the site.

Table 6-4 Risk Considerations - Coleraine

Risk Aspect	Comments
Landfill gas	There has been no monitoring of landfill gas at the site. Landfill gas is likely to have been generated, and given the time since closure may still be present within the landfill. The risk from landfill gas is considered to be low given the lack of receptors in proximity of the site.
Landfill leachate and impacts to groundwater	There has been no monitoring of leachate or groundwater quality at the site. Landfill leachate is likely to have been generated at the site and migrated downward toward the groundwater. The shallow presence of the groundwater represents a potential risk of localised groundwater contamination from leachate, and also a risk to surface water within the gulley.

Risk Aspect	Comments
Contaminated surface water runoff	While the existing soil cover and vegetation limit the potential for contaminated surface runoff, there is potential for shallow subsurface flow through the gulley and infilled waste to impact downgradient water quality.
Exposure to waste	There Is some exposed waste at the site, but whilst the site is not fully fenced it is in a remote location. Cattle graze the site.
Regulatory Compliance	There is currently no aftercare management plan for the site. A rehabilitation plan has been developed for the site.

With regard to the described conceptual model for the site, and the risk aspects, it is considered (with reference to the likelihood–consequence descriptors adopted for this assessment) "almost certain" that impacts to surface water and groundwater may have occurred at the site. The consequence associated with this likelihood is considered to be "significant".

On the basis of the likelihood-consequence assessment, the risk profile for the Coleraine site is considered to be (A) – and that the site poses a risk and requires the development and implementation of a rehabilitation and an aftercare management plan.

6.2.3 Glenisla

The Glenisla site is located in a rural bushland setting on the western side of Old Henty Highway approximately 6km southeast of Glenisla township.

The site and the land surrounding the site are flat to gently undulating. There are trees and grassed surface across the site. The site is remote and other than a sign advising of no waste disposal, there is no apparent evidence of it being a landfill. Several old glass bottles were encountered across the site surface. It is understood that the former landfilling at the site consisted of trench and fill with subsequent cover.

The site was reportedly closed in 2014. The site is not fenced.

A summary of the site geology and hydrogeology and receptors (within 500m of the site) is presented in **Table 6-5** below:

Table 6-5 Hydrogeology and Receptors – Glenisla

Geology	Depth to Groundwater	Groundwater Category	Groundwater Usage in Proximity (<500m)	Other Receptors
Formation consisting of alluvium with silt, sand and gravel	< 5m	B – potentially suitable for agriculture use (irrigation and stockwatering)	No bores in proximity of the site.	An ephemeral wetland (Shannon Swamp) located 50m to the east of the site across Old Henty Hwy, and Red Rock Creek located approximately 800m south of the site.

Table 6-6 below describes the risk aspects and associated considerations that have been incorporated for the Glenisla site as part of the likelihood-consequence risk assessment of the site, and the identification of a risk profile for the site.

Table 6-6 Risk Considerations - Glenisla

Risk Aspect	Comments
Landfill gas	There has been no monitoring of landfill gas at the site. Landfill gas is likely to have been generated, and given the time since closure may still be present within the landfill. Subject to the depth of subsurface waste, there is potential for lateral migration of gas, however, there are no receptors in proximity of the site.
Landfill leachate and impacts to groundwater	There has been no monitoring of leachate or groundwater quality at the site. Landfill leachate is likely to have been generated at the site and migrated downward toward the groundwater. The shallow presence of the groundwater represents a potential risk of localised groundwater contamination from leachate. The wetland to the east of the site represents a potential receptor of contaminated groundwater from the site (if present), and Visualising Victoria's Groundwater ranks this wetlands as having moderate potential for groundwater interaction. However, a review of historical aerial photography indicates that this wetlands is usually dry, and therefore is not considered to be a groundwater discharge point. The swamp may be a source of groundwater recharge after high rainfall events.
Contaminated surface water runoff	The site is relatively flat and with the sandy nature across its surface is likely to act in storage of rainfall with limited runoff away from the site.
Exposure to waste	Other than some localised scattered bottles, there is no exposed waste at the site. The site is in a relatively remote location.
Regulatory Compliance	There is currently no aftercare management plan for the site.

With regard to the described conceptual model for the site, and the risk aspects, it is considered (with reference to the likelihood–consequence descriptors adopted for this assessment) "possible" that impacts to groundwater may have occurred at the site. The consequence associated with this likelihood is considered to be "minor". The risk associated with landfill gas is considered to be low, due to the absence of nearby receptors.

On the basis of the likelihood-consequence assessment, the risk profile for the Glenisla site is considered to be (D) – and that the site poses a limited risk but requires the near-term development of an aftercare management plan.

6.2.4 Branxholme

The Branxholme site is located at the southwest end of Toms Road approximately 2km southeast of the township of Branxholme. It is located within a rural/bushland land setting. It is abutted by paddocks to its north, west, south and east. A residential property is located approximately 50m northeast of the site.

The land surrounding the site is mostly flat to undulating with a general southerly slope. It is not apparent whether the landfill was commenced within a gulley or low point, but the current configuration of the site consists of an elevated and mounded surface with a ridge along the southern edge of the landfill area. The site appears to have been capped with soil, and currently has a cover of grass and stands of trees. The site is fenced along its northern, western and eastern boundaries.

The site was reportedly closed in the 1990s. Cattle grazing appears to occur at the site, and at the time of site visit several cattle carcasses were present across the site.

A summary of the site geology and hydrogeology and receptors (within 500m of the site) is presented in **Table 6-7** below:

Table 6-7 Hydrogeology and Receptors – Branxholme

Geology	Depth to Groundwater	Groundwater Category	Groundwater Usage in Proximity (<500m)	Other Receptors
Formation consisting of weathered basalt including minor scoria and tuff.	10 to 20 m	B – potentially suitable for agriculture use (irrigation and stockwatering).	A registered groundwater bore (5146) located 400m north of the site, drilled to a depth of 18m for domestic use. Bore 51417 is located 500m to the northeast of the site, drilled to a depth of 18m and registered for stock watering use.	A residence located approximately 50m northeast of the site. A floodplain and creek is located approximately 200m south of the landfill.

Table 6-8 below describes the risk aspects and associated considerations that have been incorporated for the Branxholme site as part of the likelihood-consequence risk assessment of the site, and the identification of a risk profile for the site.

Table 6-8 Risk Considerations – Branxholme

Risk Aspect	Comments
Landfill gas	There has been no monitoring of landfill gas at the site. Landfill gas is likely to have been generated, and given the time since cessation of landfilling at the site, landfill gas may still be present within the landfill. Subject to the depth, if any, of subsurface waste, there is potential for lateral migration of gas. The residence to the north-east represents a potential receptor.
Landfill leachate and impacts to groundwater	There has been no monitoring of leachate or groundwater quality at the site. Landfill leachate is likely to have been generated at the site and migrated downward toward the groundwater. Due to the depth to groundwater the risk of impact to groundwater is considered to be moderate. The existing soil and vegetation cover across the site are likely to be acting as an evapo-transpiration barrier to minimise continued infiltration of rainfall into the underlying waste. There is potential for groundwater contaminated with leachate to migrate to the south towards the floodplain and creek.
Contaminated surface water runoff	The existing vegetation across the landfill area is likely to act in storage of rainfall with limited runoff away from the site.
Exposure to waste	There Is minor localised exposed waste at the site. While the site is not fully fenced, it is in a relatively remote location. Cattle tracks across the site have locally exposed the soil cover.
Regulatory Compliance	There is currently no aftercare management plan for the site.

