



Environmental Assessment and Management Plan

Tamala Park Waste Management Facility
Southern Piggyback Cell and Leachate Management Area



Prepared for Mindarie Regional Council

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1 Introduction

Mindarie Regional Council (MRC) operates the Tamala Park Waste Management Facility (the Site) on behalf of its seven member councils; the cities of Joondalup, Perth, Stirling, Vincent and Wanneroo, along with the towns of Cambridge and Victoria Park. The Site is Licenced to accept up to 350,000 tonnes of Class II and Class III waste per year for disposal in its existing landfill cells. In addition, various other materials are accepted at the Site from community members for recovery, including Household Hazardous Waste (HHW), e-waste and scrap metal. The Site is rapidly reaching capacity and to create a final profile that is conducive to capping, MRC is proposing to construct a new piggyback cell over the top of a portion of Stage 1 South landfill and butting up to the west side of the Stage 2 landfill, and existing Northern Piggyback Cell (NPC). The new cell, referred to as the Southern Piggyback Cell (SPC), is necessary to ensure the Site can meet its closure obligations.

In conjunction with the new cell development, MRC will develop a permanent Leachate Management Area (LMA) in the existing quarry area in the southern portion of the Site. The LMA is essential infrastructure to manage accumulated leachate in the Stage 2 landfill, ongoing leachate generation during the remaining operational phase of the Site, and post-closure to reduce the present and future risk to groundwater.

A Works Approval from the Department of Water and Environmental Regulation (DWER) is required to develop the SPC. This Environmental Assessment and Management Plan (EAMP) has been prepared to support the Works Approval application for the development of the SPC by outlining the existing environmental attributes, detailed designs, proposed construction works and environmental management measures to be implemented.

1.1 Objective

The objectives of this EAMP are to:

- Provide the design, construction and operational details of the SPC;
- Outline the environmental aspects requiring management;
- Describe the proposed environmental management measures;
- Undertake a residual risk assessment in accordance with the DWER's *Guidance Statement: Risk Assessments* (2017); and
- Demonstrate that the proposed management measures adequately prevent or minimise potential environmental risks.

1.2 Scope of Report

The scope of this EAMP includes:

- Section 2: Site Information;
- Section 3: Environmental Attributes;
- Section 4: Social Attributes;
- Section 5: Infrastructure Layout and Design;
- Section 6: Infrastructure Operational Aspects;
- Section 7: Environmental Aspects and Management;

- Section 8: Post Closure Management;
- Section 9: Residual Risk Assessment; and
- Section 10: Conclusion.

2 Site Information

The following sections provide details on the Site's location, zoning and surrounding land use, separation distances, licencing, and existing infrastructure.

2.1 Site Location

The Site is located approximately 30km north of Perth and comprises of Lot 9043 on Plan 424903 at 1700K Marmion Avenue, Tamala Park, WA, 6030. The Prescribed Premises boundary, as shown in Licence L9395/2023/1 (DWER Licence), covers an approximately 157-hectare (ha) area. Access to the Site is via Marmion Avenue, with internal roads providing access to the site facilities and landfill cells.

The Site locality is provided in

Figure 1.

2.2 Zoning and Surrounding Land Use

The Site is located in the City of Wanneroo (the City) and under the City's Local Planning Scheme No. 2 (LPS No. 2), part of the Site towards the north is zoned as 'urban development'. The remainder of Site, including the proposed location of the SPC, is not zoned under the City's LPS No. 2.

Under the Metropolitan Region Scheme, the northern boundary of the Site is zoned as 'urban', the northern part of the Site is zoned as 'urban deferred', central and western part of the Site is zoned as 'public purposes' and remaining part of the Site is zoned as 'parks and recreation'.

Figure 2 highlights the land use tenure around the Site.

2.3 Separation Distances

The Environmental Protection Authority (EPA's) *Guidance Statement No. 3 – Separation Distances between Industrial and Sensitive Land Uses (2005)* (Guidance Statement 3) contains the recommended separation distances between industrial activities, including waste management facilities, and sensitive land uses. Sensitive land uses are defined by the EPA as those that are sensitive to industrial emissions and include residential developments, schools, hospitals, shopping centres and other public areas and buildings. Table 2-1 provides the recommended minimum separation distances between sensitive land uses and the Prescribed Premises categories for which the Site is currently licenced.

Table 2-1: Recommended Separation Distances between Industrial and Sensitive Land Uses

Category No.	Category Description	Impacts					Recommended Separation Distance
		Gaseous	Noise	Dust	Odour	Risk	
12	Screening, etc. of material		✓	✓			500m
57	Used Tyre Storage		✓			✓	100-200m, depending on size
61	Liquid Waste Facility		✓		✓		Case by case

Category No.	Category Description	Impacts					Recommended Separation Distance
		Gaseous	Noise	Dust	Odour	Risk	
61A	Solid Waste Facility	✓	✓		✓	✓	Case by case
62	Solid Waste Depot		✓	✓	✓		200m
64	Class II or III Putrescible Landfill Site	✓	✓	✓	✓		500m for subdivisions 150m for single residences 35m internal buffer from Site boundary
77	Concrete batching or cement products manufacturing		✓	✓			300-500m, depending on size

The closest single residence to the northern boundary is 154m from the Site premises, 643 from the SPC. The closest single residence along the southern boundary is approximately 25m from the Site premises, 642m from the SPC. Land developments for possible future subdivisions are currently in process along the northeastern boundary on Connolly Drive. These separation distances are illustrated in Figure 3.

2.4 Licencing

The Site is licenced for the acceptance, storage, treatment and/or burial of multiple waste types, including waste classified as Class II or III waste, as specified in the DWER Guideline *Landfill Waste Classification and Waste Definitions 1996* (as amended 2019). The Site is classified as a Prescribed Premises pursuant to Schedule 1 of *Environmental Protection Regulations 1987* as an 'industrial premise with the potential to cause emissions and discharges to air, land or water'. Therefore, it operates under an approved Licence (L9395/2023/1) granted by the DWER. The categories covered under the Licence are listed in Table 2-2.

Table 2-2: Prescribed Premises Categories

Category Number	Category Description	Category Production or Design Capacity	Approved Premises Production or Design Capacity
12	Screening, etc. of material	50,000 tonnes or more per year	1,500,000 tonnes per annual period
57	Used Tyre Storage	100 tyres or more	500 tyres (at any one time)
61	Liquid Waste Facility	100 tonnes or more per year	500 tonnes per annual period
61A	Solid Waste Facility	1,000 tonnes or more per year	1,500 tonnes per annual period
62	Solid Waste Depot	500 tonnes or more per year	15,000 tonnes per annual period

Category Number	Category Description	Category Production or Design Capacity	Approved Premises Production or Design Capacity
64	Class II or III Putrescible Landfill Site	20 tonnes or more per year	350,000 tonnes per annual period
67A	Concrete batching or cement products manufacturing	100 tonnes or more per year	30,000 tonnes per annual period

2.5 Existing Site Infrastructure

Existing Site infrastructure includes:

- Weighbridge;
- Administration Offices;
- Workshop and crib room;
- Waste Transfer Station (WTS);
- Community Waste Drop-off and Reuse Shop;
- Landfill Gas Power Station;
- Limestone quarry and stockpile area;
- Screening bund between landfill and Kinross residential area;
- Temporary Leachate Evaporation System comprising two shallow geomembrane lined ponds;
- Stage 1 Landfill (unlined, capped and restored);
- Stage 2 Landfill (lined):
 - Phase 1 (substantially capped except southern extent);
 - Phase 2 (active and partially capped at western extent); and
 - Phase 3 (active and partially capped at western extent).
- Northern Piggyback Cell (lined and partially capped at northern extent);
- Security infrastructure: Fencing and CCTV network; and
- Environmental Monitoring Network (i.e. landfill gas and groundwater monitoring wells).
- Bitumen Road network/ Firebreak tracks
- Two water standpipes and Storage
- Vehicle Washdown Facility
- Waste Water Treatment Plant (passive)
- Sea containers/ dongers
- Leachate Management System

Figure 4 provides a general layout of the Site.

3 Environmental Attributes

3.1 Climate

Historic weather data is typically sourced from the Bureau of Meteorology (BOM) website. The Bureau of Meteorology's (BOM) closest weather station with long-term data is Perth Metro (Station 009225), located approximately 30km south of the Site. Rainfall data was also sourced from SILO for the period 1974-2024 for Latitude -31.7 and Longitude 115.75 located 2km from the Site is summarised in Table 3-1. SILO is a database of Australian climate data from 1889 to the present that is hosted by the Queensland Department of Environment and Science (DES).

Table 3-1: Summary of Monthly Rainfall and Evaporation in Millimetres (mm)

Aspect	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Rainfall (mm)	13.7	14.7	17.7	35.5	95.6	128	148	117	68.5	38.7	23.5	8.4	709
90 th Percentile Rainfall (mm)	0.5	36.8	31.7	28.3	149	121	255	80.5	33.7	107	11.2	2.8	857
Average Evap. (mm)	256	209	174	102	65.8	48.0	50.8	61.8	83.6	129	177	233	1590

The Site experiences a warm temperate climate. Most rainfall in the area occurs during the months of May to September. The driest months are November to March. The mean annual pan evaporation rate is approximately 1,590mm, which exceeds the mean annual rainfall by 881mm.

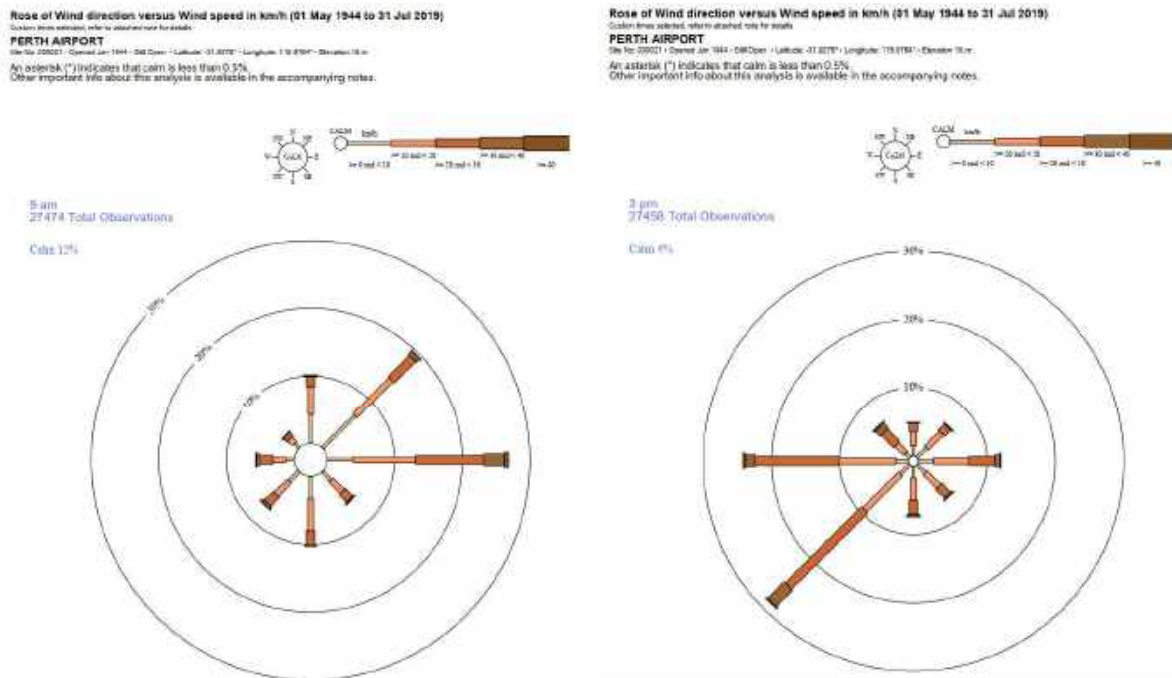
The highest mean temperature is 31.7°C, occurring in February, whilst the lowest mean temperature is 8.1°C occurring in July. Table 3-2 shows the average maximum and minimum temperatures at the Perth Metro weather station (Station number: 009225) for years 1994 to 2024.

Table 3-2: Maximum and Minimum Temperatures from Perth Metro Station (1994-2024)

Aspect	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Mean Max. Temp. (°C)	31.4	31.7	29.7	26	22.4	19.5	18.5	19.2	20.6	23.5	26.8	29.5	24.9
Mean Min Temp. (°C)	18.1	18.4	16.9	13.8	10.5	8.7	8.1	8.5	9.7	11.7	14.4	16.5	12.9

The wind direction generally ranges from east-northeast in the morning (9am), changing direction to west-southwest in the afternoon (3pm). Winds at the Site are typically moderate in the morning and moderate to strong in the afternoon. The wind rose for morning and afternoon winds is presented in **Diagram 3-1**.

Diagram 3-1: 9am (left) and 3pm (right) Wind Rose for Perth



3.2 Topography

The topography across the Site varies from 50m Australian Height Datum (AHD) in the northern and southwestern portions of the Site to 10mAHD at the eastern boundary. Topography in the SPC area varies from 42m AHD to 27m AHD.

The SPC area lies within a relative depression that is surrounded by landfill on its eastern (Stage 1 capped and restored), northern (NPC partially capped) and western (Stage 2 operational) sides. Its footprint is also above the capped Stage 1 landfill.

