



**Yulara Landfill  
Landfill Environment Management  
Plan**

Prepared for  
Voyages Tourism Australia

**20 April 2026**

Tierra Environment Pty Ltd  
ABN 84 111 615 680

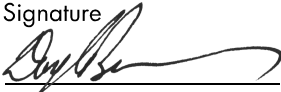
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## **Yulara Landfill Landfill Environment Management Plan**

Prepared for  
Voyages Tourism Australia

**20 April 2026**

### **Document Status**

|                                                        | Name                             | Signature                                                                            | Date              |
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## **1 INTRODUCTION**

### **1.1 Background**

This Landfill Environmental Management Plan (LEMP) has been prepared for Voyages Tourism Australia (Voyages). The facility manages waste generated by the Yulara township and the surrounding tourism infrastructure associated with Uluru-Kata Tjuta National Park.

In addition to newly developed scope within this document, this LEMP has also been informed by current good practice developed by the landfill operational team. Tierra engaged with site personnel to discuss, observe, and review existing operational procedures, with particular focus on recycling and resource recovery initiatives in the context of a remote location with limited downstream recycling options.

A number of these practices are well established and considered appropriate for the site conditions; however, they have not previously been formally documented. This LEMP formalises these practices, incorporating them into a structured environmental management framework consistent with Northern Territory Environment Protection Authority (NT EPA) expectations and guidance.

### **1.2 Scope and Objectives**

The scope and objectives of the LEMP is as follows:

- Operate within the constraints of the existing licence EPL179-03 issued 1 July 2025 and expires 30 June 2035.
- Prevent or minimise harm to human health and the environment.
- Establish performance objectives, operational controls, monitoring programs, contingency measures, reporting requirements and responsible personnel with specific consideration of the remote setting, climatic conditions, sensitive environment and actual landfill size.
- Comply with relevant legislation where appropriate again considering the remote setting, climatic conditions, sensitive environment and actual landfill size.

### **1.3 LEMP Structure**

To improve usability and clearly define responsibilities for both operational staff and third party monitoring teams (TPMT), two standalone documents have been developed to complement this LEMP. These documents are provided as appendices and present key requirements in a concise, user-friendly format to support implementation in the field. They are as follows:

- Yulara Landfill, Environmental Monitoring, Mitigation, Action and Responsibilities Plan 15 January 2026 presented in Appendix B.
- Yulara Landfill, Operational Procedures 15 April 2026 presented in Appendix C.

It is the intention of this LEMP, together with the supporting documents, that site workers and contractors are only required to familiarise themselves with the material relevant to their roles and responsibilities. For example, site personnel can be issued with the Operational Procedures document, which contains the information necessary to undertake their duties.

Similarly, personnel responsible for day-to-day monitoring, including the TPMT, need only refer to the relevant sections of the Environmental Monitoring, Mitigation, Action and Responsibilities Plan. This approach is intended to improve usability, support compliance, and ensure that key requirements are clearly understood and effectively implemented.

### **1.4 LEMP Review and Amendments**

This LEMP and its associated documents are to be reviewed at a minimum frequency of every five years. In addition, the documents should be updated as required to incorporate improved methods or practices where these demonstrably achieve better environmental outcomes, or equivalent outcomes with increased efficiency or reduced cost. Any amendments to this LEMP must be submitted to the Northern Territory



Environment Protection Authority for review and approval. No revised actions or procedures are to be implemented until formal approval has been granted by the NT EPA.

## 2 LANDFILL DESCRIPTION AND SETTING

### 2.1 Site Definition

The Yulara Landfill (site) is defined as follows:

|                    |                                                    |
|--------------------|----------------------------------------------------|
| <b>Description</b> | Yulara Landfill                                    |
| <b>Address</b>     | Lot 248 Yulara Rubbish Dump Rd, Yulara NT          |
| <b>Title</b>       | Volume CUFT 866 Folio 877                          |
| <b>Plan</b>        | LTO94/017B                                         |
| <b>Council</b>     | Unincorporated area within McDonnell Shire Council |
| <b>Zoning</b>      | No Zone                                            |
| <b>Size</b>        | 201,400m <sup>2</sup>                              |
| <b>Owner</b>       | Voyages Tourism Australia                          |
| <b>Licence</b>     | Environment Protection Licence 179-03 (EPL 179-03) |

Yulara landfill is located 3.7km north west of the Yulara community square and 7km by road from the same point. It is also located near Uluru (14.5km south, south east) and Kata Tjuta (17km south west).

### 2.2 Overview

The Yulara landfill is owned and operated by Voyages and accepts waste from the resort complex. Occasionally waste may be accepted from a local third party (Parks, contractors working for Voyages or in the area and local communities) after appropriate information on the waste has been provided to and reviewed by Voyages and meets licence conditions. The landfill is licenced to receive waste types as detailed in Licence EPL 179-03 and is summarised in Section 2.3.

### 2.3 Landfill Licence Details

The licence describes the landfill as follows:

*“The Yulara landfill receives putrescible, solid and listed waste streams from the Yulara Township that are segregated for storage or disposal by burial at the premises.”*

Scheduled activities are described as follows:

*“Operating premises for the disposal of waste by burial that service, or are designed to service, the waste disposal requirements of more than 1000 persons.*

*Operating premises, other than a sewage treatment plant, associated with collecting, transporting, storing, re-cycling, treating or disposing of a listed waste (as per Table 1) on a commercial or fee for service basis.”*

The following listed wastes are authorised to be handled:

- Grease trap waste – **treatment and disposal**
- Lead and lead compounds – **storage**
- Tyres – **storage, treatment and disposal**
- Waste mineral oils unfit for their original intended use – **storage**
- Waste mixtures, or waste emulsions, of oil and water or hydrocarbon and water – **storage**
- Containers that are contaminated with residues of a listed waste – **storage**

Additional information is provided in Section 2 and the accompanying Yulara Landfill, Operational Procedures 15 April 2026 presented in Appendix C.

## 2.4 Capacity

### 2.4.1 Current Operational Portion of Landfill

The total capacity of the landfill is not well defined due to the absence of a weighbridge and limited historical records of waste volumes. In addition, early filling practices, interpreted from a review of historical aerial imagery, do not appear to have achieved optimal airspace utilisation.

These early practices were typically based on the excavation of small, shallow pits that were filled, covered, and then abandoned in favour of new excavation areas. This approach is likely to have resulted in inefficient use of available airspace, both vertically and laterally, due to unutilised volumes between and beneath filled areas.

In contrast, current operational practices involve the excavation of a new slot within an approximately 5m deep cell immediately adjacent to the active filling slot. This approach promotes efficient use of depth and minimises the loss of airspace between successive slots.