With regard to the described conceptual model for the site, and the risk aspects, it is considered (with reference to the likelihood–consequence descriptors adopted for this assessment) “possible” that impacts to groundwater may have occurred at the site and that there has been landfill gas migration away from the site. The consequence associated with this likelihood is considered to be “significant” – with consideration of landfill gas and groundwater and the proximity of the nearby receptors.

On the basis of the likelihood-consequence assessment, the risk profile for the Branxholme site is considered to be (B) – and that the site poses a potentially significant risk and requires monitoring and the development of an aftercare management plan.

6.2.5 Dunkeld Tip Site

The Dunkeld Tip site is located at the northwest corner Tip Lane and Bellcourt Road. It is located within a rural setting.

The land surrounding the site is mostly flat to undulating with paddocks to the north, west, south and east.

It is not apparent whether the former landfill was commenced within a gulley or low point, but the current configuration of the site consists of an elevated and mounded surface. The former landfill appears to have been capped with soil and undisturbed areas contain grass and shrub cover.

It is believed that the site was closed in the 1990s. The site is currently used as a transfer station, and these operations have included the creation of a large hardstand area within the central portion of the site, and the accumulation of stockpiles of uncovered waste.

The site is fenced.

A summary of the site geology and hydrogeology and receptors (within 500m of the site) is presented in **Table 6-9** below:

Table 6-9 Hydrogeology and Receptors – Dunkeld Tip

Geology	Depth to Groundwater	Groundwater Category	Groundwater Usage in Proximity (<500m)	Other Receptors
Formation consisting of weathered basalt including minor scoria and tuff	5-10m	C – potentially suitable for agricultural use (stockwatering)	No bores in proximity of the site	No significant natural surface water features are present within the vicinity of the site.

Table 6-10 below describes the risk aspects and associated considerations that have been incorporated for the Dunkeld Tip site as part of the likelihood-consequence risk assessment of the site, and the identification of a risk profile for the site.

Table 6-10 Risk Considerations – Dunkeld Tip

Risk Aspect	Comments
Landfill gas	There has been no monitoring of landfill gas at the site. Landfill gas is likely to have been generated, and given the presumed time since cessation of landfilling at the site, landfill gas may still be present within the landfill. Subject to the depth, if any, of subsurface waste, there is potential for lateral migration of gas. However, there are no receptors in proximity of the site.
Landfill leachate and impacts to groundwater	There has been no monitoring of leachate or groundwater quality at the site. Landfill leachate is likely to have been generated at the site and migrated downward toward the groundwater. Due to the depth to groundwater the risk of impact to groundwater is considered to be moderate, however there are no receptors in the vicinity of the site that would be impacted by leachate such as groundwater extraction bores. The existing soil and vegetation cover across the site are likely to be acting as an evapo-transpiration barrier to minimise continued infiltration of rainfall into the underlying waste.
Contaminated surface water runoff	The existing vegetation across the former landfill area is likely to act in storage of rainfall with limited runoff away from the site.
Exposure to waste	While the former landfill area appears to have been covered, the current use of the site as a transfer station has led to the accumulation of a considerable amount of uncovered waste across the site surface. The site is fenced with limited public access.
Regulatory Compliance	There is currently no aftercare management plan for the site.

With regard to the described conceptual model for the site, and the risk aspects, it is considered (with reference to the likelihood–consequence descriptors adopted for this assessment), "likely" that impacts to groundwater and landfill gas migration beyond the site boundary may have occurred at the site. The consequence associated with this likelihood is considered to be "minor", due to the absence of receptors in the vicinity of the site.

On the basis of the likelihood-consequence assessment, the risk profile for the Dunkeld Tip site is considered to be (C) – and that the site poses some risk and requires the development of an aftercare management plan – with particular focus on management of the uncovered waste.

6.2.6 Dunkeld Old

The Dunkeld Old site is located at the southeast corner of Tip Lane and Wigans Road. It is within a rural setting.

The land surrounding the site is flat to undulating. It is not apparent whether the landfill was commenced within a gulley or low point, but the current configuration of the site consists of two prominent mounds surface. The site appears to have been capped with soil, and currently has a cover of grass and stands of trees. Two dams are present within the northwest portion of the site.

It is believed that the site was closed in the 1990s, and it is currently grazed by sheep.

A summary of the site geology and hydrogeology and receptors (within 500m of the site) is presented in **Table 6-11** below:

Table 6-11 Hydrogeology and Receptors – Dunkeld Old

Geology	Depth to Groundwater	Groundwater Category	Groundwater Usage in Proximity (<500m)	Other Receptors
Formation consisting of weathered basalt with minor scoria and tuff.	5-10m	C – potentially suitable for agricultural use (stockwatering)	Bore 61740 is located 450m northwest of the site. It was drilled to a depth of 36m and is registered for stock watering use	Two water filled dams are present at the site. Lagoons associated with a wastewater treatment plant are located beyond the southeast corner of the site.

Table 6-12 below describes the risk aspects and associated considerations that have been incorporated for the Dunkeld Old site as part of the likelihood-consequence risk assessment of the site, and the identification of a risk profile for the site.

Table 6-12 Risk Considerations – Dunkeld Old

Risk Aspect	Comments
Landfill gas	There has been no monitoring of landfill gas at the site. Landfill gas is likely to have been generated, and given the presumed time since cessation of landfilling at the site, landfill gas may still be present within the landfill. Subject to the depth, if any, of subsurface waste, there is potential for lateral migration of gas. There are no receptors in proximity of the site.
Landfill leachate and impacts to groundwater	There has been no monitoring of leachate or groundwater quality at the site. Landfill leachate is likely to have been generated at the site and migrated downward toward the groundwater. Due to the depth to groundwater the risk of impact to groundwater is considered to be moderate. The existing soil and vegetation cover across the site are likely to be acting as an evapo-transpiration barrier to minimise continued infiltration of rainfall into the underlying waste.
Contaminated surface water runoff	The existing vegetation across the landfill area is likely to act in storage of rainfall with limited runoff away from the site. The dams within the site represent potential receptors of surface runoff.
Exposure to waste	There is no exposed waste at the site.
Regulatory Compliance	There is currently no aftercare management plan for the site.

With regard to the described conceptual model for the site, and the risk aspects, it is considered (with reference to the likelihood–consequence descriptors adopted for this assessment), “possible” that impacts to groundwater and landfill gas migration beyond the site boundary may have occurred at the site. Additionally, the two dams that are present at the site are potentially at risk of water quality impact from the former landfill. The overall consequence associated with this likelihood is considered to be “significant” with regard to the dams.