The topography in the SPC area slopes along its northern edge from 47m AHD at the eastern extent (the highest point in the SPC area) to 27m AHD at the western extent and interface with the Stage 2 lining system (the lowest point in the SPC area). The western boundary, which follows the Stage 2 lining system north to south, slopes upwards from north to south from 27m ADH to 40m AHD. The eastern boundary slopes downward from north to south from 47m AHD to 42m AHD. The comparatively short southern boundary features a gradual downward slope from east to west between 42m and 40m AHD.

Falls within the SPC area are approximately 1V:5H from east to west with a more gradual fall approximately 1V:25H from south to north in the western portion of the SPC area.

Figure 5 shows the general topography of the Site with 5m major contour lines.

The topography of the SPC area is shown on Drawing W-101 and the wider site topography is shown on Drawing W-100.

3.3 Geology

The geology across part of the Site and most of the SPC development consists predominantly of “Qdca: Quartz skeletal sand, humic quartz sand, calcreted sand, medium and coarse sand and shelly sand, and

beach rock” and along the SPC southern boundary is “Qit: unconsolidated to strongly lithified calcarenite with calcrete/kankar soils; aeolian. Locally quartzose, feldspathic, or heavy mineral bearing soils”.

Figure 6 shows the surface geology of the Site.

3.4 Hydrogeology

An unconfined aquifer system is present within the sand and limestone of the superficial formations that underlie the Site. The water table beneath the Site occurs just above the sea level and is approximately 20 to 30m below the natural ground surface. The saturated thickness of the aquifer is approximately 40 to 50m with the underlying shale forming a confining layer with the deeper Leederville Formation. Connectivity with the Leederville is assumed to be zero, 2022/2023 Annual Monitoring Report (Talis, 2023).

According to the National Maps (<https://nationalmap.gov.au>), the hydrogeology across the Site consists of “Porous, extensive highly productive aquifers” and lies within the Swan Coastal Basin.

3.5 Groundwater

3.5.1 Historic Static Water Level

An extensive network of groundwater monitoring bores are located up-gradient, down-gradient and to the north of the Site. According to the 2024 Groundwater Monitoring Report (SLR, October 2024), “historical data shows a general decline in groundwater elevations between 2000 and 2005, after which a steady general increase in groundwater elevations is recorded across all monitoring wells. Slightly higher groundwater elevations have been historically reported east (hydraulically up-gradient) of the site whilst the lowest groundwater elevations have been reported west of the landfill (hydraulically down-gradient)”. Rapid groundwater recharge does not appear to be occurring soon after heavy rainfall is recorded, but rather as a result of year-long infiltration and percolation down towards the groundwater table, indicating a period of lag. Major peaks were recorded in 2005, 2008, 2012, 2013, 2017, 2018, 2019 and 2022, and major drops in groundwater elevations were recorded in 2007, 2010, 2013, 2014, 2016, 2018, 2019, 2020 and 2024 which, as expected, tend to correlate to years with high and low rainfall.

Groundwater elevations during the February 2024 groundwater monitoring event (GME) were recorded to be approximately 0.5m lower than the July 2024 GME and previous GME’s (May 2020 to July 2023). SLR indicate that this is due to the period from October to February 2024 being the driest since 2018.

The groundwater monitoring network is set up to target the superficial unconfined aquifer at three depths: shallow (approx. 30 m depth); intermediate (approx. 37-46 m depth); and deep targeting near the base of the aquifer (up to 86 m depth).

The locations of the relevant monitoring bores, along with the groundwater contour lines are shown in Figure 7 (July 2023 GME) and SLR Figure 3a (July 2024) for comparison purposes.

3.5.2 Groundwater Quality

Groundwater quality sampling is undertaken across the Site on a bi-annual and annual basis, and in accordance with MRC’s Site Licence.

The results outlined in the 2024 Groundwater Monitoring Report (SLR, 2024) indicated that there were no Tier 1 Assessment criteria exceedances at bores located within the Catalina residential area during the two 2024 GMEs'. Overall, very low ammonia, potassium and PFAS results from the Water Corporation bore, located to the northeast of the site, indicates that it does not appear to be impacted by the leachate plume origination from the site.

There were significant changes to the overall risk profile at the landfill, the buffer zone and the Catalina Central Estate, compared to the 2021 and 2022 assessments. Groundwater has a circum-neutral pH and is fresh to brackish. The risk to human health and environment from identified contaminant concentrations is presently acceptable.

Groundwater beneath the landfill, the buffer zone and the southern portion of the Catalina Central Estate is considered unsuitable for drinking water purposes and non-potable use as chloride, ammonia, arsenic, cobalt, iron, nickel, exceeded the Australian Drinking Water Guideline (ADWG) and/or Non Potable Use Guideline (NPUG) criteria whilst the Sum of Perfluorohexanesulfonic acid (PFHxS) and Perfluorooctanesulfonic acid (PFOS) have exceeded the PFAS National Environmental Management Plan (NEMP) (Heads of EPA Australia and New Zealand, 2020) drinking water criteria in some bores.

3.6 Surface Water

Public Drinking Water Source Areas are located along the eastern boundary of the Site and is zoned as a P3 Protection Area. The SPC development area is not located within the Protection Area. The locations of the catchments and surface water bodies within and surrounding the Site are provided in Figure 3b: Groundwater Contours - July 2024 (SLR)

Figure 8 and Figure 8.

Surface water on-site is channelled through a series of open drainage channels and culverts to sedimentation or attenuation ponds across the Site. To ensure that the system is functioning effectively, timely inspections are to be carried out.

According to the Siting, Design, Operation and Rehabilitation of Landfills Best Practice Environmental Management Guidelines (BPEM Guidelines), Environmental Protection Authority (EPA) Victoria, 2016, the required separation distance between a Class II landfill and surface waters is 100m. There are no natural surface water bodies within 500m of the Site, with the nearest permanent surface water bodies, being the Indian Ocean and Neerabup Lakes, located approximately 1.5km to the west and 3.5km to the northeast, respectively.

3.7 Flora and Fauna

To ensure that the most up-to date information was used to identify the presence of any threatened or priority flora or fauna, Talis undertook a desktop review of the Department of Biodiversity, Conservation and Attraction's (DBCA's) online databases which are discussed in the sections below.

3.7.1 Flora and Vegetation

Four Priority 2 species were identified beyond the northwestern side of the Site premises in the Flora Database search. There are no species identified within the SPC development area which was completely disturbed during the filling and capping of the Stage 1 landfill. The location of Threatened and Priority Flora is provided in Figure 9.

Bush Forever Site 323 is located within the entirety of the premises boundary up to but excluding the landfill area itself, as well as east of the Premises' eastern boundary to the western boundary of the next Lot (50m-425m from the Premises western boundary). It comprises a link between the two Bush Forever sites to the east (Site 383) and west (Site 322).

Site 322 extends west to east from the Indian Ocean to the western boundary of the Premises and adjacent Kinross residential development to the south. It is referred to as the Burns Beach Bushland.

Site 383 lies to the east of Lot 323. It is within the Neerabup National Park, Lake Gnowergup Nature Reserve and adjacent Bushland, Neerabup.

3.7.1.1 Threatened and Priority Ecological Communities

There is a mapped Threatened Ecological Community (TEC) over the eastern, half of the Site. A mapped Priority Ecological Community (PEC) is situated along part of the western boundary of the Site. The SPC development area lies within the TEC but was completely disturbed during the filling and capping of the Stage 1 landfill.

The locations of the mapped TECs and PECs within and surrounding the Site are provided in Figure 10.

3.7.2 Fauna

One threatened species is mapped as occurring along the southwestern edge of the SPC development area, one threatened species in Stage 2 Phase 2, and one threatened species along the western boundary of the Site adjacent to the Site's entrance. Two Priority 4 species are mapped as occurring along the southern boundary of the Site.

Seven threatened species, two Priority 3 and twenty-one Priority 4 species were identified outside the boundary of the Site. The location of threatened and priority fauna is provided in Figure 11.

4 Social Attributes

The social attributes of the Site include Aboriginal and European Heritage, which are discussed in the following sections.

4.1 Aboriginal Heritage

Aboriginal Heritage sites (registered or not) are protected under the *Aboriginal Heritage Act 1972* (AH Act). An Aboriginal Heritage Site under Section 5 of the AH Act is defined as:

“(a) any place of importance and significance where persons of Aboriginal descent have, or appear to have, left any object, natural or artificial, used for, or made or adapted for use for, any purpose connected with the traditional cultural life of the Aboriginal people, past or present;

(b) any sacred, ritual or ceremonial site, which is of importance and special significance to persons of Aboriginal descent;

(c) any place which, in the opinion of the Committee, is or was associated with the Aboriginal people and which is of historical, anthropological, archaeological or ethnographical interest and should be preserved because of its importance and significance to the cultural heritage of the State;

(d) any place where objects to which this Act applies are traditionally stored, or to which, under the provisions of this Act, such objects have been taken or removed.”

A search for relevant Aboriginal Heritage sites was conducted using the Department of Planning, Lands and Heritage’s (DPLH’s) online Aboriginal Cultural Heritage Inquiry System (ACHIS). Reported Aboriginal Heritage sites are categorised according to the assessment status of each place under the AH Act, as listed in Table 4-1.

Table 4-1: Aboriginal Heritage Site Assessment Categories

Category	Sub- Category	Assessment Status	Protected under the AH Act
Registered Aboriginal Site	N/A	Site has been assessed as meeting Section 5 of the AH Act	Yes
Other Registered Place	Lodged	Information has been received. Assessment has not been completed to determine if a site meets Section 5 of the AH Act	Yes (temporary)
	Stored Data/Not a Site	Site has been assessed as not meeting Section 5 of the AH Act	No

The results of the search indicated that the Site is located within several Registered and Lodged Heritage Places.

The Aboriginal Cultural Heritage (ACH) Registered Places at and near the Site include:

- DPLH 3407 ‘Tamala Park Trees’ located within the southeastern side of the Site;

- DPLH 3567 'Mindarie Waugal' located around the northern and eastern edges of Stages 1 and 2 ; and
- DPLH 18801 'Scarred Tree' is located within the northeastern boundary of the Site.

The Lodged Heritage Place near and within the Site include:

- DPLH 18003 'Tamala Park Waterhole' in the northeastern side of the Site;
- DPLH 18002 'Tamala Park Campsite' in the northeastern side of the Site; and
- DPLH 17497 'Mindarie Burial Mound' in the southwestern side of the Site

Due to the location of the SPC above historically disposed waste, it is not within a registered or unregistered Aboriginal Heritage Site.

4.2 European Heritage

To protect cultural heritage places in WA, the Heritage Council maintain a list of places that are either 'Statutory Listings' or 'Other Listings and Surveys'. Statutory Listings are heritage places that can affect or may affect the use and development of land and buildings and Other Listings and Surveys include heritage places that do not have any effect on the use and development of land and buildings.

A search of the Government of Western Australia Heritage Council's inHerit online database indicated that there are no European Heritage sites located within the Site or SPC development area.

5 Infrastructure Layout and Design

MRC intends to expand its Class II or III landfill activities with the construction of the SPC, which is necessary to create a final profile that is conducive to capping. This is essential to ensure the Site can meet its closure obligations and cap the landfill in accordance with best practice guidelines. The location of the SPC is shown in Figure 4.

The following sections provide further details on the design and construction of the SPC.

5.1 Infrastructure and Activities

The existing site infrastructure supports the operation of the landfill. The positioning of access roads directly into the landfill will be determined based on the location of the landfill tipping face. Internal access roads are strategically located and constructed to ensure easy access and egress from the landfill tipping area.

5.2 SPC Design

As part of its commitment to undertake best practice waste management, the MRC develops future cells in general accordance with the Victorian Environmental Protection Authority's (VIC EPA's) *Best Practice Environmental Management: Siting, Design, Operation and Rehabilitation of Landfills 2015* (BPEM Guidelines) and New South Wales Environmental Protection Authority's (NSW EPA's) *Environmental Guidelines Solid Waste Landfills* (NSW Guidelines), collectively referred to as the Landfill Guidelines.

Designing the SPC using the criteria within the Landfill Guidelines ensures that construction and operational risks are mitigated, and the environment is protected throughout the lifespan of the Site. Therefore, the SPC will consist of the following elements:

- Landfill gas collection trenches;
- 300mm Regulating Layer;
- 500mm Foundation Layer with Geogrid Reinforcement Layer;
- Geosynthetic Clay Liner (GCL);
- 2.0mm Linear Low Density Polyethylene (LLDPE) geomembrane;
- Protection geotextile;
- Aggregate Leachate Drainage Layer (incorporating a network of perforated HDPE leachate drainage pipes);
- Separation geotextile;
- Leachate collection sump comprising primary, secondary and potential future tertiary extraction points; and
- Leachate extraction system comprising:
 - Primary vertical telescopic DN1000 HDPE riser pipe; and
 - Secondary inclined dual DN450 HDPE riser pipes.

Further details are provided on the drawings contained within the Technical Specification, (the Specification Drawings) enclosed in Appendix C.

5.2.1 Design Drawings

The detailed design drawings for the SPC are provided in Appendix A. Note these designs are preliminary only and not for construction. Construction drawings will be prepared following the procurement process for the construction works.