To develop a preliminary estimate of remaining landfill capacity within the currently operational area of the landfill (i.e. excluding the un-developed area to the west – refer Appendix A), a review of historical aerial imagery (sourced from Google Earth) was undertaken for the period March 2005 to February 2026. The total area of the landfill footprint at each time interval was delineated to assess the rate of landform expansion and infer remaining available airspace.

| Date           | Area Filled (m <sup>2</sup> ) | Change in Area (m <sup>2</sup> ) | Area Filled per Month (m <sup>2</sup> /month) |
|----------------|-------------------------------|----------------------------------|-----------------------------------------------|
| Mar-05         | 18,582                        | NA                               | NA                                            |
| Jan-07         | 20,500                        | 1,918                            | 87                                            |
| Apr-08         | 26,800                        | 6,300                            | 420                                           |
| Nov-08         | 27,790                        | 990                              | 141                                           |
| Feb-10         | 32,090                        | 4,300                            | 287                                           |
| Jan-12         | 36,140                        | 4,050                            | 176                                           |
| Nov-13         | 40,270                        | 4,130                            | 188                                           |
| May-16         | 45,580                        | 5,310                            | 177                                           |
| Oct-18         | 48,850                        | 3,270                            | 192                                           |
| Jan-20         | 50,740                        | 1,890                            | 126                                           |
| Feb-23         | 60,520                        | 9,780                            | 264                                           |
| Feb-26         | 63,660                        | 3,140                            | 87                                            |
| <b>Average</b> |                               |                                  | <b>251<sup>1</sup></b>                        |

Based on the long-term average filling rate of approximately 251m<sup>2</sup>/month and an estimated remaining available area of approximately 10,000m<sup>2</sup>, the remaining landfill life is calculated to be approximately 3.3 years.

However, more recent operational data indicates a reduced filling rate (likely associated with improved filling practices discussed above and improved recycling practices). Based on the period from February 2023 to February 2026, the filling rate is estimated to be approximately 87m<sup>2</sup>/month (adopted conservatively as 100m<sup>2</sup>/month), which corresponds to an estimated remaining landfill life of approximately 8.4 years.

<sup>1</sup> The average monthly change is based on the entire period as opposed to the average of each number above in that column as each number is based on a differing time period. The average calculated for these numbers would not be the same as the average over the total time period.

It is noted that during the February 2026 monitoring event, discussions were held between Tierra and Voyages Indigenous Tourism Australia landfill personnel regarding subgrade placement practices (refer Section 2.6 of the *Yulara Landfill Operational Procedures*, provided in Appendix C). These discussions indicated that, for a period of time, subgrade material (effectively interim cover) had been placed in excess of requirements, as it was interpreted by site personnel to represent the final capping layer.

As a consequence, portions of the landfill contain an over-thickened subgrade layer. Subject to appropriate management, this material could potentially be reworked or removed to recover airspace, allowing for the placement of additional waste prior to reinstatement of subgrade at the appropriate thickness. This presents an opportunity to extend the operational life of the landfill beyond the estimates provided above.

### 2.4.2 Undeveloped Portion of Landfill

The undeveloped portion of the landfill is located west of the fence line through the approximate middle of the site. There has been no filling in this area to date and no filling is planned until the current operational area is completed. The area of the undeveloped portion that is able to be filled is approximately 65,000m<sup>2</sup>. Assuming the long term filling rate of 251m<sup>2</sup>/month and the more recent and more efficient filling rate of 100m<sup>2</sup>/month the filling life in the undeveloped portion of the landfill to the west is between 21.5 years and 54 years respectively.

## 2.5 Site Layout and Key Infrastructure

A site layout and key infrastructure plan is located in Appendix A. Instructions on operations in each area is detailed in the *Yulara Landfill, Operational Procedures* 15 April 2026 presented in Appendix C.

## 2.6 Site Access

Access to the site is via a locked gate located on Lot 248, Yulara Rubbish Dump Road, Yulara. The gate remains secured at all times, including when operational staff are present on site.

Access is restricted to authorised personnel only. However on rare occasions there may be the need for a third party (for example construction works at the facility or road works in the area) to access the site. All third-party access is controlled and must occur under the direction or escort of authorised personnel unless otherwise approved.

Where third parties require frequent access for waste disposal, a controlled access key may be issued. In such cases, users will be appropriately inducted and briefed on site procedures, including access protocols and the requirement to secure the gate upon entry and exit.

As the waste accepted at the landfill is generated primarily by the Resort and is not received from the general public, the exclusion of listed wastes is managed through tightly controlled access restrictions and segregation at the source. Appropriate education and awareness programs are implemented to ensure Resort staff understand waste classification requirements and are aware of materials prohibited from disposal at the landfill. In addition, signage is installed at the active landfill trench identifying the types of waste that are permitted and prohibited for disposal within that area.

Where third parties have been approved to deposit waste that occurs only after the detailed composition of the waste is determined. Site staff undertake regular inspections of waste and especially third party waste as it enters the landfill. Access to the landfill will be denied if requirements are not met and waste will be removed by the depositing party.

## 2.7 Climate

Yulara landfill is located in Australia's arid interior and key climatic data sourced from the Bureau of Meteorology climatic data for Yulara Airport is as follows:

|                 | Jan  | Feb  | Mar  | Apr  | May  | Jun  | Jul  | Aug  | Sep  | Oct  | Nov  | Dec  |
|-----------------|------|------|------|------|------|------|------|------|------|------|------|------|
| Mean Max T (°C) | 38.6 | 37.2 | 34.8 | 30.0 | 24.3 | 20.5 | 20.8 | 24.0 | 28.9 | 32.7 | 35.0 | 36.8 |
| Mean Min T (°C) | 23.1 | 22.2 | 19.7 | 14.6 | 9.3  | 5.6  | 4.5  | 6.1  | 10.8 | 15.3 | 18.6 | 21.1 |

|                    |      |      |      |      |      |      |      |     |     |      |      |      |
|--------------------|------|------|------|------|------|------|------|-----|-----|------|------|------|
| Mean Rainfall (mm) | 28.7 | 34.6 | 30.4 | 14.1 | 13.1 | 18.6 | 15.0 | 4.7 | 9.4 | 22.0 | 33.9 | 40.3 |
|--------------------|------|------|------|------|------|------|------|-----|-----|------|------|------|

- Mean monthly 9am wind directions are predominantly easterly throughout the year, except in June and July when south-easterly winds are dominant, closely followed by easterly winds. Mean monthly 9am wind speeds are generally low, with only minor occurrences of winds in the 30–40 km/h range, and very few exceeding 40 km/h. The most frequent monthly mean wind speeds fall within the 10–20 km/h and 20–30 km/h ranges.
- Mean monthly 3pm wind directions are all predominantly easterly. Mean monthly 3pm wind speeds are generally low, with only minor occurrences of winds in the 30–40 km/h range, and very few exceeding 40 km/h. The most frequent monthly mean wind speeds fall within the 10–20 km/h and 20–30 km/h ranges.