On the basis of the likelihood-consequence assessment, the risk profile for the Dunkeld Old site is considered to be (B) – and that the site poses a potentially significant risk and requires monitoring and the development of an aftercare management plan.

6.2.7 Penshurst

The Penshurst site is located near the southwest corner of Police Paddock Road and Depot Road. It is located within a rural setting surrounded by paddocks.

The site was reportedly closed in the 1990s, and it is currently in use as a transfer station.

The land surrounding the site is flat. It is not apparent whether the landfill was commenced within a gulley or low point, but the site itself is elevated above the surrounding land. The former landfill appears to have been capped with soil, and away from the transfer station operations area currently has a cover of grass and a local stand of trees.

The transfer station operations have included the creation of a hardstand area within the central portion of the site, and the accumulation of stockpiles of uncovered waste.

A summary of the site geology and hydrogeology and receptors (within 500m of the site) is presented in **Table 6-13** below:

Table 6-13 Hydrogeology and Receptors – Penshurst

Geology	Depth to Groundwater	Groundwater Category	Groundwater Usage in Proximity (<500m)	Other Receptors
Formation consisting of alluvium (silt, sand and gravel) overlying basalt	5m	B – potentially suitable for agriculture (stockwatering and irrigation).	No bores in proximity of the site.	Murdum Creek located 100m southwest of the site

Table 6-14 below describes the risk aspects and associated considerations that have been incorporated for the Penshurst site as part of the likelihood-consequence risk assessment of the site, and the identification of a risk profile for the site.

Table 6-14 Risk Considerations – Penshurst

Risk Aspect	Comments
Landfill gas	There has been no monitoring of landfill gas at the site. Landfill gas is likely to have been generated, and may still be present within the landfill. Subject to the depth, if any, of subsurface waste, there is potential for lateral migration of gas. There are no receptors in proximity of the site.
Landfill leachate and impacts to groundwater	There has been no monitoring of leachate or groundwater quality at the site. Landfill leachate is likely to have been generated at the site and migrated downward toward the groundwater. Due to the depth to groundwater the risk, and the sandy nature of the subsurface soils, the risk of impact to groundwater is considered to be high, however there are no receptors of groundwater in the vicinity of the site.
Contaminated surface water runoff	The existing soil cover across the former landfill area is likely to act in storage of rainfall with limited runoff away from the site.

Risk Aspect	Comments
Exposure to waste	While the former landfill area appears to have been covered, the current use of the site as a transfer station has led to the accumulation and spreading of waste across the site surface. The site is fenced with limited public access.
Regulatory Compliance	There is currently no landfill aftercare management plan for the site.

With regard to the described conceptual model for the site, and the risk aspects, it is considered (with reference to the likelihood–consequence descriptors adopted for this assessment), "likely" that impacts to groundwater and lateral migration of landfill gas may have occurred at the site. The consequence associated with this likelihood is considered to be "minor".

On the basis of the likelihood-consequence assessment, the risk profile for the Penshurst site is considered to be (C) – and that the site poses some risk and requires the development of an aftercare management plan, with focus on the management of the uncovered waste.

7 Potential Site Management Approaches

The development and implementation of a documented aftercare management plan is considered a first step for each of the sites.

Various site-specific actions that may be incorporated into the aftercare management plans include:

- Site fencing
- Capping to address exposed waste
- Management of illegally dumped and surficial waste
- Regular inspection program
- Groundwater quality investigation
- Landfill gas investigation
- Site rehabilitation
- Ongoing maintenance requirements (e.g. erosion control, weed and vermin control)

EPA Publication 788.3 (August 2015), *Siting, design, operation and rehabilitation of landfills*, provides further guidance on what should be considered in the preparation of an Aftercare Management Plan.

Specific recommendations, based on the risk assessment conducted and regulatory guidance, are provided in the following section.

8 Management Recommendations and Indicative Costings

8.1 Balmoral

The following actions are recommended for the Balmoral site:

- Investigation of groundwater quality at the site, with focus along the eastern boundary of the site.
- Preparation of an aftercare management plan (AMP), having regard to the findings of the groundwater quality investigations and associated assessment of risk, and also the ongoing use and eventual cessation of the site as a transfer station.
- Regular site inspection as a specific action of the AMP.
- Development of a rehabilitation plan including capping of exposed waste.
- Implementation of a Planning Overlay, such as an Environmental Audit Overlay or similar overlay, to ensure that the site is subject to appropriate planning controls in relation to future land development at, or in the vicinity of the site.

A possible timeline and indicative costings associated with these actions are presented in **Table 8-1** below:

Table 8-1 Action Costs and Timing - Balmoral

Action	Year 1	Year 2	Year 3	Comments
Groundwater Investigation	$40,000			Assumes three bores drilled to a depth of 15m each
AMP	$5,000			If sourced externally
Develop Rehabilitation Plan		$25,000		Subject to findings of groundwater investigations
Implementation of Rehabilitation Plan			*	Subject to findings of the investigations, and timing of cessation of transfer station operations.

Table Notes:

- Costs are estimates subject to contractor quotation.
- Groundwater investigation including bore installation, well survey (for multiple bores), and three monitoring events
- AMP to include annual inspection, and contingency actions to address changed site conditions (e.g. exposed waste, site intrusion, weed and vermin control).
- Development of rehabilitation plan to include updated risk assessment, site survey, and preparation of works specification.
- Site rehabilitation to include site clearance, waste burial, site grading, soil capping and vegetation.

8.2 Coleraine

The following actions are recommended for the Coleraine site:

- Investigation of surface water quality, including at the downstream and upstream ends of the site.
- Preparation of an AMP.
- Development and implementation of a rehabilitation plan
- Regular site inspection as a specific action of the AMP.

- Implementation of a Planning Overlay, such as an Environmental Audit Overlay or similar overlay, to ensure that the site is subject to appropriate planning controls in relation to future land development at, or in the vicinity of the site.

A possible timeline and indicative costings associated with these actions are presented in **Table 8-2** below:

Table 8-2 Action Costs and Timing - Coleraine

Action	Year 1	Year 2	Year 3	Comments
Surface Water Monitoring	$10,000			Three monitoring events
AMP	$5,000			If sourced externally
Develop Rehabilitation Plan	$25,000			Subject to findings of surface water monitoring
Implementation of Rehabilitation Plan		$750,000		Cost subject to final plan and contractor quotation. Year 2 allocation estimate provided by Council.

Table Notes:

- Costs are estimates subject to contractor quotation.
- AMP to include annual inspection, and contingency actions to address changed site conditions (e.g. exposed waste, site intrusion, weed and vermin control).
- Development of rehabilitation plan to include updated risk assessment, site survey, and preparation of works specification.
- Site rehabilitation to include site clearance, waste burial, site grading, soil capping and vegetation.

8.3 Glenisla

The following actions are recommended for the Glenisla site:

- Preparation of an AMP.
- Regular site inspection as a specific action of the AMP.
- Implementation of a Planning Overlay, such as an Environmental Audit Overlay or similar overlay, to ensure that the site is subject to appropriate planning controls in relation to future land development at, or in the vicinity of the site.