5.3 Construction Quality Assurance and Technical Specification

To ensure the materials and construction of the SPC meet the design criteria, a Construction Quality Assurance (CQA) Plan and Technical Specification has been prepared for the SPC, which is anticipated to be constructed in the following summer, 2025 to 2026. The CQA Plan details the testing methods and quality assurance procedures to construct the SPC. The Technical Specification details the earthworks, supply and installation of the composite lining system and leachate collection and extraction infrastructure. Copies of the Technical Specification and CQA Plan for the SPC is provided in Appendix C and Appendix D, respectively.

5.4 SPC Construction

5.4.1 Existing Conditions

The proposed SPC area has previously been capped with a 0.75mm thick Polyvinyl Chloride (PVC) flexible geomembrane (on a 300mm thick regulating layer), covered with a varying thickness of sandy, gravelly, limestone soils. The thickness of the soils was investigated in early 2024 by excavating 26 trial pits at 25m spacings. The thickness of the existing capping soils ranges from less than 0.5m to over 4.5m and is presented Drawing TW23015 W-101 in the Technical Specification.

5.4.2 Earthworks

All unsuitable materials in the SPC, such as vegetation and debris, will be cleared and removed for preparing the SPC area for development. Once the vegetation and unsuitable materials are cleared any topsoil (if present other than limestone) will be removed and will be stockpiled for later use in landfilling operations.

Following the removal of topsoil, the cover soils will be excavated and stockpiled. The stockpiled soils will be tested at a National Association of Testing Authorities (NATA) accredited laboratory for its suitability of use in the construction of the SPC. Reject material will be set aside for use as daily cover.

Once the cover soils are removed from the SPC area, the existing PVC flexible geomembrane will be removed and the area will be regraded to the design formation levels in line with the design requirements.

Once the design Formations Levels has been achieved, a herringbone network of landfill gas collection strip drains (secondary collectors) connected to perforated DN160 HDPE pipework (primary collectors) will be installed with an aggregate and geotextile surround. The gas collection system is described further in Section 5.4.3.

Once the gas pipework has been backfilled, a 300mm thick Regulating Layer will be constructed as per the Technical Specification, Talis, January 2025. The contractor may elect to construct the Regulating Layer following installation of the secondary strip drain collectors and before the primary perforated pipe collectors. In this instance the contractor will be required to trench through the Regulation Layer

to install the primary collector pipework and ensure its pneumatic connection to the secondary strip drains isn't hermetically sealed.

Once the Regulating Layer is completed and the primary gas collection trenches are backfilled to the same level, a 500mm thick Engineered Fill Layer will be constructed to support the composite lining system.

The 500mm thick Engineered Fill Layer will be constructed in two layers with a Geogrid Reinforcement Layer installed centrally to provide additional tensile strength to mitigate long-term differential settlement in the underlying Stage 1 landfill waste mass. The geogrid will assist in minimising tensile forces in the lining system where differential settlement occurs. The Engineered Fill will be subject to moisture conditioning, compaction and testing to ensure that it meets the design criteria. Field density tests will be performed to monitor the quality and uniformity of the material placement and compaction. Tests will be carried out by a NATA certified laboratory and all results will be checked by the CQA Consultant and Superintendent appointed by MRC. These tests include, but are not limited to, moisture content, Atterberg limits, grading, dry density and permeability. Further details regarding the earthworks are detailed in the Technical Specification (available in Appendix C).

5.4.3 Sub-Cell Landfill Gas Collection System

A Sub-Cell Gas Collection System (SCGCS) will be installed beneath the SPC. The system will comprise a herringbone network of geocomposite gas collection "strip drains" (secondary collectors) pneumatically connected to overlying perforated DN160 HDPE pipework (primary collectors) to provide a branched arrangement as shown on the Specification Drawings..

The perforated primary DN160 HDPE pipework will be installed in a parallel arrangement, 25m apart. The annulus around the pipework will be backfilled with nominal 20-40mm diameter aggregate with a separation geotextile surround. The aggregate will allow condensate to percolate into the underlying waste mass.

The primary and secondary collectors are orientated so that the end of the collectors are always down slope. This will allow any condensate, that can't immediately percolate into the underlying waste, to travel in the opposite direction to the gas and accumulate at the end of the collectors where it may percolate into the waste mass. This design will minimise potential condensate blockages along its length.

The primary collectors will connect to solid HDPE pipe at least 5m from the toe of the slope. The solid section of pipe will be backfilled with Engineered Fill and terminated at the surface with a temporary end cap for future connection to the gas extraction system by the Landfill Gas Contractor, EDL.

The main objective of the Sub-Cell Gas Collection System (SCGCS) is to collect and extract the landfill gas from the old Phase 1 landfill which might accumulate beneath the SPC. Collected gas will be transferred to the onsite power station to prevent a build-up of pressure which may compromise the composite lining system or cause gas to migrate to surrounding sensitive receptors.

5.4.4 Composite Basal and Side Slope Lining System

To protect the surrounding environment from potential impacts relating to migration of leachate and landfill gas, a composite lining system will be constructed/installed. The key elements of the lining system are:

- Sub-Cell Gas Collection System;

- 300mm thick Regulating Layer;
- 500mm thick Engineered Fill Layer with integrated geogrid Reinforcement Layer;
- Geosynthetic Clay Liner (GCL);
- 2.0mm Linear Low-Density Polyethylene (LLDPE) double textured Geomembrane Layer;
- Protection Geotextile Layer;
- Aggregate Leachate Drainage Layer (incorporating a network of leachate drainage pipework); and
- Separation Geotextile Layer.

The design of the composite system is shown in the detailed drawings in Appendix A.

Conformance testing of the geosynthetic lining materials (GCL, LLDPE, protection geotextile and separation geotextile) will be undertaken prior to installation to ensure they meet the requirements outlined in the Technical Specification (available in Appendix C). Installation of the lining system will be undertaken by a qualified lining installer and supervised by a CQA Consultant to ensure construction of the SPC is in accordance with the CQA Plan and Technical Specification. Following completion of installation of the GCL, LLDPE, protection geotextile and leachate collection layer, a leak detection survey will be undertaken (see Section 5.4.6). Once the CQA Consultant signs off on the survey, the final layer (separation geotextile) can be installed. Further details regarding the installation of the lining system for the SPC is provided in the Technical Specification (available in Appendix C).

5.4.5 Leachate Collection and Extraction System

To protect the surrounding environment and groundwater from contamination, a leachate collection and extraction system will be constructed/installed. The key elements of the system are:

- 300mm thick highly permeable low calcareous aggregate Leachate Drainage Layer;
- DN 225 HDPE perforated primary pipework;
- DN 160 HDPE perforated secondary pipework;
- Separation Geotextile;
- 5m wide by 15m long 250mm thick reinforced concrete slab in sump;
- Primary leachate extraction – DN 1000 vertical telescopic HDPE riser;
- Secondary leachate extraction – dual DN 450 inclined HDPE Riser with one riser perforated to also act as a primary leachate collection pipe;
- Tertiary leachate extraction – target pad located between the primary and secondary leachate extraction sumps to provide a base for retro-drilling a vertical riser should the primary and secondary risers fail; and
- Leachate main for future connection to the leachate evaporation system.

The leachate collection system incorporates an aggregate drainage layer, a network of primary and secondary leachate collection pipes, and leachate collection sump. The 300mm thick aggregate drainage layer consists of low calcareous aggregate with a hydraulic conductivity of $>1 \times 10^{-3}$ m/s.

The pipe network consists of a DN 225mm HDPE perforated primary pipe connected to DN 160mm HDPE perforated secondary pipes at maximum 25m spacings. The base of the cell has been designed with a 8-18% cross falls leading to a primary collector drain with a 3-4% fall orientated along the

western edge of the cell base which will direct leachate towards the leachate collection sump located in northwestern corner of the SPC.

The leachate collection system layout and the construction details of the leachate collection and extraction system for the SPC are presented in Appendix A and described in detail within the Technical Specification in Appendix C.

5.4.6 Leak Detection Survey

A leak detection survey will be undertaken on the geomembrane layer following installation of the leachate drainage layer and before the separation geotextile installation. A dipole survey will be conducted over the surface area of the completed leachate drainage stone and on the protection geotextile-covered sideslopes in accordance with ASTM D7007 to identify any potential holes in the geomembrane. Any anomalies detected in the underlying geomembrane will be repaired by the Contractor as directed by the CQA Consultant. Further details regarding the Leak Detection Survey are provided in the Technical Specification (Appendix C).

5.4.7 Surface Water Management System

The Surface Water Management System (SWMS) for the SPC is incorporated within the Site overall SWMS, and within Conceptual Design TW21026 C-106 outlined in *Tamala Park Surface Water Management Strategy* (Talis, 2022). The surface water management layout will be presented in the full site detailed design which Talis will undertake in 2025.

The overall Site SWMS consists of drainage channels in the form of trapezoidal open swales, which will be utilised to effectively transport surface water runoff from landfill cells to infiltration basins at low points surrounding the landfill. The SPC features a raised embankment around its eastern edge with a 3% backfall away from the cell to divert any surface water around the cell to the southern edge of the landfill.

These drains will be clean earth channels, lined with rock armouring in steep sections where necessary to mitigate scouring and maintain the integrity of the swale system. In accordance with *Austrroads Guide to Road Design Part 5B: Drainage – Open Channels, Culverts and Floodways* (Austrroads, 2019), a 150mm filter layer and geotextile layer will be installed beneath the rock-lined layer. The filter layer will consist of an intermediary material with a diameter between that of the rock armour and the underlying soil. If the material does not feature any fine-grained particles, such as sands, the geotextile layer may not be required.

The layout and construction details of the SWMW for the SPC is presented in Appendix A.

5.4.8 Landfill Gas Management System

There is an extensive network of landfill gas extraction wells and pipework across the Site. The system is owned and operated by Energy Development Limited (EDL). Presently, landfill gas is collected with an active system at approximately 2,000m³/hr, which is expected to peak in 2028 following the capping of the Site. The existing power plant has been sized with sufficient contingency to accommodate additional gas generated from the remaining sections. The plant currently comprises six gas engines. The plant is a modular system which could easily be expanded as necessary, by adding additional gas engines to increase the methane destruction and power generation capacity.

Each landfill gas well is connected to a series of lateral gas main pipes that ultimately connect to the 250mm main header that rings each stage of the Site. The circular design enables gas to continually flow to the gas engines, even in the event of a blockage along the header or any of the pipes. The main header and lateral pipes are sloped against the flow of gas to facilitate the drainage of leachate and condensate, either back into the landfill or at a number of naturally low 'drop out' points where leachate/condensate is then pumped back into the landfill. This system easily allows expansion of the wellfield with new wells and lateral pipes connected into the ring main as required.

The landfill gas management system downstream of the well heads in the SPC will be developed and installed by EDL in accordance with the requirements of the BPEM Guidelines and the gas generation rates encountered.

Regular monitoring of the landfill gas management system will be undertaken by EDL, to ensure that the system is working effectively and to optimise performance.

5.4.9 Capping System and Restoration

To minimise the long term environmental and public health risks associated with the landfill, capping and restoration will be undertaken at the Site. In general accordance with the Landfill Guidelines, the key objectives of the capping and restoration to be satisfied through these works includes:

- Ensuring that all waste materials are covered to mitigate long term environmental and health risks;
- A restoration profile which will incorporate a low permeability capping layer to restrict the infiltration of rainwater into the waste mass and stop the production of leachate;
- Final fill profile and slopes are to be no greater than 1V:20H and no less than 1V:5H to:
 - Ensure the long term stability and integrity of the capping material and containment layer;
 - Promote the shedding of surface water from the landfill;
 - Provide an aesthetically acceptable landform; and
 - Minimise long term maintenance requirements.
- A system of surface water management to positively deal with any accumulation of the rainwater;
- A gas management regime to control the generation of landfill gases and reduce any significant risk of adversely impacting the surrounding environment;
- Revegetating of the landmass to blend in with the surrounding environment;
- Deliver a suitable post closure land use; and
- Phased closure of the landfill cells as the operational life of the landfill progresses.

The proposed capping system, from bottom to top, is as follows:

- 200mm Regulating layer;
- Sub-cap Gas Collection Layer (geocomposite);
- 1.5mm thick double textured Linear Low-Density Polyethylene (LLDPE) Geomembrane Layer;
- Sub-surface Drainage Layer (geocomposite);
- 1200mm of Restoration Layer, comprising:
 - 1000mm thick layer of site won subsoils; and

- 200mm thick layer of topsoil/growing medium;
- Vegetation Layer incorporating hydromulch / seeding to reduce erosion and advance revegetation.

The proposed restoration profile is outlined in the Tamala Park Closure and Post Closure Management Plan (the Closure Plan) Talis, 2021.

5.4.10 As-Built Drawings

During cell construction, an approved qualified surveyor will survey each layer of the composite liner system. This data will be used to prepare 'as-built' drawings which will be endorsed by the surveyor. The as-built drawings will include but are not limited to:

- Formation Layer levels;
- Sub-Cell Gas Collection System Layout;
- Regulating Layer levels;
- Engineered Fill Levels and slope angles for the basal liner system;
- Locations and identification marks of each geosynthetic panel, including anchor trenches;
- Locations of damaged areas and penetrations;
- Locations of patch repairs.
- Location of leachate collection and extraction pipework including connections of primary pipework to secondary pipework;
- Location and inverts of leachate extraction pipework and sumps; and
- Top of Leachate Drainage aggregate collection layer levels including mounding of material over pipework (top of bank and bottom of bank each side of mound);

5.5 Project Timeline

The current estimated timeframe for each stage is shown in Table 5-1.