In general the some climatic conditions can be considered favourable for the management of a landfill with respect to the following key aspects:

#### In Terms of Leachate and Stormwater Management

- Mean annual rainfall is low (266.7mm per year)
- Mean annual evaporation after adjusting for pan factor and evaporation from soil (soil factor) is expected to be high, of the order of 1,000mm<sup>2</sup>
- The majority of rain falls occurs in summer when evaporation is at its highest

The above climatic conditions limit the amount of stormwater which can infiltrate into the waste. The prevailing climatic conditions generally limit the potential for stormwater pooling on site and infiltration into the waste. However, it is noted that rainfall during certain months can contribute a disproportionately high percentage of the total seasonal rainfall. Therefore, stormwater management strategies must account for these periods of elevated rainfall to ensure effective control and minimise environmental impacts.

#### In Terms of Dust Management

While the climatic conditions are relatively dry, the generally low wind speeds and consistent prevailing wind direction blowing away from nearby towns and settlements are beneficial in minimising the potential for dust generation to adversely impact sensitive receptors.

## **2.8 Sensitive Receptors**

The sensitive receptors at and surrounding the site can be described as Primary Receptors (those in the immediate vicinity and with a likelihood of impact) and Secondary Receptors (those either a reasonable distance from the landfill or unlikely to be impacted). The siting of the landfill results in less Primary Receptors than Secondary Receptors.

The Primary Receptors are expected to be as follows:

Surrounding native flora and fauna – The landfill is located within a relatively undisturbed arid landscape. Native vegetation communities and associated fauna are expected to be sensitive to dust and litter.

Surface Water Features – While permanent surface water is absent, ephemeral drainage lines are important receptors during rainfall events. They can receive and transport stormwater runoff and their sediments or contaminants off-site. These features are particularly sensitive during infrequent but intense rainfall events. In significant rainfall events there is minor surface water flow off site to the east midway along this boundary.

The Secondary Receptors are expected to be as follows:

<sup>2</sup> There is no evaporation data at Yulara so the Alice Springs Airport pan data has been used and adjusted for pan factor and soil factor for a mean annual result of 1,040mm per year

Groundwater – Risks to groundwater may include impact from leachate migration. This is considered low likelihood due to the depth to groundwater and the thickness of low permeability soils at the site. Groundwater is considered a Secondary Receptor for this reason.

Ambient Air – Given the generally low to moderate wind speeds and prevailing easterly direction, receptors include downwind natural environment and occasional site workers or visitors. Potential impacts include dust, odour, and windblown litter.

Cultural and Heritage Values – The landfill is located in proximity to an area of high cultural significance associated with Uluru-Kata Tjuta National Park. Sensitive receptors therefore include Indigenous cultural values and visual amenity of the broader landscape.

Yulara Township – Although not immediately adjacent, the township is the nearest human receptor. Potential pathways include windblown dust or litter (limited by prevailing wind direction) and odour (generally low risk for a small landfill and due to the distance to the nearest human receptor – 2.2km to Nyangatjatjara College and 2.5km to the workers accommodation)

The above receptors have been considered in the supporting documents.

## 2.9 Geological and Topographical Information

The Yulara landfill is located within the Amadeus Basin to the south west of the outcrops of Neoproterozoic aged sedimentary rocks referred to as the “Sedimentaries”. These outcrops form northwest to southeast trending ridges located approximately 1.5km west north west of the landfill.

Based on modelling the Dune Plains Aquifer undertaken by CloudGMS for NT Power and Water Corporation it appears that the township of Yulara lies within the Dunes Plains Aquifer while the landfill is located just west of the interpreted western boundary of this aquifer between the Dune Plains Aquifer and outcrops and sediments associated with the “Sedimentaries”. The Quaternary age sediments within the Dune Plains Aquifer are significantly deeper (up to 100m thick) than the Quaternary age sediments below the landfill (less than 20m thick) and they constitute the aquifer itself.

This appears to be confirmed based on material logs from groundwater wells installed at the site. The geology at the landfill is interpreted as:

- Quaternary age Red Soils
  - Red sand, mud and gravel; sheet wash deposits found in inter-dune depressions and on gentle slopes flanking hills.
  - Formed from erosion of the nearby Sedimentaries

which are overlying

- Proterozoic age Winnall Beds
  - Brown to pale quartz sandstone, often micaceous, dominantly tabular but massive in upper part; minor red-purple fine sandstone to siltstone.

The topography in the vicinity of the landfill is relatively complicated due to outcropping of the Sedimentaries, the Quaternary sediments formed on its flanks and the change in geology across the western boundary of the Dune Plains Aquifer and the Olga Thrust. The topography is described as follows:

To the north west of the landfill, north west to south east trending ridgelines of the sedimentary outcrops are present. Ground levels fall gently to the north east and south-west away from these ridges.

The landfill is located to the south east of the main sedimentary outcrop, resulting in an overall gentle fall in topography toward the south east. In addition, the landfill lies to the east of a smaller, localised sedimentary outcrop, which creates a secondary, shallow cross-fall toward the east.

As a result of this setting, land immediately surrounding the landfill to the north, and west is slightly elevated compared to the flatter plains to the south and east.

## **2.10 Hydrogeology**

The upper Quaternary aquifer is likely linked to (feeds into) the Dune Plains Aquifer through permeable and porous layers within the Quaternary age Red Soils. The Dune Plains Aquifer and also likely the Quaternary aquifer is actively recharged during the high rainfall events during the monsoonal periods. Based upon available information the regional groundwater flow is towards Lake Amadeus (i.e. to the north-east). The local topography (an indicator of groundwater flow in recent sedimentary aquifers) as described above and the surface topography (which appears to be sloping down to the north east) together suggest that local groundwater flow may be toward the east.

However based on the measured depth to water in groundwater wells at the landfill during the latest groundwater monitoring event in February 2026 groundwater flow was found to be to the south east in the northern half of the landfill and to the north east in the southern half of the landfill with the waters converging on the eastern site boundary.

### 3 ENVIRONMENTAL MANAGEMENT FRAMEWORK

#### 3.1 Relevant Legislation and Guidelines

The following are directly relevant to the operation and management of landfills in the Northern Territory:

- Department of Lands, Planning and Environment, Waste Management and Pollution Control Act 1998 (WMPC Act)
- NT EPA, Guideline for Reporting on Environmental Monitoring, 2016 (Landfill Reporting Guidelines)
- NT EPA, Guidelines for the Siting, Design and Management of Solid Waste Disposal Sites in the Northern Territory, 2013 (2025 updated version 1.1) (Landfill Guidelines)
- NT EPA, Environmental Protection Licence No. 179, licence version 03 July 2025 (EPL 179-03)

The landfill pre-dates the introduction of the Guidelines for the Siting, Design and Management of Solid Waste Disposal Sites in the Northern Territory. As such, certain aspects of its design, construction, and historical operation do not fully align with the requirements of these guidelines.

Notwithstanding this, the current operational objective is to achieve, where practicable and proportionate to the scale of the facility, compliance with the intent of the guidelines. Where full compliance is not feasible, management measures are implemented to progressively improve environmental performance and reduce associated risks.