A possible timeline and indicative costings associated with these actions are presented in **Table 8-3** below:

Table 8-3 Action Costs and Timing - Glenisla

Action	Year 1	Year 2	Comments
AMP	$5,000		If sourced externally

Table Notes:

- Costs are estimates subject to contractor quotation.
- AMP to include annual inspection, and contingency actions to address changed site conditions (e.g. exposed waste, site intrusion, weed and vermin control).

8.4 Branxholme

The following actions are recommended for the Branxholme site:

- Investigation of landfill gas with focus along the northeast boundary of the site.
- Investigation of groundwater, with two bores to the south of the site, and one bore to the north.
- Preparation of an aftercare management plan (AMP), having regard to the findings of the landfill gas investigations and associated assessment of risk.
- Regular site inspection as a specific action of the AMP.
- Implementation of a Planning Overlay, such as an Environmental Audit Overlay or similar overlay, to ensure that the site is subject to appropriate planning controls in relation to future land development at, or in the vicinity of the site.

A possible timeline and indicative costings associated with these actions are presented in **Table 8-4** below:

Table 8-4 Action Costs and Timing – Branxholme

Action	Year 1	Year 2	Comments
Groundwater Investigation	$40,000		Assumes three bores drilled to a depth of 15m each
Landfill Gas Investigation	$20,000		Three bores drilled to a nominal depth of 5m
AMP	$5,000		If sourced externally, and subject to the findings of the LFG investigation.
Management of Site		*	Costs and schedule subject to developed action plan.

Table Notes:

- Costs are estimates subject to contractor quotation
- Groundwater investigation including bore installation, well survey (for multiple bores), and three monitoring events
- Landfill Gas investigation including bore installation and three monitoring events.
- AMP to include annual inspection, and contingency actions to address changed site conditions (e.g. exposed waste, site intrusion, weed and vermin control).

8.5 Dunkeld Tip

The following actions are recommended for the Dunkeld Tip site:

- Preparation of an aftercare management plan (AMP), having regard to the continued use and eventual cessation of the transfer station operations.
- Regular site inspection as a specific action of the AMP.
- Implementation of a Planning Overlay, such as an Environmental Audit Overlay or similar overlay, to ensure that the site is subject to appropriate planning controls in relation to future land development at, or in the vicinity of the site.

A possible timeline and indicative costings associated with these actions are presented in **Table 8-5** below:

Table 8-5 Action Costs and Timing – Dunkeld Tip

Action	Year 1	Year 2	Comments
AMP	$5,000		If sourced externally
Management of Site		*	Costs and schedule subject to developed action plan

Table Notes:

- Costs are estimates subject to contractor quotation.
- AMP to include annual inspection, and contingency actions to address changed site conditions (e.g. exposed waste, site intrusion, weed and vermin control).

8.6 Dunkeld Old

The following actions are recommended for the Dunkeld Old site:

- Surface water monitoring of the existing dams.
- Groundwater monitoring to assess if leachate is migrating to onsite dams.
- Preparation of an aftercare management plan (AMP).
- Regular site inspection as a specific action of the AMP.
- Implementation of a Planning Overlay, such as an Environmental Audit Overlay or similar overlay, to ensure that the site is subject to appropriate planning controls in relation to future land development at, or in the vicinity of the site.

A possible timeline and indicative costings associated with these actions are presented in **Table 8-6** below:

Table 8-6 Action Costs and Timing – Dunkeld Old

Action	Year 1	Year 2	Comments
Surface Water Monitoring	$10,000		Three monitoring events to coincide with groundwater monitoring.
Groundwater Investigation	$40,000		Assumes three bores drilled to a depth of 15m each
AMP	$5,000		If sourced externally, and subject to the findings of the surface water monitoring
Management of Site		*	Costs and schedule subject to developed action plan

Table Notes:

- Costs are estimates subject to contractor quotation.
- Groundwater investigation including bore installation, well survey (for multiple bores), and three monitoring events
- AMP to include annual inspection, and contingency actions to address changed site conditions (e.g. exposed waste, site intrusion, weed and vermin control).

8.7 Penshurst

The following actions are recommended for the Penshurst site:

- Preparation of an aftercare management plan (AMP), having regard to the continued use and eventual cessation of the transfer station operations.
- Regular site inspection as a specific action of the AMP.
- Implementation of a Planning Overlay, such as an Environmental Audit Overlay or similar overlay, to ensure that the site is subject to appropriate planning controls in relation to future land development at, or in the vicinity of the site.

A possible timeline and indicative costings associated with these actions are presented in **Table 8-7** below:

Table 8-7 Action Costs and Timing – Penshurst

Action	Year 1	Year 2	Comments
AMP	$5,000		If sourced externally
Management of Site		*	Costs and schedule subject to developed action plan

Table Notes:

- Costs are estimates subject to contractor quotation.
- AMP to include annual inspection, and contingency actions to address changed site conditions (e.g. exposed waste, site intrusion, weed and vermin control).

9 Conclusions and Recommendations

The risk assessment of the seven Southern Grampians Shire Council former landfill sites has found a differing level of risk associated with each of the sites, with one site (Coleraine) requiring consideration for rehabilitation in the short term. A summary of the risk ranking determined for each of the sites is presented as follows:

- Coleraine risk ranking (A): the site poses a risk and requires the development and implementation of a rehabilitation and aftercare management plan.
- Balmoral, Branxholme, and Dunkeld Old risk ranking (B): the sites pose a potentially significant risk and requires monitoring and development of an aftercare management plan.
- Dunkeld Tip and Penshurst risk ranking (C): the sites pose some risk and requires the development of an aftercare management plan.
- Glenisla risk ranking (D): the site poses limited risk but requires the near-term development of an aftercare management plan.

There is currently no aftercare management policy at Council and it is recommended that this policy be developed possibly with the assistance of BSWWRRG to provide a uniform approach across the region. A component of this policy should include the development of aftercare management plans for each of the sites; regular inspections and contingency actions to address site issues.

It is recommended that Council maintains a register of all of the closed landfills within the Shire, and that an environmental audit overlay (or similar overlay such as an Environmental Significance Overlay), is applied across each of the sites. This will ensure that any future planning provisions for the sites and adjacent sites, have regards to the residual contaminated nature of each of the sites.

It is recommended that internal provisioning of adequate funds be maintained to address the management actions described in **Section 8** above, and that this provisioning be periodically updated to account for any changed conditions, regulatory guidance, and/or developing needs at the sites.

It is recommended that BSWWRRG and Council engages with the EPA to advise it of Council's aftercare management approach toward meeting the forthcoming General Environmental Duty obligation in the *Environment Protection Amendment Act 2018* which will come into effect on 1 July 2020.

10 References

Environment Protection Authority. (1999). Publication 674, *Rehabilitation of Landfills Exempt from Licensing.* November 1999.

Environment Protection Authority. (2004). Waste Management Policy - *Siting, Design and Management of Landfills*, No. S264, Gazette. 14 December 2004.