Table 5-1: Project Timeline

Infrastructure	Project Stage	Timeframe
SPC	DWER Assessment	April 2025 to July 2025
	Procurement process	March 2025 to July 2025
	Lining System Construction	September 2025 to December 2025
	Waste Acceptance	March 2026
	Capping and Closure	August 2028

6 Infrastructure Operational Aspects

The following sections outline the key operational aspects of the SPC and the corresponding environmental control systems.

6.1 Class II or III Landfill

6.1.1 Waste Acceptance & Disposal

The Site is classified as Class II or III and will be licenced to accept the following waste types only, in accordance with the DWER's *Landfill Classification and Waste Definitions 1996 (as amended 2019)* and as per the Site Licence L9395/2023/1:

- Clean Fill;
- Type 1 and Type 2 Inert Wastes;
- Putrescible Waste;
- Contaminated Solid Waste (meeting criteria specified for Class II or Class III landfills); and
- Type 1 and Type 2 Special Wastes.

Upon entering and once weighed, accepted loads will be directed to the designated area for unloading or disposal in the active cell and tip face. The tip face will be clearly signed, and the site operator will ensure the load is in the correct location for the materials' appropriate management.

In the event that non-conforming waste materials are discovered within a vehicle, these will be denied access. Alternatively, if a vehicle is supposedly carrying a clean stream, such as green waste, but it is identified as being contaminated following inspection, this material will be directed to the landfill and charged the relevant disposal costs. If asbestos is identified, the contaminated load is directed to the hazardous area for special burial in accordance with the Site's asbestos management procedures.

The daily covering of the waste shall be undertaken as per Site Licence requirements. The placement of daily cover will be carried out by the Site staff and plant, as part of the environmental management processes, to discourage vermin, prevent exposure to fauna, litter, odour, dust emissions and potential impacts on amenity.

6.1.2 Operational Hours

The current hours for the Site will not change during the construction and operation of the SPC.

The business hours for the Site are:

- Monday to Sunday 8:00am to 4:45pm, including public holidays; and
- Closed on Good Friday, Christmas Day and New Year's Day.

The staff operational hours for the Site are:

- Monday to Sunday 7:00am to 6:00pm, including public holidays;
- Closed on Good Friday, Christmas Day and New Year's Day.

Member councils may access the site between 6:00am and 6:00pm. The contractor will be allowed to follow the extended hours offered to MRC's member councils

6.2 Leachate Management System

6.2.1 Existing Leachate Extraction/Monitoring points in Stage 2

Stage 2 leachate levels are currently being monitored in Risers 1, 2 and 3 located on the northern edge of Phase 1, Riser 6 located in the northwest of Phase 2, and Risers 1A, 2A and 3A located on the southern edge of Phase 3. The leachate management system enables leachate to be pumped from Risers 1, 2 and 3 in Phase 1, from Riser 6 in Phase 2 and Risers 1A, 2A and 3A in Phase 3. Leachate from Phase 3 is pumped to one above ground storage tank located adjacent to the southeast corner of Stage 2 where it can be redistributed for irrigation or evaporation in the existing leachate evaporation mats.

6.2.2 Additional Leachate Generation from the SPC

In 2022, Talis undertook a water balance and sized two ponds, a leachate storage pond and a leachate evaporation pond. Talis has recently updated the Site's water balance to determine the site has sufficient treatment capacity to reduce the volume of leachate currently stored in the Stage 2 landfill and treat additional leachate generated from the proposed SPC during its operation and post-closure.

Leachate generation will be at its highest following commissioning of the SPC, but will significantly reduce but not cease following the final phase of capping.

The leachate generation modelling assumed a 'worst case', peak leachate generation scenario in terms of open catchment, comprising the SPC commencing operation prior to the capping of the Stage 2 landfill. It also comprised two 90th percentile rainfall years followed by three years of 50th percentile rainfall. The modelling found that two leachate ponds with a combined operational volume of approximately 50,000m³ was sufficient to cater for the remaining operational life of the site when the generation rate is at its peak. Leachate generation will reduce substantially following the final phase of capping and complete landfill closure.

The ponds also passed the storm check to accommodate a 24-hour, 1-in-20-year storm event without overflowing. The water balance is attached in Appendix F.

6.2.3 Leachate Collection System

The SPC will include a leachate collection system consisting of 300mm thick non-calcareous aggregate and a network of primary and secondary perforated HDPE collector pipes. The leachate is collected in the aggregate layer and pipes and transmitted to the sumps at the lowest point of the cell.

Collectively, the gravel layer and collection pipes offer an effective long-term solution for the collection and quick extraction of leachate from the base of the SPC. The layout of the leachate collection system is provided in Appendix A.

6.2.4 Leachate Extraction System

Once the SPC is constructed, a submersible pneumatic pump, installed inside the primary 1000mm diameter leachate extraction riser pipe of the cell, will extract leachate automatically when sufficient head is present over the pump's inlet. The pumps, which use the direct air displacement method, are fitted with a built-in level sensor which triggers the controller to feed air from an air compressor into the submerged pump chamber to displace the leachate. This direct air displacement method enables

the system to self-regulate, operating at the very low flow rates (0-1L/s) as is typical in landfill applications, extracting small quantities of leachate as soon as enough is present at the sump.

The hydraulic head of leachate over the landfill liner surface will be managed during the landfill operation in general accordance with Landfill Guidelines requirements through extraction of leachate from the sump. Leachate levels on the base of the SPC will be maintained as low as reasonably practicable with a maximum 1m depth on surface of the basal liner and depth of 1.5m within the leachate sump.

The design incorporates the following options for leachate extraction:

- Primary leachate extraction via vertical telescopic riser: a vertical telescopic riser will be extended progressively, from the base of the SPC to the final fill height, as waste lifts are placed. The telescopic design comprises outer and inner riser sections connected with shear pins. This allows the pipes to slide over each other during settlement and reduce the down drag forces acting on the sump;
- Secondary leachate extraction via inclined risers: dual inclined risers will be installed from the sump, across the base of the SPC, and up to the crest of the eastern side slope. The risers will be secured at the crest via a cast in-situ concrete headwall. The southern riser pipe will be perforated to also act as a primary collection pipe; and
- Tertiary leachate extraction: An extended slab will be constructed between the primary and secondary riser slabs. The extended slab will act as a target pad for retro-drilling in the event that the primary and secondary risers become inoperable and a tertiary vertical riser need to be installed.

The leachate extracted from the SPC will be transferred to the leachate evaporation system via a solid, butt-fusion welded, HDPE pipe rising main.

The final design of the leachate conveyance system is to be confirmed following detailed design works by the specialist contractor.

6.2.5 Leachate Evaporation System

As outlined in the EPN LMP and the Water Balance LMP attached in Appendix F, the Site has a temporary leachate evaporation system located in the southern portion of Stage 2 Phase 1. Since these ponds will need to be decommissioned during the next phase of capping, Council is looking to develop a new LMA in the existing quarry area. The LMA system will consist of two ponds. Pond 1 to be designed as a deeper storage pond from which leachate will be transferred to the shallower Pond 2 for evaporation. Each pond will be lined with a GCL overlayed with a 2.0mm HDPE geomembrane and would be constructed to a depth of approximately 2.7-4.9m and 1.7m and with the cut faces at a gradient of 1H:3H and 1V:2.5H, for the storage pond and the evaporation pond respectively. The geosynthetic lining materials will be secured in a 0.6m deep anchor trench around the perimeter of each pond. The ponds will be fully enclosed by a chain-link security fence and will have one access point secured by a double-gate. Pond 1 will have a base sloped towards a low point that allows for easy extraction to undertake any maintenance works and to pump leachate into Pond 2 that will have a flat base and will be maintained at optimal levels to maximise evaporation potential.

To manage ingress of surface water into the leachate evaporation ponds, the crest of each pond will slope away from the pond perimeter to divert surface water away from it.

The ponds will be constructed and operated in general accordance with the Landfill Guidelines. The Water Balance LMP did not account for evaporation maximisation methods, such as leachate aeration, drip irrigation, spray atomisers, to ensure the model was developed with a further element of conservatism. Due to public concerns regarding multiple odour sources at the Site, MRC will commission the ponds and operate them and monitor odour for an initial trial period prior to installing any forced evaporation systems.

6.2.6 Additional Monitoring and Management Measures

To minimise leachate generation within the SPC, the active tip face and daily cover requirements will be maintained as per the Site Licence.

The leachate collection system for the SPC will be regularly inspected, maintained, and repaired when necessary. Leachate monitoring will be undertaken on a regular basis to ensure the leachate collection and extraction system is operating effectively, to determine the head and quality of leachate, and to ensure compliance with assessment criteria and compliance limits.

The current leachate monitoring and sampling regime will be adopted to incorporate the SPC, once operational.

6.3 Landfill Gas Management

The landfill gas management system at the Site is comprised of the following infrastructure elements:

- Extensive network of landfill gas collection wells (Horizontal, Vertical and Perimeter);
- Gas mains;
- Condensate dropout points (barometric traps), where condensate and leachate are returned to the landfill; and
- Methane destruction and power generation through a 6 MW power plant located to the south of the Stage 2 landfill.

The wellfield is monitored, maintained and expanded on a regular basis, resulting in an optimisation of landfill gas capture for environmental control.

The SPC landfill gas management system will comprise the connection of the Sub-Cell Gas Collection System described in Section 5.4.3, which EDL will connect to the existing landfill gas main which is connected to the existing power plant managed by EDL. Once the SPC becomes operational and following filling, further horizontal and vertical gas collection wells will be installed and progressively connected to the power station.

6.4 Surface Water Management

The SWMS for the SPC is incorporated within the Site overall SWMS, and within Conceptual Design TW21026 C-106 outlined in *Tamala Park Surface Water Management Strategy (Talis, 2022)*.

The overall surface water management for the Site consists of a series of perimeter swale drains along the boundary of the landfill cells. The surface water run-off will then be directed into surface water infiltration basins located around the perimeter of the Site. Currently, the first infiltration basin is being constructed as part of the Stage 2 West Capping Works. MRC intend to develop the surface water drainage and infiltration basins for previously capped stages as the Site is progressively capped.

Regular site maintenance and repairs of drains and other associated surface water management infrastructure will be undertaken. Site staff will also inspect the system for evidence of contamination, excessive sedimentation and structural integrity of the system on a regular basis.

Water within the future surface water infiltration basins will also be monitored to ensure compliance with the Site Licence and to identify any environmental issues that may impact the surrounding environment. Due to the absence of surface water basins, or pooling of surface water in general due to the permeable nature of the soils, the Site does not require surface water sampling to be undertaken. The layout and construction details of the SWMS for the SPC are shown in Appendix A.

7 Environmental Aspects and Management

The potential for the expansion of Class II or III landfill operations to impact on a number of key environmental and social aspects is well recognised with the development of the SPC. The potential impacts associated with each key aspect are discussed in the following subsections, namely:

- Surface water;
- Leachate;
- Groundwater;
- Air emissions, including:
 - Landfill Gas;
 - Odour;
 - Dust;
 - Noise; and
 - Asbestos.
- Geotechnical Stability;
- Litter;
- Vermin and Feral Animals;
- Weeds;
- Fire; and
- Security.

The potential impacts to these aspects and the proposed controls and measures to manage the potential impacts are outlined in the following subsections.

7.1 Surface water

As stated within Section 3.6 and as required by Condition 17 of the Licence, stormwater must be diverted away from active landfill cells and leachate ponds into dedicated stormwater swales. Stormwater swales are to be kept clear of any waste to allow effective draining as per Condition 17 of the Licence.

To manage surface water outside the footprint of the SPC, surface water swales will be installed around cell's perimeter as required and will direct water to infiltration basins. Sediment would be captured within these ponds before the water is infiltrated into the underlying soil profile. In case of greater storm event, controlled release into the environment is done via a notched weir outfall.

The Site licence does not require surface water sampling to be undertaken. Routine inspections are undertaken to check for performance, maintenance and repairs.

Any surface water that interacts with the landfill cells will be classified as leachate and would be collected via the leachate collection system prior to evaporation in the Site's leachate evaporation ponds.

7.2 Leachate

As outlined in Section 5.4.5, leachate will be collected in the leachate collection system designed for the SPC. Leachate will be pumped from the sumps by automatic pneumatic pumps with the ability to manually override the system if required. Leachate extraction points are checked regularly to ensure pumps are operating effectively and the leachate head within the SPC is kept to a minimum. The leachate will be transferred from the sumps via pipework to the LMA located in the quarry area, which is shown in Figure 4.

7.2.1 Leachate Generation Modelling

To ensure the leachate pond system has the appropriate capacity, the potential volume of leachate that will be generated by future landfilling activities must be modelled. The modelling for the Site aims to determine the 'worst case' scenario for leachate generation, which is later used as an input for the Water Balance Assessment. Leachate generated from each cell is dependent on the presence of the capping system, the capping design, the surface area of the cell, and rainfall into the cell during a set period. Other contributing factors to leachate generation include evaporation from the cell surface, solar radiation, relative humidity, and the presence of any vegetation on the uncapped waste profile.

Therefore, the proposed leachate modelling has been designed to manage the following 'worst case', peak leachate generation scenario:

- Two 90th percentile rainfall year followed by three years of 50th percentile rainfall; and
- The landfill reaching its final stages of development.