In addition, other legislation is relevant to the landfill, although not specific to its direct operation. The following provides a non-exhaustive list of applicable legislation:

- Environment Protection Act 2019
- Environment Protection Regulations 2020
- Litter Act 1972
- Waste Management and Pollution Control Act 1998
- Waste Management and Pollution Control (Administration) Regulations 1998
- Weeds Management Act 2001
- Weeds Management Regulations 2006

#### 3.2 Stakeholders

Stakeholders will need to be consulted liaised with from time to time and in some cases on a frequent basis. Stakeholders include the following:

| Stakeholder                              | Details                                                                                                                                                                                                                                                                                                         | Responsibilities/Relationship                                                                                                                                 |
|------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Traditional owners<br>(Anangu People)    | The adjacent Uluru-Kata Tjuta National Park is managed through a "joint management" model, where the Anangu People and the Australian Government (via Parks Australia) work together. The park is Aboriginal-owned land, leased back to the government, with a Board of Management featuring an Anangu majority | Cultural knowledge guides conservation and tourism decisions.<br>Weed and Pest management at the landfill in alignment with Park's objectives where possible. |
| Voyages Tourism<br>Australia Pty Limited | Site Owner and operator                                                                                                                                                                                                                                                                                         | Operation of the landfill<br>Engagement of TPMT<br>Licence and legislative compliance.                                                                        |



| Stakeholder                    | Details                                  | Responsibilities/Relationship                                                                 |
|--------------------------------|------------------------------------------|-----------------------------------------------------------------------------------------------|
| NT EPA                         | Primary environmental regulator          | Approvals, compliance, and auditing.                                                          |
| Parks Australia                | Joint management role with Anangu People | Fire management (prescribed burning), flora and fauna management in and surrounding the park. |
| Local community and businesses | Non-Voyages organisations                | Occasional disposal of waste only after approval from Voyages staff and inspection of waste.  |
| Other tourism operators        | Non-Voyages operators                    |                                                                                               |

### 3.3 Roles and Responsibilities

The current site structure in order of hierarchy is as follows:

#### 3.3.1 Waste Services Manager

Provides strategic leadership and overall management of waste services. Responsible for the effective delivery of day to day operations.

- Ensure compliance with environmental, regulatory, and WHS requirements
- Manage budgets, contracts, and stakeholder relationships
- Oversee performance reporting and continuous improvement initiatives
- Coordinate staff rostering and task allocation
- Monitor site activities, productivity, and safety
- Respond to and escalate incidents as required
- Coordinate maintenance activities and contractor engagement
- Maintain records, reporting, and regulatory submissions
- Liaise with customers and contractors

#### 3.3.2 Leading Hand / Senior Operator

Provides on site supervision and operational support.

- Supervise landfill and transfer station operations
- Ensure compliance with licence conditions and site procedures
- Oversee plant, equipment, and infrastructure
- Direct and support operators on site
- Induct, mentor, and support staff development
- Promote and enforce safe work practices
- Act in a supervisory role when required

#### 3.3.3 Waste Operators

Deliver frontline waste management services.

- Collect, segregate, and dispose of waste
- Operate plant and equipment safely and efficiently

- Conduct site housekeeping and routine inspections
- Identify and report hazards and incidents

#### **4 MONITORING, MITIGATION, ACTION & RESPONSIBILITIES**

A standalone document titled "Yulara Landfill, Environmental Monitoring, Mitigation, Action and Responsibilities Plan" 15 January 2026 has been prepared and is presented in Appendix B. The contents of the document includes the following:

- Voyages Staff Monitoring
  - Site Condition
  - Fuel Consumption
  - Filled Volumes
  - Cell/Slot Excavation Inspection
  - Litter
  - Fence Condition
  - Odour
  - Weeds and Pests
  - Air Quality
  - Erosion
  - Noise
- Third Party Monitoring
  - Landfill Gas
  - Groundwater
  - Leachate
  - Stormwater
  - Cell/Slot Excavation Inspection
  - Weed and Pest Animals Monitoring

## **5 OPERATIONAL PROCEDURES**

All operational procedures have been incorporated in a stand alone document Yulara Landfill, Operational Procedures 15 April 2026 presented in Appendix C. The contents of the document includes the following:

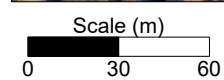
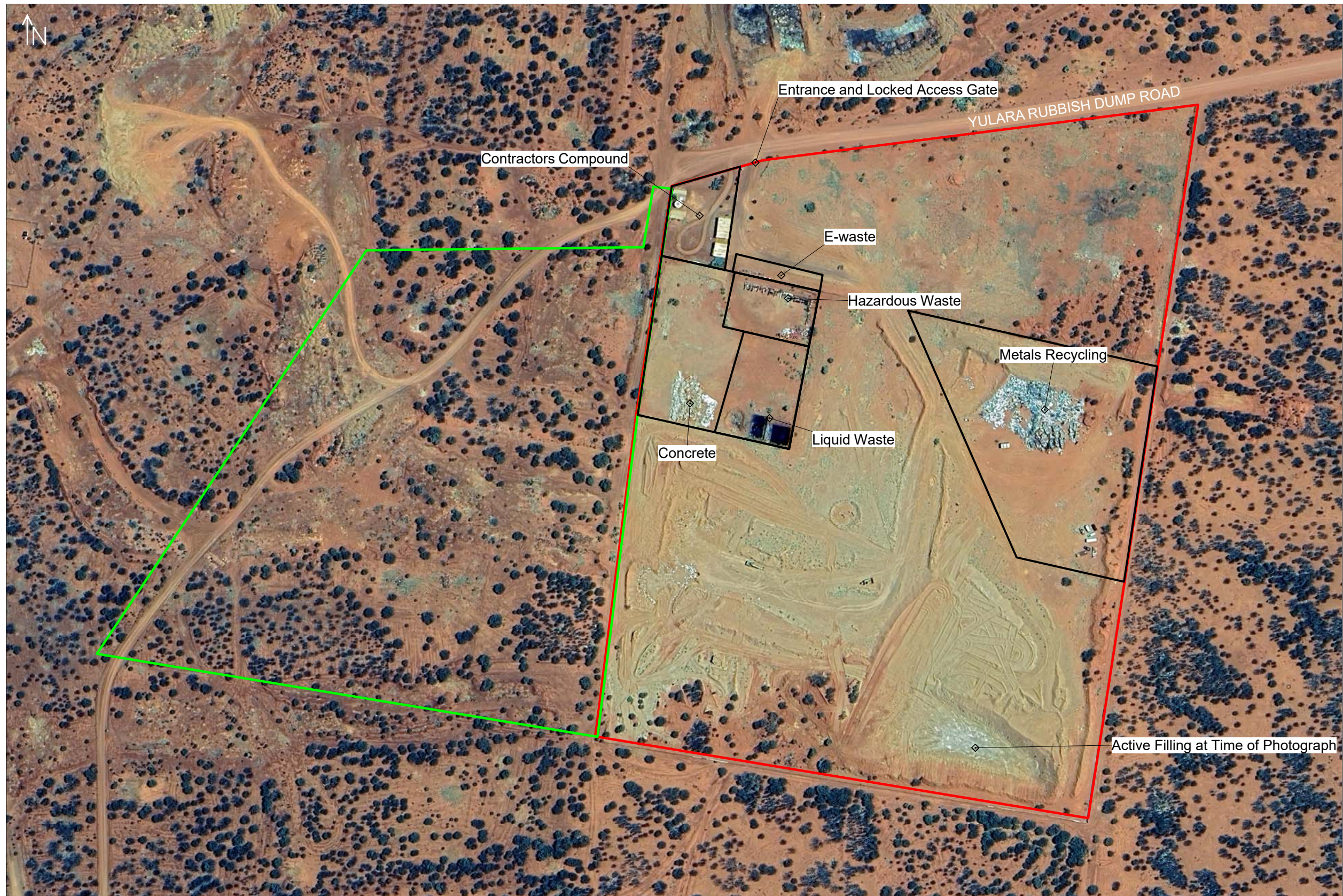
- Voyages Staff General Procedures
  - Hours of Operation and Access
  - Cell Excavation
  - Cell/Slot Excavation Inspection
  - Waste Collection
  - Waste Placement
  - Subgrade Placement
  - Recycling
  - Listed Waste Storage
  - Grease Trap Waste
  - Fuel Management
  - Equipment Maintenance
  - Fence Maintenance
- Voyages Staff Emergency Procedures
  - Fire Response
  - Chemical Spill Response
  - Wet Weather/Flooding
- Third Party Procedures
  - General
  - Landfill Gas
  - Groundwater
  - Leachate
  - Stormwater
  - Cell Excavation Inspection
  - Weed and Pest Animals Monitoring