Environment Protection Authority. (2015). Publication 788.3, *Siting, design, operation and rehabilitation of landfill.* August 2015.

Environment Protection Authority. (2016). Publication 1323.3, *Landfill licensing.* September 2016.

Environment Protection Authority. (2018). Publication 1490.1, *Closed Landfill Guidelines.* January 2018.

Environment Protection Authority. (2018). Publication 1671, *Local Council Self-Assessment Tool for Closed Landfill Environmental Risk.* February 2018.

Environment Protection Authority. (2019). Publication 1596.2, *Calculation of financial assurance for landfills, prescribed waste management (PIW) and container washing.* January 2019.

URS. (2004a). Rehabilitation Plan for the Gellibrand Landfill. 9 June 2004.

URS. (2004b). Rehabilitation Plan for the Forrest Landfill. 9 June 2004.

11 Limitations

EHS Support Pty Ltd ("EHS Support") has prepared this report in accordance with the usual care and thoroughness of the consulting profession for the use of Barwon South West Waste and Resource Recovery Group (BSWWRRG) and the Councils which are responsible for these landfills, and only those third parties who have been authorised in writing by EHS to rely on the report. It is based on generally accepted practices and standards at the time it was prepared. No other warranty, expressed or implied, is made as to the professional advice included in this report. It is prepared in accordance with the scope of work and for the purpose outlined in the Proposal dated 29 July 2019.

The methodology adopted and sources of information used by EHS are outlined in this report. EHS has made no independent verification of this information beyond the agreed scope of works and EHS assumes no responsibility for any inaccuracies or omissions. No indications were found during our investigations that information contained in this report as provided to EHS was false.

This report was prepared between based on the conditions encountered and information received at the time of the site visits and subsequent compilation of these findings. EHS disclaims responsibility for any changes that may have occurred after this time.

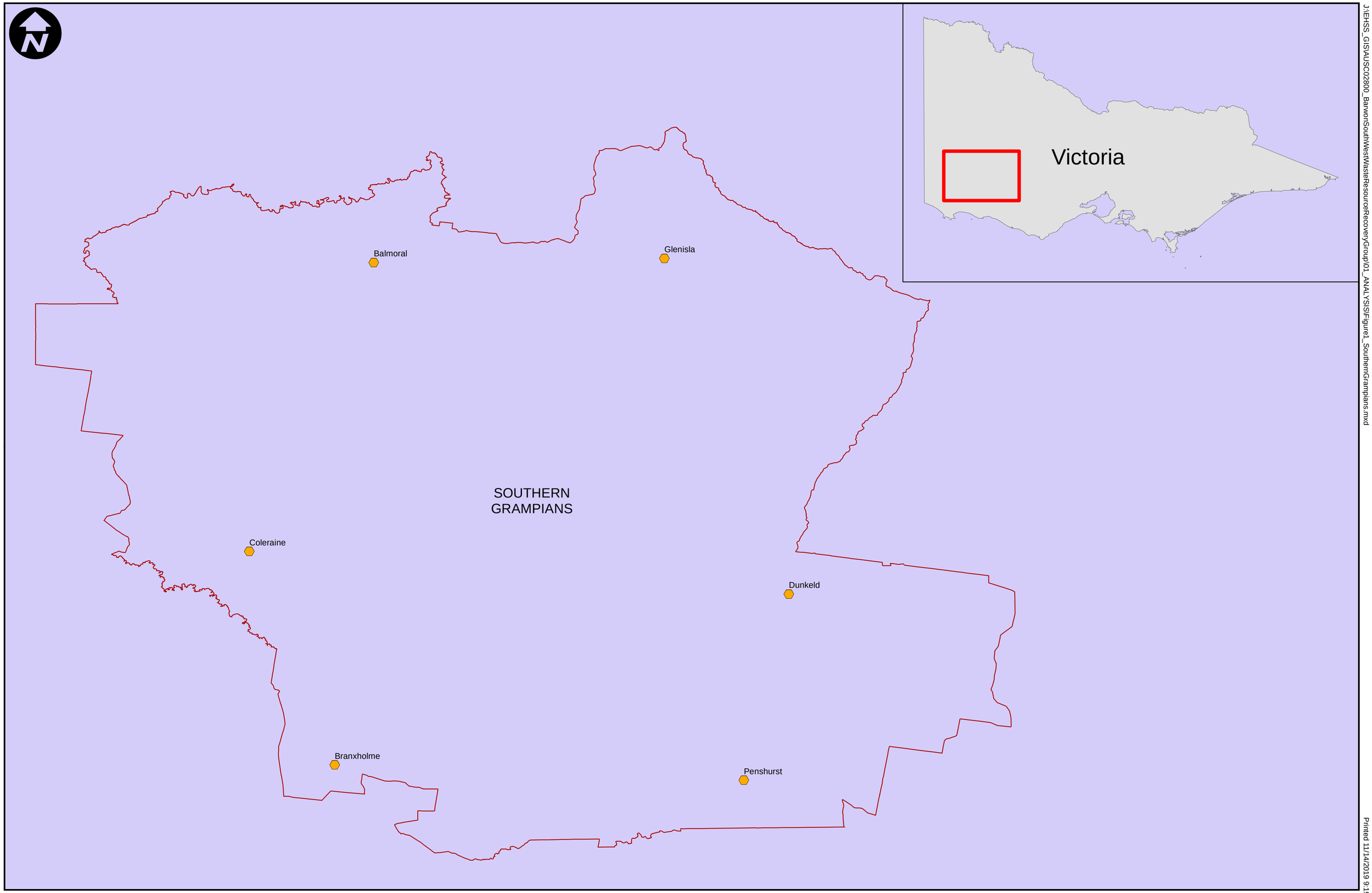
This report should be read in full. No responsibility is accepted for use of any part of this report in any other context or for any other purpose or by third parties. This report does not purport to give legal advice. Legal advice can only be given by qualified legal practitioners.

Where conditions encountered at the site are subsequently found to differ significantly from those anticipated in this report, EHS must be notified of any such findings and be provided with an opportunity to review the recommendations of this report.

Whilst to the best of our knowledge information contained in this report is accurate at the date of issue, subsurface conditions, including groundwater levels can change in a limited time. Therefore this document and the information contained herein should only be regarded as valid at the time of the investigation unless otherwise explicitly stated in this report.

To the extent permitted by law, EHS Support expressly disclaims and excludes liability for any loss, damage, cost or expenses suffered by any third party relating to or resulting from the use of, or reliance on, any information contained in this Report. EHS Support does not admit that any action, liability or claim may exist or be available to any third party. It is the responsibility of third parties to independently make inquiries or seek advice in relation to their particular requirements and proposed use of the relevant property.