This scenario represents a very conservative approach that attempts to model the peak leachate generation rate at the Site when the largest area of the landfill containing waste remains uncapped and the capped areas continue to produce leachate. Further details on the generation modelling are discussed in the following sections.

7.2.2 Data Inputs

The potential generation of leachate volumes from the Site landfill was modelled using the Hydrologic Evaluation of Landfill Performance (HELP 3.95D) software program. The HELP program is a quasi-two-dimensional hydrologic model of water movement across, into, through and out of landfills. It requires weather, soil and design data and uses solution techniques that account for the effects of surface storage, runoff, infiltration, evaporation, vegetative growth (where vegetated), soil moisture storage, and seepage through soil, geomembrane or composite liners.

The details and justification of the data selection for the HELP model are discussed in the following sections.

7.2.2.1 Landfill Cell Design

Two significant factors in determining leachate generation rates are the overall landfill surface area and the combination of layers, including the capping system, waste mass, and basal lining system. The landfill surface area acts as the catchment for rainfall infiltration, which is maximised when the landfill remains uncapped. The design and configuration of these layers, along with their specific installation areas, influence the infiltration rates and must be carefully considered during the assessment.

The conditions within each zone vary depending on the stage of the project, as areas transition between capped and uncapped states over time.

The landfill surface areas and associate profiles that are proposed for the Site are outlined in Table 7-1 and shown in Drawing W-403 (Appendix A).

Table 7-1: Landfill Cell Design Parameters

Landfill Aspect	Surface Area (m ²)	Location	Design
Zone 1	40,000	Stage 2 Phase 1	- Basal lining: Basal Lining System #1 - Capping system: Capping System #1 – Capped
Zone 2	144,000 (West 35,500 Central 95,000 East 13,500)	Stage 2 Phase 2 and 3	- Basal lining: Basal Lining System #1 - Capping system: Capping System #2 – Uncapped / Capped
Zone 3	28,000	Corresponds to the new cell, the SPC	- Basal lining: Basal Lining System #3 - Capping system: Capping System #2 – Uncapped / Capped - During the assessment period, the first year this zone will be under construction
Zone 4	9,250	Southern part of the Northern Piggyback	- Basal lining: Basal Lining System #2 - Capping system: Capping System #2 – Uncapped / Capped
Zone 5	3,250	Northern part of the Northern Piggyback	- Basal lining: Basal Lining System #2 - Capping system: Capping System #1 - Capped

7.2.2.2 Landfill Capping Scenarios

Over the five-year evaluation period for the water balance, the landfill will experience various scenarios. The landfill will be capped in three progressive stages, with periods where significant areas remain uncapped, impacting leachate generation and water management and the SPC will commence operations.

This assessment period captures the worst-case scenario for the Site, characterized by the largest uncapped surface area. The specific phases, along with their dates and descriptions, are summarized in Table 7-2.

Table 7-2: Landfill Capping Scenarios

Scenario	Start Date	End Date	Description
Scenario 1	Jan 2025	Dec 2025	Current scenario, with Stage 1 Phase 1 capped and the western section of Stage 2 Phase 2 capped. SPC not operational.
Scenario 2	Jan 2026	Dec 2028	The SPC becomes operational, and the capping of the central section of Stage 2 is implemented.
Scenario 3	Jan 2029	Dec 2029	Final capping of the landfill, covering the eastern section of Stage 2, the SPC, and the remaining portion of the Northern Piggyback.

7.2.2.3 Evapotranspiration

Evapotranspiration was calculated in the HELP model based on the transfer and balance of energy in the environment which included relative humidity and average daily wind speed data. Soil evaporative zone depth, maximum leaf area index and growing season data were also included in the model.

The evaporative zone depth was defined as 50 centimetres (cm) for capped areas and 30cm for uncapped. In reality, the evaporative zone depth would vary due to changes in compaction rates, exposure to the weather, type of waste and initial moisture content. The operational evaporative zone depth was elected conservatively as to determine the upper limit of leachate which would require management.

The HELP model applies a maximum leaf area index to define the ratio of the leaf area of actively transpiring vegetation. The operational phase of the landfill was modelled with zero (0) representing bare ground leaf area index in the uncapped area and 1 for the capped area.

In the HELP model user guidelines, the growing season is defined as when the normal mean daily temperature rises above 10°C. As shown in Section 3.1, the average daily temperature near the Site does not drop below 10°C, and thus the growing season was designated for the whole year.

7.2.2.4 Curve Number

HELP modelling requires a user-defined Curve Number (CN) which is an empirical parameter for predicting runoff, the HELP user guide provides a table for typical runoff curves based on the stand of grass and soil texture. The lowest runoff curve number accepted in the HELP model, 0.1, was assigned to represent little to no runoff occurring during storm events.

7.2.2.5 Layer Design

The different soil layers used in the HELP model for each of the capped and uncapped zones are detailed in Appendix F.

The placement quality of the HDPE in the uncapped landfill cells will not affect leachate generation rates; however, this variable has been assumed as 'Good' for the purpose of the modelling. A 'Good' HDPE placement quality assumes good field installation with well-prepared, smooth soil surface and geomembrane wrinkle control to ensure good contact between the geomembrane and the adjacent soil that limits drainage rate. It is assumed that there is no subsurface inflow for any of the layers.

7.2.3 Leachate Generation

To understand the future leachate generation volumes from Zones 1 to 5 under varying rainfall scenarios, the HELP model was run for 5 consecutive years, as follows:

- Years 1-2: 90th percentile 'wet' rainfall years
- Years 3-5: 50th percentile 'average' rainfall years

This ensures that the Site's leachate management infrastructure is capable of managing leachate generated under consecutive wet years without overtopping, with leachate levels returning to lower levels once wet conditions abate. Although the exact installation date of the evaporation ponds is not determined, the model assumes initial conditions beginning in 2025 to reflect a conservative worst-case scenario, as the central section of Zone 2 remains uncapped, making it the largest uncapped area at the Site.

Table 7-3 summarises the predicted monthly leachate generation volumes, calculated over the 5-year period for Zones 1 to 5. The complete results and inputs of the HELP modelling are available in Appendix F.

Table 7-3: Yearly Leachate Generation (m³)

Year	Zone 1	Zone 2 - West	Zone 2 - Central	Zone 2 - East	Zone 3	Zone 4	Zone 5	Total
1	2,781	694	26,969	3,832	0	2,626	230	37,132
2	2,666	663	1,775	3,832	7,949	2,626	220	19,732
3	1,922	525	1,404	1,944	4,031	1,332	158	11,315
4	1,922	522	1,397	2,063	4,278	1,413	159	11,754
5	1,922	522	1,396	198	327	62	159	4,586

Green: The zone is capped;

Blue: The zone remains uncapped;

Orange: The zone is under construction or not yet operational.

During the 90th percentile wet year with the central and east areas of Zone 2 uncapped, as well as Zone 4 uncapped, the Site is predicted to generate approximately 37,132m³ of leachate per annum.

With the capping of the central area of Zone 2 (Central Stage 2 Phase 2) and the inclusion of Zone 3 (SPC), leachate generation decreases to 19,732m³ in the second consecutive wet year. In subsequent years, under 50th percentile average rainfall conditions, leachate generation is projected to decline further to approximately 11,315m³ per annum. Once the landfill is fully capped, the evaporation ponds are estimated to maintain an annual surplus evaporation capacity of approximately 7,000m³, which will contribute to the long-term reduction of leachate volumes.

This progression highlights the importance of progressive capping and site design in reducing leachate generation volumes over time. As more areas of the landfill are capped, and waste is added to active zones, the effective uncapped surface area decreases. This results in lower rainfall infiltration and increased waste absorptive capacity, making leachate generation levels more manageable in the longer term.

7.3 Water Balance Assessment

A Water Balance Assessment was utilised to determine the appropriate size of the proposed leachate evaporation ponds and to assess their subsequent performance. Using a Microsoft Excel algorithm, the assessment presented a simplified input and output system based on the following:

- Inputs:
 - Monthly rainfall
 - Additional leachate generated from rainfall
- Outputs:
 - Evaporation

7.3.1 System Inputs

The leachate generation volumes presented in Table 7-3 were utilised as part of the Water Balance Assessment for the ponds as well as the monthly rainfall for 50th and 90th percentile rainfall years. As

detailed in Section 3.1, the 90th percentile rainfall scenario equates to an annual rainfall of 857mm and the 50th percentile rainfall scenario was calculated as 716mm.

The system does not explicitly model the leachate currently stored in the landfill. However, this volume will be progressively managed during the operational phase by taking advantage of dry months to reduce pond levels and ensuring that the system enters wet months with as much capacity as possible. The operation of the leachate pond system is described in detail in Section 6.2.5.

7.3.2 System Outputs

To quantify the amount of leachate evaporated each year, the following parameters were assumed:

- The freeboard was set at 500mm to determine the operational volume of each pond;
- The actual evaporation rate was assumed to be 70% of the potential pan evaporation rate;
- No rainfall within an evaporation pond's catchment area was lost to run-off; and
- For the purpose of the calculations, the evaporation area was set at a 700mm freeboard for each evaporation pond.

No evaporation maximisation methods, such as leachate aeration, drip irrigation, spray atomisers, have been assumed as part of the Water Balance Assessment, to ensure the model was developed with a further element of conservatism.

The model allows for additional leachate to be processed; however, the exact volume that can be treated will depend on rainfall patterns, evaporation rates, and available pond capacity during dry months.

Details on the system outputs are provided in Appendix C.

7.3.3 Assessment Results

The Water Balance Assessment determined that two leachate evaporation ponds are required to effectively manage leachate volumes at the Site. The assessment results informed the design, which consists of a dual-pond system within the LMA. Pond 1 is designed as a deeper storage pond from which leachate will be transferred to the shallower Pond 2 for evaporation. All Drawings for the proposed leachate evaporation pond system have been provided in Appendix A.

During a 50th percentile rainfall year, the proposed pond system is expected to achieve a balanced water outcome, with leachate generation matched by evaporation capacity. Once the landfill is fully capped and leachate generation is reduced significantly, this additional capacity will increase to 7,000m³ per year, further aiding in the reduction of the leachate volume currently stored within the landfill cells. The results of the modelling are provided in Appendix C.

Typical construction details for the leachate evaporation pond system can be seen in Drawing C-310 (Appendix A). The design characteristics of the evaporation ponds are provided in Table 7-4.

Table 7-4: Leachate Evaporation Pond Design Characteristics

Pond	Catchment Area (m ²)	Evaporation Area* (m ²)	Operational Volume ^o (m ³)	Total Volume (m ³)
Pond 1	21,837	18,844	31,413	41,239

Pond 2	16,803	15,834	18,355	26,582
Total Capacity	38,640	34,678	49,796	67,821

*Maximum Evaporation Area is considered to be at 700mm freeboard from pond crest.

° Operational Volume is considered to be at 500mm freeboard from pond crest.

7.3.3.1 Storm Event Check

The BPEM Guidelines state that a leachate pond must maintain a freeboard sufficient to accommodate rainfall from a 24-hour, 1-in-20-year storm event without overflowing. This requirement has been addressed as a storm event check within the Water Balance Assessment. The storm event was incorporated into the Water Balance Assessment to verify whether the cumulative residual volume in each pond has sufficient capacity to accommodate the storm event, in addition to normal rainfall and leachate inputs for any given month, while remaining below the freeboard level.

The Annual Exceedance Probability (AEP) for a 24-hour, 1-in-20-year storm event was calculated as 97.1mm, as indicated in Table 7-4. The Water Balance Assessment confirmed that the proposed pond system has adequate capacity to manage this storm event while also handling normal system inputs during an average rainfall year.

The results of the Water Balance Assessment with the storm event check are provided in Appendix C.

7.4 Groundwater

As outlined in Section 5.4.4, a composite lining system will be installed in the SPC which will be designed in accordance with the criteria within the Landfill Guidelines and global best practice, which is a significant improvement on other historical Class II or III landfill cells within the Site. One of the key purposes of the lining system and leachate extraction system is to protect the surrounding environment and groundwater from impacts caused by the leachate.

Groundwater monitoring is undertaken to ensure that in the event the integrity of the lining system is comprised and leachate seeps from the landfill cell, contamination can be detected early. Groundwater is monitored on a bi-annual and annual basis and results are reported as required by Condition 37 of the Licence. Throughout the lifespan of the Site, groundwater will continue to be monitored at all bore locations in the network.

There are no monitoring bores within the SPC development footprint. 17 existing monitoring bores are located down-hydraulic gradient of the SPC, and 16 bores are located up-hydraulic gradient. All of these bores will continue to be monitored as per the Licence conditions to highlight any potential impacts to groundwater from the existing and proposed SPC.

7.5 Air Emissions

7.5.1 Landfill Gas

The decomposition of the organic content within the waste stream will result in the generation of landfill gas which contains methane, carbon dioxide and other volatile organic compounds. These gases contribute to the effects of climate change, produce an odour, reduce amenity, impact human health and present explosive risks.

To ensure these impacts are mitigated, there is an extensive network of landfill gas extraction wells and pipework across the Site. Through an active vacuum system, the network removes landfill gas from the Class III landfill cells and transfers it to the Site's power plant.

Horizontal landfill gas wells will be installed progressively to collect and capture gas emissions in the SPC, as required.