Consulting Engineers and Scientists



**APPENDIX A**  
PLANS





Legend

- Operational Portion of Landfill
- Undeveloped Portion of Landfill

Notes:

1. Base aerial photo by Google Maps, taken 22 February 2023.
2. Site boundaries are approximate, based on coordinates from strike.net.gov.au.
3. Location of landfill features are approximate and based on field records.

Figure 1 - Site Layout Plan  
Landfill Environmental Management Plan  
Yulara Landfill



**APPENDIX B**

**ENVIRONMENTAL MONITORING, MITIGATION, ACTION AND RESPONSIBILITIES PLAN**



**Yulara Landfill**

**Environmental Monitoring,  
Mitigation, Action and  
Responsibilities Plan**

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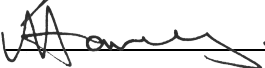
## Yulara Landfill

### Environmental Monitoring, Mitigation, Action and Responsibilities Plan

Prepared for  
Voyages Tourism Australia

**17 April 2026**

#### Document Status

|                                                        | Name                             | Signature                                                                            | Date              |
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## **APPENDIX A**

ODOUR MONITORING LOCATIONS

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LANDFILL GAS MONITORING LOCATIONS

## **APPENDIX C**

GROUNDWATER AND LEACHATE MONITORING LOCATIONS

## **APPENDIX D**

SCHEDULE OF MONITORING, ACTIONS AND RESPONSIBILITIES

## **APPENDIX E**

DAILY INSPECTION RECORDS AND SITE DIARY

## 1 INTRODUCTION

### 1.1 General

This monitoring plan has been prepared by Terra Environment Pty Ltd for Voyages Tourism Australia (Voyages). It documents an environmental monitoring, mitigation, actions and responsibilities plan for the Yulara Landfill located approximately 3.5km to the north west of the Yulara township in the Northern Territory. A plan showing the location of landfill is provided as Figure 1 in Appendix A.

### 1.2 Site Definition

The Yulara Landfill (site) is defined as follows:

|                    |                                                    |
|--------------------|----------------------------------------------------|
| <b>Description</b> | Yulara Landfill                                    |
| <b>Address</b>     | Lot 248 Yulara NT                                  |
| <b>Title</b>       | Volume CUFT 866 Folio 877                          |
| <b>Plan</b>        | LTO94/017B                                         |
| <b>Council</b>     | Unincorporated area within McDonnell Shire Council |
| <b>Zoning</b>      | No Zone                                            |
| <b>Size</b>        | 201,400m <sup>2</sup>                              |
| <b>Owner</b>       | Voyages Tourism Australia                          |

### 1.3 Background

This monitoring plan has been prepared to prevent or minimise detrimental environmental impacts caused by the operation of the waste facility. To achieve this Voyages staff and a third party monitoring team (TPMT) will implement a program of regular facility inspections and scheduled monitoring. The inspections and monitoring will involve evaluating the facility's compliance with environmental management practices, operational procedures, and containment measures to prevent or minimise contamination of surrounding ecosystems.

This document has been prepared as a stand-alone document which forms a portion of the overall Landfill Environment Management Plan (LEMP). The document also incorporates, where appropriate, mitigation measures (or remedial measures), actions and responsibilities.

Landfill gas, groundwater, and leachate monitoring will be conducted at designated locations around the Facility to detect any changes in gas emanation or water quality that could indicate potential contamination or other environmental concerns. This will include testing for key environmental indicators and relevant parameters, as determined by experience of similar facilities and regulatory guidelines (refer Section 3).

Voyages staff currently undertake daily, weekly and monthly inspections of such things as litter, site condition, fuel consumption, fence condition, filled volumes etc. These will be continued going forward and supplemented with additional inspections or monitoring tasks presented in Section 2.

As a condition of the Landfill License with the Northern Territory Government, Voyages is required to conduct an annual monitoring program for animal pests, disease vectors and weeds within the premises of the Waste Management Facility. This is proposed to be continued by a TPMT and details are presented in Section 3.

During the February 2025 round of groundwater bore installation a layer of higher permeability soil was identified higher in the stratigraphic profile than expected. Encountering this layer near the base of a cell would be detrimental to the performance of that cell to impede transmission of liquids. For this reason a method and an inspection process has been developed to ensure that at least 1.0m of suitably low permeability materials (clays or mudstones) are located immediately beneath future cells (refer Section 3.5).

The entire monitoring and inspection program will be subject to an annual review as part of the reporting requirements. This review will involve analysing trends in the collected monitoring data over time to identify

any emerging patterns or deviations that may suggest a change in environmental impact. Additionally, the review will assess the relevance and effectiveness of the parameters being tested, ensuring they remain appropriate for the Facility's operations and potential risks.

Based on the outcomes of this annual evaluation, the TPMT will prepare a report which details recommendations to improve the monitoring program. These improvements may include updating sampling locations, adjusting the frequency of inspections, revising analytical methods, or expanding the range of parameters analysed, all with the goal of enhancing the program's capacity to detect, mitigate and prevent environmental harm.