Figures



Legend

- VLR_BSW_-_RA_Sites
- Local Government Areas

EHS Support

0 2.5 5 10 15 20 25

Kilometers

Barwon South West Waste and Resource Recovery Group
Closed Landfill Risk Assessment

FIGURE 1
Site Location Plan
Southern Grampians

J:\EHSS_GIS\AUSC02800_BarwonSouthWestWasteResourceRecoveryGroup\01_ANALYSIS\Figure1_SouthernGrampians.mxd

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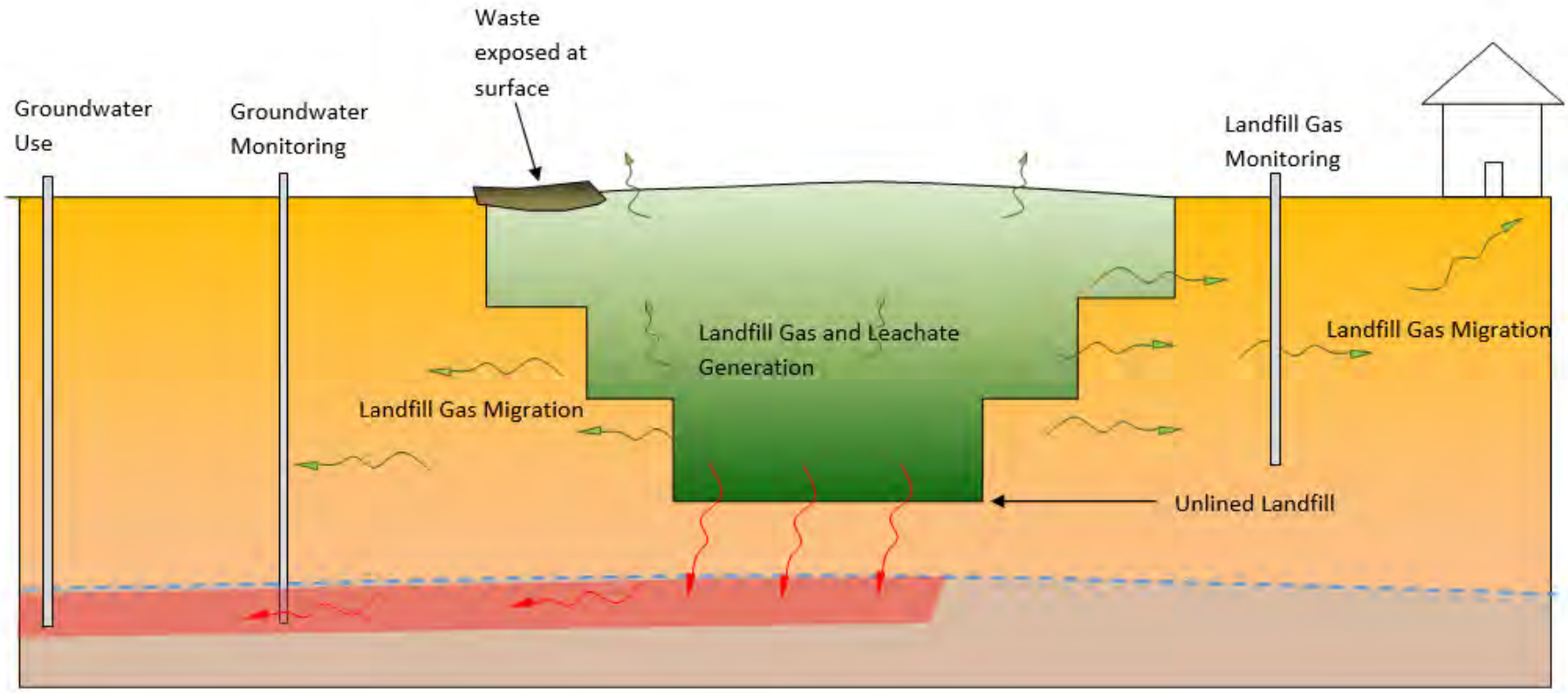
Appendix A Conceptual Site Model Components

CONCEPTUAL SITE MODEL COMPONENTS



Contaminants:

- Waste
- Landfill leachate
- Landfill gas

Migration Pathways

- Direct contact with exposed waste
- Lateral and upward migration of gas
- Leachate migration to groundwater and surface waters
- Migration of exposed waste and sediment to surface waters

Receptors:

- Surface land users
- Building occupants
- Groundwater users
- Surface water bodies

Appendix B Risk Assessment Criteria

Likelihood Descriptors:

1	**Almost Certain**	Impacts known to have occurred, or considered very likely based on CSM
2	**Likely**	Impacts considered likely based on CSM
3	**Possible**	Impacts might have occurred
4	**Unlikely**	Impacts not expected but might have occurred
5	**Rare**	Impacts not expected based on CSM

Consequence Descriptors:

1	**Severe**	Long term and widespread environmental impacts - with immediate extensive remedial requirement
2	**Significant**	Long term but localised environmental impacts - with immediate remedial requirement
3	**Moderate**	Localised environmental impacts - with some remedial requirement
4	**Minor**	Localised environmental impacts - with minor remedial requirement
5	**Negligible**	Negligible environmental impacts - no remedial requirement

Ratings

	Likelihood				
Consequence	**1 Almost Certain**	**2 Likely**	**3 Possible**	**4 Unlikely**	**5 Rare**
1 Severe	A	A	A	B	C
2 Significant	A	A	B	C	D
3 Moderate	A	B	C	D	D
4 Minor	B	C	D	D	D
5 Negligible	C	D	D	D	D

(A): site poses a signficant risk and requires the development and implementation of a rehabilitation and aftercare management plan.
(B): site poses a potentially significant risk and requires monitoring and development of an aftercare management plan – including potential rehabilitation
(C): site poses some risk and requires the development of an aftercare management plan
(D): site poses limited risk but requires the near-term development of an aftercare management plan

Appendix C Field Notes and Aerial Photos

Southern Grampians, Balmoral, Rural, township

Created	2019-09-10 02:49:49 UTC by Raghava Dasika
Updated	2019-09-11 09:29:06 UTC by Raghava Dasika
Location	-37.2417423595, 141.84015384
Municipality	Southern Grampians
Site Name	Balmoral
Site Setting	Rural, township
Topography	Undulating with mounds of waste and soil. Southeastern portion is flat with soil cover over waste
Cover Condition	Variable - wide areas of uncovered waste. Soil cover over southwestern portion

Surrounding Land Use

North Description	Paddock
North Photo	
East Description	Paddock, wooded

East Photo	
South Description	Paddock
South Photo	
West Description	Paddock

West Photo	
Receptors	- Glenelg River 250m to the east - Mathers Creek 200m to the south - Residences 250m to the northwest - Caravan Park 300m to the south

View east from western end of site

Surface Feature Description	View east from western end of site
Surface Feature Photo	

Mounded soil (road cuttings?) at northwestern side of site

Surface Feature Description	Mounded soil (road cuttings?) at northwestern side of site

Surface Feature Photo	

Concrete waste on western side of site

Surface Feature Description	Concrete waste on western side of site
Surface Feature Photo	

Unburied waste

Surface Feature Description	Unburied waste

Surface Feature Photo	

Drum waste

Surface Feature Description	Drum waste
Surface Feature Photo	

Top of waste pile - view south

Surface Feature Description	Top of waste pile - view south

Surface Feature Photo	

View west of southern edge of site

Surface Feature Description	View west of southern edge of site
Surface Feature Photo	

View north from southern boundary

Surface Feature Description	View north from southern boundary

Surface Feature Photo

Southeastern portion of site - view north

Surface Feature Description	Southeastern portion of site - view north

Surface Feature Photo

View northward of southern edge of site. Mounding of >5m

Surface Feature Description	View northward of southern edge of site. Mounding of >5m

Surface Feature Photo

View north of southwest corner of site

Surface Feature Description	View north of southwest corner of site

Surface Feature Photo

Remnant unused trench for waste? SE corner of site

Surface Feature Description	Remnant unused trench for waste? Southeast corner of site

Surface Feature Photo	
Notes	- Site is elevated above surrounding ground. - Site surrounded by low lying flood plain. - Site formely consisted of trench and fill landfill. - Site is fenced.