7.5.2 Odour

Odours are generated from a range of sources including the acceptance/transport of putrescible waste, greenwaste activities, leachate evaporation ponds and exposed waste prior to the application of cover material. To mitigate odours there are a range of management measures currently employed which include:

- Installation of a landfill gas management system;
- Consideration of meteorological conditions during material handling;
- Regular maintenance and monitoring of the leachate treatment system;
- Covering of waste during transport;
- Daily cover and compaction of waste as per the Site Licence;
- Immediate burial of highly odorous wastes on acceptance at the weighbridge;
- Management of leachate evaporation and irrigation operations during favourable weather conditions; and
- Odour complaint system and follow-up investigations/actions.

These management measures will continue to be applied during the operation of the SPC and are anticipated to be sufficient to effectively manage odour emissions from the Site.

7.5.3 Dust

Dust will be generated during the construction and operation phase of the SPC as a result of clearing, earthworks and handling of materials. Excessive dust generation can impact local air quality causing respiratory impacts and reduced vision. To manage dust generation, the MRC currently implements a range of measures, including:

- Vehicles to maintain minimum speed limits;
- Use of a water cart as necessary;
- Covering of waste during transport; and
- Appropriate handling and unloading of waste to minimise dust generation.

These measures are anticipated to allow the MRC to effectively manage potential impacts relating to dust and will continue to be implemented during the construction and operation of the SPC.

7.5.4 Noise

Noise will be generated during the construction and operational phases of the SPC as a result of vehicle and machinery activities. To reduce noise impacts, MRC currently implements a range of management measures, including:

- Site operations hours are restricted to 7:00am to 6pm Monday to Sunday and closed on good Friday, Christmas day and New Year's day;
- Regular maintenance of mobile machinery and equipment; and
- All staff provided with and trained in the use of appropriate Personal Protective Equipment (PPE).

These measures will continue to be implemented during the construction and operation of the SPC and are expected to allow MRC to adequately manage the potential noise impacts at the Site.

7.5.5 Asbestos

Asbestos is a hazardous fibrous substance which can occur within waste materials, particularly Construction and Demolition (C&D) wastes such as building rubble. Asbestos poses a potential risk if fibres become airborne and are breathed into the lungs. Serious health impacts may occur, often as a result of significant exposure to asbestos, including mesothelioma, lung cancer and asbestosis.

MRC accepts asbestos and asbestos containing materials for burial into a designated asbestos disposal area, as per the Site Licence. Any asbestos contaminated waste loads will be managed and when relevant, will be buried within the asbestos disposal area as per the Site's Licence.

In addition to MRC's Licence requirements, several management measures are implemented to ensure that risks associated with the acceptance of asbestos are minimised. These include:

- All asbestos and asbestos containing materials accepted at the Site are placed in the designated disposal area and covered with 1000mm of inert waste type 1, clean fill, or putrescible waste as soon as practicable on the same working day, as per the Site Licence;
- Any asbestos contaminated waste loads will be managed and when relevant, will be buried within the designated asbestos disposal area;
- All staff are trained in the appropriate inspection, handling and disposal of asbestos materials; and
- All staff provided with and trained in the use of appropriate PPE.

These management measures, along with the existing Licence conditions, are expected to be sufficient to minimise the risks associated with asbestos.

7.6 Geotechnical Stability

The geotechnical stability of the landfill is a key factor that may impact the integrity of the landfill environmental controls. Loss of integrity to the landfill liner can result in contamination of groundwater and soils. An assessment of the underlying soil characteristics and, in the case of a piggyback cell, also the waste's behaviour is critical to understanding the stability risks and to define appropriate engineering requirements.

The stability risk assessment is intended to provide sufficient confidence that stability is assured, and the integrity of the SPC will be maintained through construction, operation, closure and the post-closure lifecycle. The assessment includes risk screening to determine the geotechnical analysis required with respect to the natural geology, waste stream, and proposed engineering works for the basal, side slope, and waste mass. The assessment also considers monitoring and risk management systems to be implemented across the lifecycle of the SPC.

The basal slopes of the SPC are steeper than a traditional landfill cell as they generally follow the fill profile of the historical Stage 1 landfill that the SPC is located above. All basal and side slope grades comply with the Landfill Guidelines, and Site specific engineering controls for the subgrade were developed with due consideration of the underlying settleable waste mass. The proposed slopes will allow for the transmission of leachate to the drainage sump following differential settlement.

The SPC design features a 300mm compacted Regulating Layer, 500mm Engineered Fill layer with geogrid reinforcement layer, composite geosynthetic lining system, 300mm leachate collection layer incorporating a network of perforated leachate collection pipes connected to primary and secondary leachate extraction risers with capability to install tertiary extraction in the future should it be required.

In addition, the proposed landfill closure profile consists of maximum 1V:4H pre-settlement grades on the side slopes. The closure profile was previously assessed in the Capping Stability Risk Assessment (Capping SRA), Talis, (June 2021), provided to DWER to support the Closure and Post-closure Management Plan (Closure Plan), Talis, (June 2021) and is not repeated herein.

A summary of the key findings of the SPC SRA, enclosed in Appendix E, is presented in the following sections.

7.6.1 Seismic Conditions

All limit equilibrium FoS calculated during the seismic conditions assessed are in excess of the minimum values for both peak and post peak scenarios and therefore deemed acceptable.

7.6.2 Basal & Sideslope Lining System Analysis

The SRA considered the north-south 1V:3H (southern) sideslope to the lower tie-in to Stage 2 liner, and the east-west piggyback liner towards the proposed extraction sumps. The Factors of Safety (FoS) for both slopes exceeded the minimum requirements under static (FoS >1.5), seismic loadings OBE 1:475 AEP (FoS >1.1) and SEE 1:1000 AEP (FoS >1.0) for circular and non-circular failure modes under drained and undrained conditions.

The lowest topographic levels are approximately 27m above the inferred maximum potentiometric head across the site, therefore the risk of basal heave is not considered a viable failure mechanism.

The short-term and long-term stability of the side slope has been analysed, and acceptable factors of safety have been determined.

Analysis for the interface assessment with regards to gas pressure upon the piggyback lining system has shown, for the interfaces and the gas pressure considered, that a factor of safety of 5.43 exists for peak and 4.14 for post peak conditions on the 1V:8H southern piggyback liner, which is considered acceptable.

The unconfined liner interface stability assessment found that the unconfined liner interfaces are considered acceptable with regards to FoS and tension. The generation of potential tensions in the geosynthetic lining system are more applicable to the construction activities, aggregate placement in the 1V:3H sideslopes.

Analysis found that a CAT D6R LGP bulldozer operating on a 300mm thick layer of aggregate on the 1V:8H geosynthetic slopes returned a FoS of 0.89 which is below the acceptable limit of FoS >1.3. As

such, aggregate placement will need to employ alternative plant such casting by excavator from 1m thick haul roads and/or final spreading by lighter plant such as a positrack at reduced depths.

7.6.3 Waste Mass Analysis

The stability assessment utilised an inferred filling profile with benches in the temporary waste slope. The Factors of Safety (FoS) exceeded the minimum requirements under static (FoS >1.3), seismic loadings OBE 1:475 AEP (FoS >1.1) and SEE 1:1000 AEP (FoS >1.0) for drained non-circular failure modes. The calculated factor of safety for the temporary waste slopes are considered acceptable.

7.6.4 Liner Integrity Assessment

The key issue for the proposed SPC lining system will be development of strains within the lining system due to loading and settlement of the overlying and underlying waste masses. A FLAC2D finite difference model was developed to consider the degree of strains likely to develop within the lining system, in particular the LLDPE geomembrane. The finite difference FLAC2D liner integrity analysis demonstrate that maximum axial strain of 2.75% is significantly lower than the maximum allowable LLDPE geomembrane strain values for LLDPE density <0.935 g/cm³, LLDPE density >0.935 g/cm³, LLDPE randomly textured, and LLDPE structured profile are 12%, 10%, 8% and 10% respectively, and are therefore considered acceptable.

Both the Capping SRA and the Cell Development SRA are provided in full in Appendix E.

7.7 Litter

Litter may be generated during the transport and handling of waste, causing impacts to amenity. To minimise the impacts from litter, the following management measure are currently implemented onsite:

- Maintenance of 1.8m high fencing;
- Use of litter screens at the tipping face and / or within the landfill cell;
- Daily compaction and covering of waste; and
- Regular removal of windblown waste from fences and access roads.

These management measures will continue to be applied during the operations of the SPC and are anticipated to be sufficient to manage potential impacts associated with litter.

7.8 Vermin and Feral Animals

Due to the types of waste accepted, water sources and surrounding bushland, feral animals and vermin such as cats, foxes, rabbits, mice and rats have the potential to be attracted to the Site. Several management activities relating to vermin and feral animals will be undertaken, including:

- Application of adequate cover material;
- Regular monitoring for vermin and feral animals; and
- Vermin control such as baiting and trapping.

These management measures are expected to be sufficient to adequately manage risks associated with vermin and feral animals.

7.9 Weeds

Weed species have been recorded in cleared or disturbed areas within the Site. The MRC currently implements a range of management measures to ensure that weed populations do not spread, which include:

- Routine weed inspections; and
- Control measures (herbicides and physical removal) are undertaken several times per year as required and prior to flowering periods.

These management measures are expected to be sufficient to adequately manage risks associated with weeds.

7.10 Fire

There are a variety of fuel sources for fires at the Site, including waste in the active landfill areas, machinery, greenwaste stockpiles and Site vegetation. MRC uses a variety of management measures to ensure that the risk of fires at the Site is minimised. These include:

- Fire response infrastructure and equipment, including water hydrant, mobile water carts, fire extinguishers and fire breaks located around the Site;
- As stipulated by Condition 16 of the Licence, an adequate water supply and a means of distribution to be provided at all times for the purposes of firefighting;
- Pursuant to Condition 34 of the Licence, MRC makes a record of any unauthorised fires that occur;
- Fire safety measures reviewed annually; and
- All staff trained in appropriate fire response techniques.

These management measures are expected to be sufficient to manage the risk of fires at the Site and will continue to be applied during the operations of the SPC.

7.11 Traffic

The proposed operations will result in continued traffic movements to and from the Site and on the surrounding road network. Onsite traffic movements have the potential to generate noise, dust and create an occupational health and safety risk to staff. To minimise any potential impacts of traffic movements at the Site, the following management measures will be implemented:

- A one-way system will facilitate free flowing movement of community visitors through the Site's Recycling and Reuse Shop and Waste Transfer Station areas;
- Authorised access to certain areas around Site;
- Signage providing directions, traffic control measures and safety instructions will be established and maintained at appropriate locations around the Site;
- Vehicles will be restricted to a maximum speed limit of 10km/hour, unless otherwise signed;
- Employees and contractors shall wear high visibility and reflective clothing when working at the Site;
- All vehicles will be maintained in good working condition and drivers instructed to use conservative driving techniques;

- Two-way radio communications adopted; and
- All employees and contractors will be inducted with the Site Occupational Health and Safety (OHS) and traffic management procedures.

Through the adoption of these management measures, all potential impacts associated with traffic movements on and surrounding the Site will be controlled to appropriate standards.

7.12 Security

A breach of security may result in injury to persons or damage to infrastructure. To minimise potential security the following management measures are implemented:

- Appropriate signage is installed at the Site entrance;
- Lighting and CCTV is installed in relevant areas of the Site, including at the main Site access road and key buildings;
- A perimeter fence is installed around the Site and is monitored and maintained on a regular basis; and
- All access gates and buildings are locked securely outside of operational hours.

These are anticipated to allow MRC to effectively manage any risks associated with the security at the Site.

7.13 Rehabilitation

Following completion of the capping system, the landfill cells will be rehabilitated using native species. The key stages of the rehabilitation works are:

- Drainage works, contour banks, topsoiling and scarifying;
- Direct seeding by manual broadcasting of seed;
- Staking and tree guarding;
- Weed control and general maintenance; and
- Revegetation monitoring using permanent transects and quadrants.

Progressive rehabilitation at the Site will be undertaken in accordance with the Landfill Guidelines and the Bush Forever requirements.

As required by Condition 4 of MRC's Licence, rehabilitation will take place within 6 months after disposal into the new cell has been completed.

7.14 Environmental Management Summary

A summary of the environmental management measures is provided in Table 7-5.