## **1.4 Objectives**

Through regular and ongoing inspections by Voyages staff and through the scheduled monitoring by the TPMT, the objectives of this monitoring plan are as follows:

- Prevent or minimise detrimental environmental impacts caused by the operation of the waste facility.
- Meet regulatory compliance requirements (including Environment Protection Licence EPL197-03) and document findings.
- Detect environmental impacts in a timely manner via ongoing and scheduled monitoring.
- Track long term trends in landfill gas, groundwater, leachate and stormwater.
- Provide actions to reduce weeds and pest animals.
- Assess the appropriate extent of excavation of future cells.
- Assess and update as required the inspection and monitoring program.

## **1.5 Format**

### **1.5.1 General**

The inspection and monitoring program requires input from both onsite personnel and independent third parties, as no single group can effectively manage all tasks alone. Allocation of responsibilities must consider cost, expertise, and the need for objectivity. Routine inspections and ongoing monitoring are most cost-effectively performed by onsite staff. However, specialised tasks such as landfill gas monitoring, groundwater and leachate sampling, and weed and pest assessments require specific expertise, equipment, and independent interpretation, and are therefore best carried out by a qualified third party. As these tasks are infrequent, third-party involvement is not cost-prohibitive. Accordingly tasks have been divided into two categories as per Section 1.5.2 and 1.5.3 below.

Sections 2 and 3 detail each task including monitoring requirements, actions, mitigation measures, documentation and responsibilities. For the more generic tasks where a procedure or instruction is recommended it will be presented in table format. For the more complicated tasks such as groundwater monitoring or cell excavation there will be a cross reference to the appropriate section in the Procedures document.

### **1.5.2 Voyages Staff Monitoring**

The following tasks will be undertaken by Voyages staff and more detail is presented in Section 2.

#### Existing Tasks

- Site condition
- Fuel consumption
- Filled volumes
- Litter
- Fence condition

New Tasks

- Odour
- Weeds and pests
- Dust
- Erosion
- Cell excavation inspection

**1.5.3 Third Party Monitoring Teams**

The following tasks will be undertaken by the TPMT and more detail is presented in Section 3.

- Landfill gas monitoring
- Groundwater monitoring
- Leachate monitoring
- Stormwater monitoring
- Cell excavation inspection
- Weed and pest animal monitoring

## 2 VOYAGES STAFF MONITORING

### 2.1 Site Condition

The following tasks shall be undertaken daily by voyages staff.

| Task              | Details                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|-------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Objectives        | <ul style="list-style-type: none"> <li>- Minimise/avoid dust generation.</li> <li>- Minimise/avoid dust leaving the site.</li> <li>- Track fill levels and forward plan future cell excavations.</li> <li>- Check the security of the site.</li> <li>- Assess wind blown litter.</li> <li>- Assess how waste is being separated for recycling.</li> </ul>                                                                                                                                                                                                                                                                                                                                                             |
| Monitoring        | <ul style="list-style-type: none"> <li>- Daily and ongoing inspection of dust by site staff when on site and particularly while undertaking works on site.</li> <li>- Inspect and make note of filling progress in current portion of cell to determine the need to commence excavations of the next portion of the cell.</li> <li>- Check the integrity of fence line and security cameras.</li> <li>- Assess the amount of litter blown against the fence line and beyond the fence line in trees and bushes.</li> <li>- During kerb side pickup inspection of disposed materials and assess if materials are being adequately separated and placed in the appropriate bins.</li> </ul>                             |
| Actions           | <ul style="list-style-type: none"> <li>- Minimise or suspend site works particularly excavation/movement of soil during strong winds or moderate and strong winds on hot days to minimise dust generation and litter movement.</li> <li>- Set dates to undertake excavations of future portions of the cell with adequate time to accommodate delays, breakdowns or inclement weather.</li> <li>- Repair fence line if damaged.</li> <li>- Replace or order and replace damaged security cameras.</li> <li>- Pick up litter on boundary fence or if beyond boundary fence arrange a litter clean up program.</li> <li>- If wastes are not correctly separated notify resident on the appropriate disposal.</li> </ul> |
| Future Mitigation | <ul style="list-style-type: none"> <li>- Planned future excavations should be timed to coincide with adequate staffing levels and when equipment is in service.</li> <li>- Review daily or interim compaction and covering practices if wind blown litter levels are not acceptable.</li> <li>- Ensure adequate stock of fence repair materials are available.</li> </ul>                                                                                                                                                                                                                                                                                                                                             |
| Documentation     | Complete appropriate section of "Daily Inspection Records and Site Diary" form.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Procedures        | Refer Sections 2.2, 2.6 and 2.12 of Procedures document.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Responsibilities  | Voyages staff supplemented by independent inspections by the TPMT when present on site.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |

### 2.2 Fuel Consumption

Voyages monitors energy consumption across all aspects of its operations, including the landfill, which specifically tracks its fuel usage. Section 6.14 of the Voyages Environmental Management Plan outlines the organisation's energy sustainability objectives, applicable standards, and measurement criteria.

The following table presents the energy-related criteria relevant to the landfill, along with site-specific commentary where applicable.

| Task              | Details                                                                                                                                                                                                                        |
|-------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Objectives        | <ul style="list-style-type: none"> <li>- Reduce energy consumption from fossil fuel sources.</li> <li>- Collection of fuel consumption data for reporting as part of Voyages' Renewable Energy Target (RET) scheme.</li> </ul> |
| Monitoring        | <ul style="list-style-type: none"> <li>- Monitoring of fuel usage as used.</li> </ul>                                                                                                                                          |
| Actions           | NA                                                                                                                                                                                                                             |
| Future Mitigation | Review of fuel consumption statistics as part of the selection process when sourcing new plant.                                                                                                                                |
| Documentation     | Recording of fuel usage in fuel log as used.                                                                                                                                                                                   |
| Procedures        | NA                                                                                                                                                                                                                             |
| Responsibilities  | Voyages staff                                                                                                                                                                                                                  |

### 2.3 Filled Volumes

Due to limited resources on site, excavation of the landfill cell requires forward planning and is typically undertaken intermittently as resources become available. Voyages staff have therefore adopted a progressive excavation method, whereby the cell is cut in small slots perpendicular to its length. This approach allows individual slots to be excavated to full depth within a short timeframe, rather than undertaking full excavation of the entire cell, which would require substantially more time and resources.