Southern Grampians, Brankholme, Rural

Created	2019-09-09 23:29:51 UTC by Raghava Dasika
Updated	2019-09-11 09:14:39 UTC by Raghava Dasika
Location	-37.8693879443, 141.815748587
Municipality	Southern Grampians
Site Name	Brankholme
Site Setting	Rural
Topography	Mounded to undulating, with embankment along southern edges
Cover Condition	Clay cap with grass cover. Grass eroded in a number of locations by cattle tracking . Minimal exposed waste limited to southern embankment and low points within western part of site

Surrounding Land Use

North Description	Paddock
North Photo	
East Description	Paddock

East Photo	
South Description	Paddock
South Photo	
West Description	Paddock

West Photo	
Receptors	Dam near southeastern corner of site, wetland (?) 200m south of site

View southwest from entrance

Surface Feature Description	View southwest from entrance
Surface Feature Photo	

Mounding in centre of site

Surface Feature Description	Mounding in centre of site

Surface Feature Photo

Clayey soil cover exposed by cattle track

Surface Feature Description	Clayey soil cover exposed by cattle track

Surface Feature Photo

Dead cattle under tree

Surface Feature Description	Dead cattle under tree

Surface Feature Photo	

Southern edge - view east

Surface Feature Description	Southern edge - view east
Surface Feature Photo	

Souther edge view west

Surface Feature Description	Southern edge view west

Surface Feature Photo

Southwestern embankment - encroached onto adjacent land

Surface Feature Description	Southwestern embankment - encroached onto adjacent land

Surface Feature Photo

View north of western portion of site

Surface Feature Description	View north of western portion of site

Surface Feature Photo	

Western edge of site - view south

Surface Feature Description	Western edge of site - view south
Surface Feature Photo	

Protruding waste at low point in centre of site

Surface Feature Description	Protruding waste at low point in centre of site

Surface Feature Photo	
Notes	- Site appears to have been capped with clayey soil. - Site slopes in a southerly direction as does surrounding land. - Site is gated but not fenced on southern and western sides, with cattle using the site for grazing. - Site is not effectively fenced. - Cattle carcasses on site at time of site visit. - Cattle have eroded vegetation and exposed soil cap. - Some low points with exposed waste.

Southern Grampians, Coleraine, Rural

Created	2019-09-10 00:40:14 UTC by Raghava Dasika
Updated	2019-09-11 09:23:07 UTC by Raghava Dasika
Location	-37.625726522, 141.639650921
Municipality	Southern Grampians
Site Name	Coleraine
Site Setting	Rural
Topography	Western portion of site is undulating with remnant gully features low point where waste settlement has occurred.
Cover Condition	Eastern portion appears to have been capped with gravelly soil, with grass cover and small stands of trees. No exposed waste. Western portion contains extensive exposed waste with water seepage emanating through waste into the creek gulley.

Surrounding Land Use

North Description	Paddock on rising ground
North Photo	
East Description	Gulley though paddocks

East Photo	
South Description	Hilly paddock
South Photo	
West Description	Hilly paddock

West Photo

Flowing swale drain (diverted creek?) along northeastern edge of eastern portion of site

Surface Feature Description	Flowing swale drain (diverted creek?) along northeastern edge of eastern portion of site

Surface Feature Photo

View west from eastern end of landfill

Surface Feature Description	View west from eastern end of landfill

Surface Feature Photo	

Damned creek outside western end of site - with culvert discharging to swale through landfill site

Surface Feature Description	Damned creek outside western end of site - with culvert discharging to swale through landfill site
Surface Feature Photo	

Gravelly soil cover on western side (older portion) of site

Surface Feature Description	Gravelly soil cover on western side (older portion) of site

Surface Feature Photo

Southern edge of western portion of landfill

Surface Feature Description	Southern edge of western portion of landfill

Surface Feature Photo

Illegal dumping at centre of site

Surface Feature Description	Illegal dumping at centre of site

Surface Feature Photo	

View south of eastern edge embankment at centre of site

Surface Feature Description	View south of eastern edge embankment at centre of site
Surface Feature Photo	

Illegal dumping on north eastern edge of site

Surface Feature Description	Illegal dumping on north eastern edge of site

Surface Feature Photo	

Flow through eroded waste at western portion of site

Surface Feature Description	Flow through eroded waste at western portion of site
Surface Feature Photo	

Waste in a gully - western portion of site

Surface Feature Description	Waste in a gully - western portion of site

Surface Feature Photo	

Western end of site - view south

Surface Feature Description	Western end of site - view south
Surface Feature Photo	

Car bodies at eastern portion of site

Surface Feature Description	Car bodies at eastern portion of site

Surface Feature Photo	
Notes	- Site is leased from farmer who wants site returned for grazing purposes. - Cattle have access to the site. - Site has been established over a creek channel. - Landfilling was initiated to mitigate gully erosion. - Rehabilitation of the site has been designed by the Shire with tenders being sought for its implementation.

Southern Grampians, Dunkeld - old landfill , Rural

Created	2019-09-10 23:50:44 UTC by Raghava Dasika
Updated	2019-09-11 09:51:44 UTC by Raghava Dasika
Location	-37.6683712146, 142.330052192
Municipality	Southern Grampians
Site Name	Dunkeld - old landfill
Site Setting	Rural
Topography	Undulating with two prominent mounds. Dams in northwest portion
Cover Condition	Grass cover over soil cap - minor remnants of waste. A couple of "pot holes" across the site that may possibly represent settlement of underlying waste.