Table 7-5: Summary of Environmental Management Measures

Aspects	Management Measures
Surface Water	• Surface water management system:

Aspects	Management Measures
	○ Surface water swales around cell's perimeter; and ○ Infiltration Basin. ● Ongoing surface water monitoring.
Leachate	● Leachate collection system within the SPC, designed using the criteria within the Landfill Guidelines, including: ○ 300mm aggregate drainage layer; ○ primary and secondary pipe network (DN225mm and DN160mm HDPE); ○ no less than a 1-3% base slope; and ○ collection sump which includes primary, secondary and future tertiary extraction option. ● Leachate extraction system, including: ○ Primary DN1000mm vertical riser; ○ Secondary DN450mm dual inclined risers; ○ Submersible pumps; and ○ Solid HDPE pipe rising main to the Site's proposed centralised LMA. ● Ongoing monitoring in accordance with the LMP.
Groundwater	● Composite lining system designed in accordance with the criteria within the Landfill Guidelines; ● Ongoing bi-annual and annual monitoring in accordance with Condition 30 of the Site Licence; and ● Reporting in accordance with Condition 36 and 37 of the Site Licence.
Landfill Gas	● Progressive installation of horizontal and vertical landfill gas wells as part of a proactive landfill gas extraction system; ● Monitoring in accordance with Condition 31 of the Site Licence; and ● Reporting in accordance with Condition 36 and 37 of the Site Licence.
Odour	● Installation of a landfill gas management system; ● Consideration of meteorological conditions during material handling; ● Regular maintenance and monitoring of the leachate treatment system; ● Covering of waste during transport; ● Daily cover and compaction of waste as per the Site Licence; ● Immediate burial of highly odorous wastes on acceptance at the weighbridge; and ● Odour complaint system and follow-up investigations/actions.
Dust	● Vehicles to maintain minimum speed limits; ● Use of a water cart as necessary; ● Covering of waste during transport; and ● Appropriate handling and unloading of waste to minimise dust generation.
Noise	● Site operations hours are restricted to 7:00am to 6pm Monday to Sunday and closed on Good Friday, Christmas day and New Year's day; ● Site opening hours are restricted to 8:00am – 4:45pm Monday to Sunday and closed on Good Friday, Christmas Day and New Year's Day; ● Regular maintenance of mobile machinery and equipment;

Aspects	Management Measures
	- Environmental complaint system and follow-up investigations / actions; and - All staff provided with and trained in the use of appropriate Personal Protective Equipment (PPE).
Asbestos	- All asbestos and asbestos containing materials accepted at the Site are placed in the designated disposal area and covered with 1000mm of inert waste type 1, clean fill, or putrescible waste as soon as practicable on the same working day, as per the Site Licence; - Any asbestos contaminated waste loads will be managed and when relevant, will be buried within the designated asbestos disposal area; - All staff are trained in the appropriate inspection, handling and disposal of asbestos materials; and - All staff provided with and trained in the use of appropriate PPE.
Geotechnical Stability	- All basal and side slopes comply with Landfill Guidelines; - The proposed pre-settlement landfill closure profile consists of a 1V:20H profile on the crown and 1V:4H on the side slopes, which generally align with the gradients recommended in the Landfill Guidelines; - Site specific engineering controls for the basal lining system were developed with consideration of the underlying Stage 1 landfill waste mass and local geological and hydrogeological regime; and - Assessment of the landfill design through a Stability Risk Assessment which determined that all required factors of safety were met, and the design is deemed acceptable.
Litter	- Maintenance of fencing 1.8m high; - Use of litter screens at the tipping face and / or within the landfill cell; - Daily compaction and covering of waste; and - Daily removal of windblown waste from fences and access roads.
Vermin and Feral Animals	- Application of adequate cover material; - Regular monitoring for vermin and feral animals; and - Vermin control such as baiting and trapping.
Weeds	- Routine weed inspections; and - Control measures (herbicides and physical removal) are undertaken several times per year as required and prior to flowering periods.
Fire	- Fire response infrastructure and equipment, including hydrant, mobile water cart, fire extinguishers, and fire breaks located around the Site; - As stipulated by Condition 16 of the Licence, an adequate water supply and a means of distribution to be provided at all times for the purposes of firefighting; - Pursuant to Condition 34 of the Licence, the DWER is informed of any unauthorised fires as soon as practicable, but no later than 14 days after the fire event; and - All staff trained in appropriate fire response techniques.
Traffic	A one-way system will facilitate free flowing movement of community visitors through the Site's Recycling and Reuse Shop and Waste Transfer Station areas;

Aspects	Management Measures
	• Authorised access to certain areas around Site; • Signage providing directions, traffic control measures and safety instructions will be established and maintained at appropriate locations around the Site; • Vehicles will be restricted to a maximum speed limit of 10km/hour, unless otherwise signed; • Employees and contractors shall wear high visibility and reflective clothing when working at the Site; • All vehicles will be maintained in good working condition and drivers instructed to use conservative driving techniques; • Two-way radio communications adopted; and • All employees and contractors will be inducted with the Site OHS and traffic management procedures.
Security	• Appropriate signage is installed at the Site entrance; • Lighting and CCTV is installed in relevant areas of the Site, including at the main Site access road and key buildings; • A perimeter fence is installed around the Site and is monitored and maintained on a regular basis; and • All access gates and buildings are locked securely outside of operational hours.
Rehab	• Drainage works, contour banks, topsoiling and scarifying; • Direct seeding by manual broadcasting of seed; • Staking and tree guarding; • Weed control and general maintenance; and • Revegetation monitoring using permanent transects and quadrants.

8 Post Closure Management

The Landfill Guidelines state that the typical period for aftercare for a putrescible landfill is approximately 30 years. The Closure Plan for the Site considered the following aspects in planning for the aftercare period:

- Maintenance of landfill cap, in particular to:
 - Prevent/control erosion;
 - Restore depressions, seal and monitor cracks in the cap caused by settlement; and
 - Restore/maintain vegetation.
- Maintenance and operation of leachate collection and treatment systems;
- Maintenance and operation of landfill gas extraction systems;
- Environmental monitoring of:
 - Groundwater;
 - Surface water;
 - Landfill gas;
 - Leachate; and
 - Settlement.

The environmental management measures that will be employed, and associated monitoring works, are described in the following sections.

8.1 Landfill Gas

During the use of an active system, the wells within the waste mass will be monitored monthly as part of the well tuning process to ensure air is not being drawn into the landfill. This will occur both during the operation of the power plant, and the operation of the flare following the closure of the power plant. Once the regular monitoring indicates that flow rates and/or methane concentrations have reduced to the point where a passive system is viable, the system will be installed and monitored monthly for two years to confirm that the gas has stabilised. After which the wells will be monitored biannually for 28 years.

8.2 Landfill Leachate

8.2.1 Leachate Head

Post-Closure, leachate generation will reduce significantly. Leachate levels in the engineered cells will be measured on a quarterly basis to ensure that the extraction system is maintaining leachate levels in line with the LMP. Prior to monitoring leachate head, the pumps should be switched off for at least 24 hours to allow leachate levels to stabilise.

8.2.2 Leachate Generation Rates

The quantity of leachate extracted from each of the cells should be monitored via an inline water meter. Additional inline water meters should also be added to the leachate evaporation pond inlets,

and any outlets which may be used to record the volume of leachate which is irrigated prior to Site closure.

Volumetric leachate generation data can be used to check that water balances for the Site are still valid, to potentially identify potential loss of containment at the landfill, to identify if additional evaporation capacity needs to be developed, or if forced evaporation methods need to be modified/augmented.

This cheap and simple equipment is crucial to measuring the performance of the leachate management system and optimising it where necessary/practicable.

8.2.3 Leachate Composition

Leachate collected in the landfill cells will be sampled directly from the a combined leachate collection/holding point such as the Ertech tanks, and a further sample obtained from the leachate evaporation ponds to characterise composition and strength. Given the recent odour issues the Batter 1 Pond witnessed, sampling the ponds in conjunction with regular maintenance is critical to identify early if anaerobic conditions are establishing to enable timely corrective actions to be undertaken.

Annual monitoring of leachate composition following the closure of the Site is considered sufficient from a risk management perspective.

8.2.4 Leachate Treatment

Since the current leachate evaporation ponds are located in the southern portion of Stage 2 Phase 1, the ponds will need to be relocated when the Stage 2 central area is capped. The ponds will be sized to accommodate the requirements of the combined catchments of the SPC and remaining open areas of the current Stage 2 landfill. The size and location of the ponds is currently being determined during the LMA detailed design stages.

8.3 Surface Water

To ensure that the SWMS is functioning effectively, inspections should be undertaken. Based on the climate and precipitation patterns. The inspection rounds should be carried out during winter, ideally at the start and end or after a significant rain event. The Site Licence does not require surface water sampling to be undertaken.

After the first five years following the rehabilitation of the landfill, inspections can be carried out at a reduced frequency of once a year and following a heavy rainfall event. After this time, inspection frequencies may be reduced if they indicate that the surface water management system is effective.

8.4 Groundwater

A total of twenty-six active groundwater monitoring bores exist at the Site. The bores are a combination of MRC's groundwater monitoring bores (nine), CSIRO bores (twelve) and Department of Water bores (five).

Fourteen groundwater bores are monitored for the full suite of testing on an annual basis and for a reduced suite of testing on a bi-annual basis in accordance with the Site Licence. Following rehabilitation, groundwater will be monitored at the same frequency for the first five years, reducing

to annually for the remaining 25 years, unless groundwater chemistry indicates impacts from the landfill, in which case more frequent monitoring may be required.

8.5 Topography

Following rehabilitation, inspections of the integrity of the capping system should be conducted annually and following severe weather events. It would be beneficial for the proposed topsoil/compost layer to remain in place, at least until the surface vegetation has established and it may be necessary to reinstate displaced restoration soils.

It is expected that, following the waste reprofiling works and installation of the capping system, a minimal amount of settlement will occur, as the waste has been compacted during placement. In general, most of the settlement occurs in landfills in the first two years following rehabilitation, however, the current leachate recirculation campaign will have accelerated that stabilisation process further.

It is therefore proposed that annual surveys be undertaken to monitor the settlement rate for the first two years. Following this, surveys will be conducted every two years (up to 15 years post-rehabilitation), unless the settlement rate observed indicates that more frequent surveys are required. By this time, it is anticipated that settlement will be very minor so surveys should be undertaken every five years, or until the topography of the cell has stabilised.

8.6 Vegetation

Vegetation growth should be visually monitored following the revegetation of the Site. Any plants that die off or fail to take should be replaced to ensure the integrity of the cap. Monitoring for weeds should also be undertaken, with weed control measures implemented as required.

8.7 Monitoring Program

The proposed Post-Closure Management and Monitoring Program is presented in Table 8-1.

Table 8-1: Post-Closure Management & Monitoring Program

Aspect	Monitoring Method	Frequency	Duration
Topography	Topographic survey	Biannually*	First 2 years following closure
		Every 2 years	Following 13 years
		Every 5 years	Following 15 years
Landfill Gas	Landfill Gas Wells	Monthly	Whilst the active system is operational
		Monthly	For the first two years following the installation of a passive system

Aspect	Monitoring Method	Frequency	Duration
		Biannually	For the third through to the 30th year following the installation of the passive system
	Surface Emissions	Annually	Ongoing for 30 years post-closure
	Accumulation	Annually	Ongoing for 30 years post-closure
	Gas Engine / Flare Emissions	Continuous	During operation of the active system
Landfill Leachate	Leachate riser and evaporation pond sampling	Biannually	First 5 years following closure
		Annually	Following 25 years
Groundwater	Borehole sampling	Biannually	During operation
		Annually	Following 25 years
Surface water	Visual Inspection	Biannually	First 5 years following closure
Vegetation	Visual Inspection	biannually	During operation and the post-closure period

** Following extreme weather events, it is recommended to undertake an inspection on of the restoration soils and monitor the formation of any rills or gullies*

As the Site is still operational and will be closed off in phases, MRC needs to consider its current monitoring commitments as specified within its DWER Licence as well as the post-closure monitoring requirements detailed in Table 8-1.

9 Residual Risk Assessment

Each of the potential risks was assessed as per the *DWER Guidance Statement: Risk Assessments - Part V, Division 3, Environmental Protection Act 1986* (February 2017) (Guidance Statement). The objective of the Residual Risk Assessment is to ensure the potential risks associated with the proposed activities are understood and managed appropriately to ensure that there is no unacceptable residual risk. The sources of hazards, pathways and receptors of hazards identified are outlined in the following subsections.

9.1 Sources of Hazards

For the purpose of this assessment, a source is defined as a primary risk with the potential to cause significant contamination or harm to the environment. With regards to the environment and public health, sources and its potential hazards which may arise from the various future activities have been identified and are shown in Table 9-1.

Table 9-1: List of Potential Hazards

Source	Description of Hazards
Surface Water	Excessive surface water that is not properly managed can lead to flooding onsite. Surface water that comes into contact with general mixed or putrescible waste can generate leachate.
Leachate	Risk to groundwater from the seepage of leachate from the landfill in the event the integrity of the lining system is compromised.
Landfill Gas	Generation of landfill gas and uncontrolled release to the atmosphere contributing to greenhouse gas emissions. Vertical or horizontal movement of gases through soil to buildings onsite or nearby houses presenting an explosion risk.
Odour	Odours generated from putrescible waste, landfill gas, and leachate can cause impacts to amenity.
Dust	Dust generated during construction works can result in reduced visual amenity and cause respiratory issues.
Noise	Noise emissions can cause impacts to amenity.
Asbestos	Asbestos is a known carcinogen that can cause mesothelioma, lung cancer and asbestosis. Asbestos fibres inhaled deep into the lungs can result in the development of mesothelial cells which may result in cancer.
Litter	Litter can result in impacts to amenity on and immediately surrounding the Site.
Vermin and Feral Animals	Exposed waste can attract vermin which may cause nuisance and present health risks.
Weeds	Introduction and spread of weeds can comprise revegetation.
Dieback	Spread of dieback on and offsite and its impacts to rehabilitated areas.
Fire	Potential for fires from waste materials and equipment.

Source	Description of Hazards
Security	Unauthorised personnel may access the Site resulting in a security breach of the Site facilities, plant and equipment.

9.2 Pathways for Hazards

For the purpose of this assessment, a pathway for a hazard is defined as the route by which potential contamination or harm can migrate. The key migration pathways at a landfill generally includes the following:

- Air through which lightweight materials, such as dust, litter, odour and landfill gas, can travel;
- Surface along which the sources of contamination or harm can travel or be present at (e.g., surface water runoff, litter, persons walking or working over the surface); and
- Sub-surface whereby the underlying soils, bedrock, aquifers and infrastructure permit gas and leachate migration towards the receptors as follows:
 - Lateral and vertical migration of leachate within or towards the groundwater; and
 - Lateral and vertical migration of landfill gas either in the gas phase or dissolved in groundwater via subsoil, bedrock, aquifers and manmade underground services such as pipelines, drainage systems and manholes.