Effective implementation of this approach relies on maintaining an accurate understanding of available airspace within existing slots, as well as staff availability, to support efficient forward planning. Given the significant costs associated with creating new airspace and managing filled areas, optimising the use of existing airspace is critical to ensuring efficient resource allocation and cost-effective landfill operations.

| Task              | Details                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|-------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Objectives        | <ul style="list-style-type: none"> <li>- Maximise filling within a given airspace.</li> <li>- Scheduling and long term planning of future works.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Monitoring        | <ul style="list-style-type: none"> <li>- Weekly monitoring of available airspace or percentage filled.</li> <li>- Weekly assessing of the filling to determine if it is adequately compacted.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Actions           | <ul style="list-style-type: none"> <li>- Forward scheduling excavation works for new slots within cells nominally once filled volume in a slot reaches approximately 50%. As this is usually undertaken when there is free capacity of the limited available resources the work may need to be undertaken sporadically over a long period and this should be factored in to the planning. Maintain at least 3 months of filling capacity as a minimum.</li> <li>- If waste does not appear to be adequately compacted instruct the dozer operator to "push out" the waste and make multiple passes over it and repeat if necessary.</li> </ul> |
| Future Mitigation | <ul style="list-style-type: none"> <li>- Additional use of the dozer maybe required to achieve the desired level of compaction.</li> <li>- The need for a trash compactor should be assessed if the dozer is not adequately compacting the fill.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                    |
| Documentation     | Complete appropriate section of "Daily Inspection Records and Site Diary" form.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |



| Task             | Details                                                                                 |
|------------------|-----------------------------------------------------------------------------------------|
| Procedures       | Refer Section 2.2, 2.5 and 2.6 of Procedures document.                                  |
| Responsibilities | Voyages staff supplemented by independent inspections by the TPMT when present on site. |

## 2.4 Cell/Slot Excavation Inspection

This section should be read in conjunction with Section 3.5. As only trained Voyages personnel are permitted to undertake this inspection process the actual process remains in Section 3.5 as a TPMT task.

It was originally intended that the cells would be excavated in one event and as a result the TPMT could be present on site to identify high permeability layers (sand rich layers) and mitigate accordingly (halt excavation at least 1m above sand rich layers). Due to the limited resources available onsite cells are excavated in slots (small excavations perpendicular to the orientation of the cell) resulting in nominally 15 to 20 excavation events per cell. It is not feasible to have the TPMT on site for each of these events. During the TPMT's last visit to site in August 2025 the Voyages Land and Environment Manager was trained in the identification of sand rich layers and the method as described in Section 3.5. The Voyages Land and Environment Manager will now undertake the slot excavation inspections. The task table from Section 3.5 is repeated here for quick reference and the details of the process remain in Section 3.5 here in and in Section 2.2 in the Yulara Landfill Operational Procedures document.

| Task              | Details                                                                                                                                                                                              |
|-------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Objectives        | Identification of higher permeability (sand rich) layers and avoid excavation to within 1m or more of such layers (resulting in at least 1m of low permeability materials beneath the base of fill). |
| Monitoring        | Assessment of materials for suitable permeability (low permeability clays and silts) at the commencement of each slot's excavation. Final cell depth will be dependent on findings.                  |
| Actions           | Halt excavations at least 1m above higher permeability layers (if encountered).                                                                                                                      |
| Future Mitigation | NA                                                                                                                                                                                                   |
| Documentation     | Complete appropriate section of "Daily Inspection Records and Site Diary" form.                                                                                                                      |
| Procedures        | Refer bullets above table in Section 3.5 of this document and Sections 2.3 and 4.6 of Procedures document.                                                                                           |
| Responsibilities  | Voyages Land and Environment Manager supplemented by training by the TPMT as required and dual inspection when TPMT on site.                                                                         |

## 2.5 Litter

Litter at landfills most typically is wind blown paper and plastics. Other forms of litter (debris on haul roads, dispersed waste piles) are unlikely to occur if the transport and placement of waste is well managed. This is unlikely to occur at the Yulara landfill as access is restricted to Voyages staff and there is only one easily identified pit for the depositing of waste. As a consequence the main priority of monitoring will be wind blown litter and the resulting outcomes. The dispersal of wind blown litter will be greater during high wind events and when waste is not covered in a timely fashion.

In addition to the above EPL179-03 specifies the following with respect to litter:

20      *The licensee must ensure that litter:*

20.1      *is contained within the boundary of the premises;*

20.2      *is not deposited or allowed to accumulate in stormwater drain(s), water or leachate dam(s);*

20.3      *does not accumulate along the boundary of the premises.*

With regard to 20.2 above we note that as the landfill is essentially flat at this stage (may change in the future) there are no stormwater drains or dams on site. There is however a liquid waste pond and this will be treated as a dam and consequently litter entering it should be avoided.

On the basis of the above the following will apply:

| Task              | Details                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|-------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Objectives        | <ul style="list-style-type: none"> <li>- Minimise/avoid blowing of litter.</li> <li>- Minimise/avoid accumulation along boundary fences.</li> <li>- Minimise/avoid litter in the leachate ponds.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Monitoring        | <ul style="list-style-type: none"> <li>- Daily assessment of actual and forecast wind conditions (direction and strength) at start of day and throughout the course of the day.</li> <li>- Daily inspection of fence lines for litter during daily site circuit.</li> <li>- Daily inspection of vegetation surrounding the site boundary for litter during daily site circuit.</li> <li>- Daily and ongoing (when staff are on site) inspection of tip face for wind blown litter.</li> </ul>                                                                                                                                                                                                                                                                                                                    |
| Actions           | <ul style="list-style-type: none"> <li>- If wind conditions are or are forecast to be strong and/or they are blowing along the length of the trench consider either stopping deposition of waste or immediately covering waste as deposited.</li> <li>- If litter has built up along fence lines schedule collection within 48hrs. Generally if litter build up is low it should be collected as identified.</li> <li>- If vegetation surrounding the site boundary has litter schedule collection within 48hrs. Generally this is also low and if present it should be collected during the perimeter inspection.</li> <li>- If litter is already being blown by wind, stop depositing of waste until the existing waste can be covered and only deposit new waste if it can be covered immediately.</li> </ul> |
| Future Mitigation | <ul style="list-style-type: none"> <li>- To mitigate windblown litter from the tip face without losing airspace by prematurely covering the waste, the waste and interim cover could be shaped to form a wind barrier to shelter future waste deposition from prevailing winds or blowing along the trench. Similarly the excavated natural material should be placed as a bund around the tip face as a windbreak rather than being stored in one large stockpile.</li> <li>- Tip face actions will mitigate new litter at the boundaries however earlier intervention to halt and cover waste going forward should reduce litter at or beyond the boundaries in the future.</li> </ul>                                                                                                                         |
| Documentation     | Complete appropriate section of "Daily Inspection Records and Site Diary" form. There is no need to document ongoing monitoring when staff are on site unless winds are or may become problematic. At such times, note the conditions and record any action taken.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Procedures        | Refer Actions and Future Mitigation above.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Responsibilities  | Voyages staff supplemented by independent inspections by the TPMT when present on site.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |

## 2.6 Fence Condition

The site perimeter fencing serves several important functions: it acts as a deterrent to unauthorised access and illegal dumping, provides a barrier to feral animals, and serves as a trap for windblown litter. Regular upkeep and maintenance of the fencing are essential to ensure these functions are effectively maintained.