Surrounding Land Use

North Description	Paddock
North Photo	
East Description	Wastewater treatment plant

East Photo	
South Description	Treated paddock
South Photo	
West Description	Paddock

West Photo	
Receptors	Two dams located on site

View south from northern site boundary - mounding

Surface Feature Description	View south from northern site boundary - mounding
Surface Feature Photo	

Dams at northwestern edge of landfill area

Surface Feature Description	Dams at northwestern edge of landfill area

Surface Feature Photo	

General site surface - site used for sheep grazing

Surface Feature Description	General site surface - site used for sheep grazing
Surface Feature Photo	

Opening on southern mound

Surface Feature Description	Opening on southern mound

Surface Feature Photo	

View north from southern mound

Surface Feature Description	View north from southern mound
Surface Feature Photo	

Distressed tree at northern end of site

Surface Feature Description	Distressed tree at northern end of site

Surface Feature Photo	
Notes	- Site is used for sheep grazing

Southern Grampians, Dunkeld - Transfer Station Site, Rural

Created	2019-09-11 00:12:01 UTC by Raghava Dasika
Updated	2019-09-11 09:55:54 UTC by Raghava Dasika
Location	-37.6692410466, 142.347071478
Municipality	Southern Grampians
Site Name	Dunkeld - Transfer Station Site
Site Setting	Rural
Topography	Surrounding land is flat to gently undulating. Site is elevated and mounded
Cover Condition	Site and old landfill area variously contains soil and hard stand cover

Surrounding Land Use

North Description	Paddock
North Photo	
East Description	Paddock
East Photo	

South Description	Paddock
South Photo	
West Description	Paddock
West Photo	
Receptors	No receptors in proximity

Waste oil containers in transfer station area

Surface Feature Description	Waste oil containers in transfer station area

Surface Feature Photo	

Hard stand across centre of site - view east

Surface Feature Description	Hard stand across centre of site - view east
Surface Feature Photo	

Southern edge of site - view east

Surface Feature Description	Southern edge of site - view east

Surface Feature Photo	

Southwest corner of site - view west

Surface Feature Description	Southwest corner of site - view west
Surface Feature Photo	

View east from western boundary

Surface Feature Description	View east from western boundary

Surface Feature Photo

Western edge of former landfill - view southwest

Surface Feature Description	Western edge of former landfill - view southwest

Surface Feature Photo

View south of western edge of old landfill

Surface Feature Description	View south of western edge of old landfill

Surface Feature Photo	

Eastern edge of site - view south

Surface Feature Description	Eastern edge of site - view south
Surface Feature Photo	
Notes	- Site appears to have been capped and is now largely used as a transfer station across the majority of its area. - Site use is resulting in waste spreading across site and disturbance of the formerly capped area. - The current operations have the potential to contaminate the site, as there is storage of waste oils and fuels as part of waste management at the site. - Site is fenced.

Southern Grampians, Glenisla, Bushland

Created	2019-09-10 05:06:33 UTC by Raghava Dasika
Updated	2019-09-11 09:42:11 UTC by Raghava Dasika
Location	-37.2473027883, 142.172602583
Municipality	Southern Grampians
Site Name	Glenisla
Site Setting	Bushland
Topography	Gently undulating
Cover Condition	Sandy soil and grass cover

Surrounding Land Use

North Description	Bushland
North Photo	
East Description	Bushland
East Photo	

South Description	Bushland
South Photo	
West Description	Bushland
West Photo	
Receptors	Ephemeral wetland across road east of site

Wet low point (possible settlement of trench fill) at western side of site

Surface Feature Description	Wet low point (possible settlement of trench fill) at western side of site

Surface Feature Photo	

Site view north

Surface Feature Description	Site view north
Surface Feature Photo	

Small mound of road base at southern end of site

Surface Feature Description	Small mound of road base at southern end of site

Surface Feature Photo	

Sign

Surface Feature Description	Sign
Surface Feature Photo	

View north of site from southeast corner (site entrance)

Surface Feature Description	View north of site from southeast corner (site entrance)

Surface Feature Photo	
Notes	- Site was operated as trench and fill. Site surface is capped with sandy soil, and is generally at level with surrounding land. - Other than the sign there is almost no physical evidence of the site having been a former landfill. - There are a few scattered old bottles and minor waste across the surface on the southern side of the site. - The sandy soil cover is soft and wet in places - possibly aligned with waterlogged trenches. - A low point is present on the western side - can be readily filled using the road cuttings that are stockpiled on site. - With some further vegetation site can be returned to surrounding bushland use - Site is unfenced.

Southern Grampians, Penshurst Transfer Station, Rural

Created	2019-09-11 01:04:47 UTC by Raghava Dasika
Updated	2019-09-11 10:03:24 UTC by Raghava Dasika
Location	-37.8562967945, 142.319574226
Municipality	Southern Grampians
Site Name	Penshurst Transfer Station
Site Setting	Rural
Topography	Flat to undulating - site is elevated above surrounding land
Cover Condition	Away from the transfer station area, site is covered with grass and soil cap. Minor waste on surface.

Surrounding Land Use

North Description	Paddock
North Photo	
East Description	Paddock

East Photo	
South Description	Paddock
South Photo	
West Description	Paddock - note swale drain along toe of western embankment

West Photo

Northeastern edge of landfill

Surface Feature Description	Northeastern edge of landfill

Surface Feature Photo

Northern edge - view east

Surface Feature Description	Northern edge - view east

Surface Feature Photo	

Site - view south from northern edge

Surface Feature Description	Site - view south from northern edge
Surface Feature Photo	

Northern site surface

Surface Feature Description	Northern site surface

Surface Feature Photo	

Western edge of site - view south

Surface Feature Description	Western edge of site - view south
Surface Feature Photo	

Soil and mulch mounds at centre of site

Surface Feature Description	Soil and mulch mounds at centre of site

Surface Feature Photo

Building waste including ACM

Surface Feature Description	Building waste including ACM

Surface Feature Photo

View north from southern edge of site

Surface Feature Description	View north from southern edge of site

Surface Feature Photo	

View west along southern boundary of site - filling appears not to have extended to southern boundary

Surface Feature Description	View west along southern boundary of site - filling appears not to have extended to southern boundary
Surface Feature Photo	

Southern edge of landfill - with disturbance as part of transfer station operations

Surface Feature Description	Southern edge of landfill - with disturbance as part of transfer station operations

Surface Feature Photo	

Landfill surface disturbance at southern end of transfer station operations

Surface Feature Description	Landfill surface disturbance at southern end of transfer station operations
Surface Feature Photo	

Transfer station area

Surface Feature Description	Transfer station area

Surface Feature Photo	
Notes	- Transfer station operations started after capping of landfill. - Northern portion of the site is undisturbed by transfer station operations. - Central portion of site is disturbed by transfer station operations with various waste stockpiles including asbestos containing materials. - Waste stockpiles are uncontrolled. - Site is accessible by sheep that enter from adjacent paddocks through breaks in adjacent fences.


204
55
Horsham Rd
C214
BALMORAL
0
10
20
30
40 m


Toms Rd
BRANKSHOLME
0 10 20 30 40 m


Middle Higgy Rd
Middle Higgy Rd
COLERAINE
0 10 20 30 40 m


Tip Lane
255
DUNKELD OLD
0
10
20
30
40 m


Bellicourt Rd
Tip Lane
Tip Lane
Tip Lane
DUNKELD TIP
0
10
20
30
40 m


Old Henty Hwy
GLENISLA
0 10 20 30 40 m


Police Paddock Rd
Depot Rd
Depot Rd
Depot Rd
PENSHURST
0
10
20
30
40 m