9.3 Receptors of Hazards

For the purpose of this assessment, a receptor is defined as the location where the impact of the contamination or harm is registered. The possible receptors of the contamination or harm cause by the identified hazards are summarised in Table 9-2.

Table 9-2: Receptors

Receptor	Description of the Receptor
Atmosphere	• Ozone layer surrounding the Earth impacted by Methane causing the greenhouse effect.
Air Quality	• Local air quality.
Site Users	• Persons authorised to traverse across the Site including: ◦ Operational staff; ◦ Contractors carrying out maintenance or monitoring; and ◦ Visitors/Customers.
Site Infrastructure	• Buildings onsite and associated infrastructure.
Surrounding Land Users	• People who work or live beyond the boundary of the facility.
	•
Groundwater	• Groundwater that exists beneath the landfill either as a local perched system or as a regional aquifer from which a water supply may be extracted for industrial or potable purposes.

Receptor	Description of the Receptor
Flora	Flora in surrounding areas.
Fauna	Fauna species whose habitat is within or surrounding the facility.

9.4 Risk Rating Matrix

To assess the various risks, the potential hazards identified in Table 9-1 were classified according to the DWER's Guidance Statement shown in Table 9-3.

Table 9-3: Risk Rating Matrix

		Consequence				
		Slight	Minor	Moderate	Major	Severe
Probability	Almost Certain	Medium	High	High	Extreme	Extreme
	Likely	Medium	Medium	High	High	Extreme
	Possible	Low	Medium	Medium	High	Extreme
	Unlikely	Low	Medium	Medium	Medium	High
	Rare	Low	Low	Medium	Medium	High

9.5 Risk Profile

Risk management measures refer to the key management strategies that will be adopted onsite to ensure that all hazards and potential risks identified are controlled to an appropriate level, and that strategies are in place to react to any potential incidents or accidents. In most cases these risk management measures decrease the probability and/or consequence of identified hazards and therefore lower the risk rating. The current risk rating and revised probability and consequence for each identified hazard following the implementation of management measures for the SPC are shown in Table 9-4.

Table 9-4: Residual Risk Profile for the SPC

Source	Pathway	Receptor	Risk	Probability	Consequence	Risk Rating	Management Measures	Revised Probability	Revised Consequence	Revised Risk Rating
Surface Water	Surface	Vegetation and flora	Sedimentation from uncontrolled stormwater impacting flora and vegetation.	Possible	Minor	Medium	- Revegetation of capped areas - Surface water management system consisting of trapezoidal swales directed to surface water attenuation ponds prior to discharge; - Installation of a surface water extraction system within the temporary slope area in the Piggyback South area; - Diversion of water that does not come into contact with waste to surrounding areas; - Landfill design using the criteria within the Landfill Guidelines; - Progressive capping of cells to minimise infiltration of water; and - Seasonal surface water monitoring.	Unlikely	Slight	Low
	Surface	Groundwater	Water that encounters waste generating leachate that can cause contamination to groundwater.	Almost certain	Major	Extreme		Possible	Slight	Low
	Surface	Surface water	Uncontrolled stormwater that encounters waste generating leachate and contaminating surrounding surface water.	Possible	Major	High		Unlikely	Slight	Low
Leachate	Subsurface	Groundwater	Contamination of groundwater resulting from seepage from the proposed landfill cell.	Possible	Major	Extreme	- Landfill design using the criteria within the Landfill Guidelines; - Construction of landfill cell, including a leachate collection and extraction system, as per Technical Specification and CQA Plan; - Primary, secondary and tertiary leachate extraction options designed to provide contingency leachate extraction options in the event of riser failure; - Improved leachate management with the development of the LMA; - More robust monitoring of leachate volumes managed in the LMA; - Utilisation of the Site's landfill leachate evaporation pond system; and - Annual groundwater monitoring.	Unlikely	Minor	Medium
Landfill Gas	Subsurface	Site Infrastructure	Vertical or horizontal movement of gases through soil to buildings onsite or nearby houses presenting an explosion risk.	Possible	Severe	Extreme	- Progressive capping of cells; - Installation of active landfill gas collection and extraction system; - Landfill gas monitoring within four weeks of completion of construction of each well and flare and monthly thereafter; and - Additional monitoring and management undertaken as part of power station operation.	Rare	Major	Medium
	Subsurface	Surrounding Land Users		Possible	Severe	Extreme		Rare	Major	Medium
	Air	Atmosphere	Release of landfill gas into the atmosphere contributing the greenhouse gas emissions.	Almost certain	Moderate	High		Possible	Slight	Low
Odour	Air	Site Users	Odours generated from the acceptance and degradation of	Almost certain	Minor	High		Possible	Slight	Low

Source	Pathway	Receptor	Risk	Probability	Consequence	Risk Rating	Management Measures	Revised Probability	Revised Consequence	Revised Risk Rating
			waste in the landfill impacting amenity onsite.				- Progressive installation of the landfill gas management system; - Consideration of meteorological conditions during material handling; - Covering of waste during transport; - Daily cover and compaction of waste; - Immediate burial of highly odorous wastes on acceptance at the weighbridge; - Working face is kept to maximum linear length of 50m; - Regular maintenance and monitoring of the leachate treatment system; and - Odour complaint system and following up investigations/actions.			
	Air	Surrounding Land Users	Odours generated from the waste, landfill gas and leachate storage and evaporation ponds impacting nearby receptors.	Almost certain	Moderate	High		Possible	Minor	Medium
Dust	Air	Site Users	Visibility may be impaired, and inhalation of dust may occur during construction activities and handling of waste.	Possible	Minor	Medium	- Water cart to be used as necessary; - No construction works or earthworks will take place during high winds; - Vehicles to maintain minimum speed limits; and - Covering of waste during transport	Possible	Slight	Low
Noise	Air	Site Users	Noise impacts from activities onsite impacting Site users.	Likely	Slight	Medium	- Broadband reversing alarms on mobile machinery; - Regular maintenance of equipment and machinery; - Implement safe working practices and use appropriate PPE; and - Sufficient separation distances from sensitive receptors.	Unlikely	Slight	Low
	Air	Surrounding Land Users	Noise impacts from activities onsite impacting nearby receptors.	Possible	Slight	Low		Unlikely	Slight	Low
Asbestos	Air	Site Users	Inhalation of asbestos fibres from asbestos.	Possible	Major	High	- All asbestos and asbestos containing materials accepted at the Site are placed in the designated disposal area and covered with 1000mm of inert waste type 1, clean fill, or putrescible waste as soon as practicable on the same working day, as per the Site Licence; - Any asbestos contaminated waste loads will be managed and when relevant, will be buried within the designated asbestos disposal area; - All staff are trained in the appropriate inspection, handling and disposal of asbestos materials; and - All staff provided with and trained in the use of appropriate PPE.	Unlikely	Moderate	Medium

Source	Pathway	Receptor	Risk	Probability	Consequence	Risk Rating	Management Measures	Revised Probability	Revised Consequence	Revised Risk Rating
Geotechnical Stability	Surface	Site Infrastructure	Partial collapse of batter can lead to damage to the landfill lining system and its environmental engineering controls.	Possible	Major	High	- All basal and side slopes comply with Landfill Guidelines - The proposed landfill closure profile consists of a 1V:20H profile on the crown and 1V:5H on the side slopes;	Rare	Minor	Low
	Surface	Site Users	Instability of landfill waste profile can lead to health & safety concerns.	Possible	Major	High	- Site specific engineering controls for the subgrade were developed with consideration of the local groundwater and geology - Assessment of the landfill design through a Stability Risk Assessment which determined that all required factors of safety were met, and the design is deemed acceptable.	Rare	Minor	Low
Litter	Air and surface	Site Users	Litter impacting on amenity onsite.	Possible	Slight	Low	- Maintenance of fencing 1.8m high; - Use of litter screens at the tipping face and / or within the landfill cell;	Rare	Slight	Low
	Air and surface	Surrounding Land Users	Litter impacting amenity of nearby receptors.	Unlikely	Slight	Low	- Daily cover and compaction of waste; - Regular removal of windblown waste from fences & access roads; and - Working face is kept to maximum linear length of 50m.	Rare	Slight	Low
Vermin & Feral Animals	Surface	Site Users	Putrescible waste can attract vermin and feral animals presenting health risks, reduced amenity and nuisance.	Possible	Minor	Medium	- Daily covering and compaction of waste as stated within the Licence and as per the Landfill Guidelines; - Feral animal management procedure; and - Biannual pest control program completed by a licensed animal pest control contractor.	Possible	Slight	Low
Weeds	Air and Surface	Vegetation and flora	Introduction of weeds impacting surrounding native vegetation or revegetation onsite.	Possible	Minor	Medium	- Routine inspections; and - Chemical or physical removal of weed species.	Unlikely	Slight	Low
Dieback	Surface	Vegetation and flora	Spread of dieback offsite and impacts to rehabilitation.	Possible	Minor	Medium	- Use of washdown facility; - Minimising disturbance where possible; and - Rehabilitation of landfill cap with local native species, several of which not susceptible to dieback.	Possible	Slight	Low
Fire	Surface	Site Users	Risk of fires onsite from equipment or landfill creating risk to personnel and infrastructure.	Unlikely	Severe	High	Implementation of the Site's Emergency Preparedness and Response Plan;	Rare	Minor	Low
	Surface	Site Infrastructure		Unlikely	Major	Medium	- Fire response infrastructure and equipment, including, hydrant, 2 x10,000L mobile water carts, fire extinguishers and fire breaks; and - Staff trained in fire response techniques.	Rare	Minor	Low

Source	Pathway	Receptor	Risk	Probability	Consequence	Risk Rating	Management Measures	Revised Probability	Revised Consequence	Revised Risk Rating
Security	Surface	Site Infrastructure	Unauthorised personnel may access the site resulting in a security breach of the site facilities, plant and equipment.	Unlikely	Minor	Medium	- Appropriate signage will be installed at the site entrance; - Lighting and CCTV will be installed in relevant areas of the Site including at the access road and key buildings; - The perimeter fence will be installed around the Site and will be monitored and maintained on a regular basis; and - All access gates and buildings will be locked securely outside of operational hours.	Unlikely	Slight	Low

10 Assessment Conclusion

The Residual Risk Assessment identified the current sources of hazards as well as possible sources of hazards arising from the proposed works. The risk rating prior to the implementation of management measures ranged from 'Low' to 'Extreme'. The revised risk ratings were all downgraded to 'Low' to 'Medium' once management measures were applied. Given the proposed management measures, MRC will ensure any potential health, environment, and amenity impacts are avoided or minimised.

11 Conclusion

The construction of the SPC is required to ensure that there is sufficient capacity at the Site for disposal of Class II and III waste and to allow development of the final landform required for closure of the Site in accordance with the approved Closure Plan. The SPC has been designed using the criteria within the Landfill Guidelines and will be constructed in accordance with these guidelines to minimise the risk of potential environmental impacts.

To further reduce potential environmental impacts associated with the operation of the SPC, MRC will continue to implement its existing environmental management procedures. As determined through the Residual Risk Assessment in Section 9, the residual risk rating was determined to be 'low' to 'medium' following the implementation of these management measures. Therefore, MRC believes that the construction and operation of the SPC can be adequately managed in accordance with the existing Site Licence.

APPENDIX A

Drawings

Southern Piggyback Cell Drawings

- W-100: Existing Site Layout and Topography
- W-101: Existing Topography and Capping Levels
- W-102: Formation Levels and Sub-Cell Gas Collection Layout
- W-103: Engineered Fill and Liner Subgrade Levels
- W-104: Leachate Collection and Extraction Layout
- W-201: Long Section Sheet 1 of 2
- W-202: Long Section Sheet 2 of 2
- W-301: Landfill Standard Details Sheet 1 of 3
- W-302: Landfill Standard Details Sheet 2 of 3
- W-403: Landfill Standard Details Sheet 3 of 3

Leachate Management Area Drawings

- W-110: Site Layout
- W-111: Existing Topography
- W-112: Formation Levels
- W-113: Engineered Fill Levels
- W-114: Leachate and Gas Management Layout
- W-115: Surface Water Management Layout
- W-210: Leachate Storage Pond 1 Sections
- W-211: Leachate Evaporation Pond 2 Sections
- W-310: Typical Details

APPENDIX B

Figures

Figure 1: Locality

Figure 2: Zoning

Figure 3: Separation Distances

Figure 4: Site Layout

Figure 5: Topography

Figure 6: Geology

Figure 7: Groundwater Contours - July 2023

Figure 3b: Groundwater Contours - July 2024 (SLR)

Figure 8: Surface Water

Figure 9: Threatened and Priority Flora

Figure 10: Threatened and Priority Ecological Communities

Figure 11: Threatened and Priority Fauna

Figure 12: Cultural Heritage

APPENDIX C

Technical Specification

APPENDIX D

CQA Plan

APPENDIX E

Stability Risk Assessment

APPENDIX F

HELP Modelling and Water Balance Assessment



Assets | Engineering | Environment | Noise | Spatial | Waste

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