In addition, regular inspections help identify areas where windblown litter has accumulated and require collection, supporting ongoing site cleanliness and compliance. In addition to the perimeter fence there is also an internal fence which encloses the liquid waste ponds and hazardous waste area. This fence serves to restrict access and prevent entry by unauthorised personnel and fauna.

Maintaining these fences in good condition is essential to ensure safety, environmental protection, and regulatory compliance.

Voyages staff have discussed the installation of a perimeter stormwater bund to contain stormwater. If this is established its integrity will be assessed daily along with the fence and litter. The bund has been included below as if it is established. In addition there can be a minor wash out under the fence (midway along the eastern side) after extreme rain events. As this is infrequent and relatively minor it is monitored in this section and not Section 2.10 – Erosion.

| Task              | Details                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|-------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Objectives        | <ul style="list-style-type: none"> <li>- To assess the integrity of the perimeter and internal fence and the perimeter stormwater bund and the need for repair.</li> <li>- To identify litter build up requiring action.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Monitoring        | <ul style="list-style-type: none"> <li>- Daily inspection of perimeter and internal fence integrity and the perimeter stormwater bund.</li> <li>- Daily inspection of buildup of litter on fence line.</li> <li>- Inspection for washout on eastern fence line after extreme rain events.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Actions           | <ul style="list-style-type: none"> <li>- Voyages staff to undertake repairs of fence and the perimeter stormwater bund in a timely fashion. As bund repairs are simply earthworks they must be completed as the first task of the day.</li> <li>- If repairs are beyond the capabilities of site staff then engage a fencing contractor to undertake repairs. Until the contractor is present Voyages staff shall place temporary repairs such as temporary fence or orange barrier mesh and stakes.</li> <li>- Voyages staff to clear litter build up from fence.</li> <li>- Where washout has occurred along the eastern fence line, it shall be reinstated. Depending on the extent of the washout, repairs shall be undertaken either manually by shovelling soil back beneath the fence or, where more extensive, by utilising plant to place and compact suitable material.</li> </ul> |
| Future Mitigation | Voyages staff should maintain a readily accessible supply of fencing materials, such as mesh, star droppers (fence posts), and ties either on-site or at the store, to facilitate timely minor repairs as needed.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Documentation     | Complete appropriate section of “Daily Inspection Records and Site Diary” form. Record on form any actions undertaken associated with repairs, contacting a contractor, ordering fence supplies or collecting litter.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Procedures        | Refer Section 2.12 of Procedures document.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Responsibilities  | Voyages staff supplemented by independent inspections by the TPMT when present on site.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |

## 2.7 Odour

As the site is located more than 2km from the nearest sensitive receptors (2.2km to Nyangatjatjara College and 2.5km to the workers accommodation) odour is unlikely to impact them. Basic olfactory odour monitoring will still be undertaken as a precautionary step at the intersection of Yulara Rubbish Dump Road and Mala Road and at the tip face (refer discussion following bullet points below). As the landfill is not open

to the public and the township does not have substantial industries the risk of unsuitable materials being disposed of at the landfill is low, however it is not inconceivable with the ongoing maintenance program, that paints and solvents maybe inadvertently disposed of in the cell.

In addition to the above EPL179-03 specifies the following with respect to odour:

42      *The activity must not cause or release, beyond the boundary of the premises:*

42.3      *offensive odour*

We note that this is unlikely to be achievable as due to the landfill's small size the filled areas extent to the boundary and the current cell is adjacent the southern boundary. However the site is surrounded for many kilometres by bushland which can be considered as a buffer zone and the nearest sensitive user is 2.2km to the east. The NT EPA Guidelines for the Siting, Design and Management of Solid Waste Disposal Sites in the Northern Territory states the following:

*"In order to protect sensitive areas from impacts associated with landfill operations, such as odours, noise, litter and dust, an adequate separation (buffer zone) distance needs to be maintained between the landfill and adjacent land uses. The requirement for and extent of buffer areas should be determined on a site specific basis. Where possible, the buffer area should be controlled by the landfill operator."*

Hence the monitoring position at the intersection of Yulara Rubbish Dump Road and Mala Road (at the end of the buffer zone between the landfill and sensitive users) has been established for future ongoing odour monitoring. On the basis of the above the following will apply:

| Task              | Details                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|-------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Objectives        | <ul style="list-style-type: none"> <li>- Identify odours from the landfill and impacting sensitive receptors.</li> <li>- Identification of unsuitable materials being deposited in the cell, (primarily paints and solvents but also anything unusual or not noticed before) to avoid/minimise impact to underlying sediments.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                 |
| Monitoring        | <ul style="list-style-type: none"> <li>- Daily and ongoing olfactory monitoring for odours at the intersection of Yulara Rubbish Dump Road and Mala Road.</li> <li>- Ongoing olfactory monitoring at the tip face for paints, solvents and odours not typically noticed.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Actions           | <ul style="list-style-type: none"> <li>- If landfill odour is noticed at the intersection of Yulara Rubbish Dump Road and Mala Road then the source should be investigated at the landfill. The source will likely be emanating from the tip face and cover or additional cover may be required.</li> <li>- It is likely that if the odour has been detected the material has escaped its container. The excavator shall be used to dig through the waste for the offending material and remove it from the cell. The waste shall be placed on plastic sheeting on an already filled area of the landfill until either the paint has dried (no longer mobile) or the solvent or unusual odour has volatilised.</li> </ul> |
| Future Mitigation | Voyages staff should proactively engage with potential waste disposers to communicate the organisation's expectations and requirements regarding correct disposal methods.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Documentation     | Complete appropriate section of "Daily Inspection Records and Site Diary" form. No documentation is required if no odours are noticed.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Procedures        | Refer Actions and Future Mitigation above.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Responsibilities  | Voyages staff supplemented by independent inspections by the TPMT when present on site.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |

A plan of the odour monitoring locations is presented in Appendix A.

## 2.8 Weeds and Pests

A TPMT is engaged annually to conduct a comprehensive weed and pest animal monitoring program. This program includes the assessment of pest animals, disease vectors, and weed species within the boundaries of the Waste Management Facility. While it is not expected that Voyages staff perform such in-depth assessments on a continual basis, instead they are responsible for routine baseline monitoring. This ongoing monitoring supports informed decision-making regarding operational practices, such as the need for waste covering or other mitigation measures. On this basis of the above the following will apply:

| Task              | Details                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|-------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Objectives        | <ul style="list-style-type: none"> <li>- Identification of the presence of pests and mitigate.</li> <li>- Identification of weeds and removal to avoid further spreading.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Monitoring        | <ul style="list-style-type: none"> <li>- Daily and ongoing observation of bird numbers circling or on the ground at the tip face.</li> <li>- Daily and ongoing observation of vermin and dogs at the tip face.</li> <li>- Monthly assessment of vegetation in the working areas of the landfill (other areas will be assessed annually).</li> </ul>                                                                                                                                                                                                                                                                                                                                                        |
| Actions           | <ul style="list-style-type: none"> <li>- If birds are observed circling or foraging at the tip face, or if vermin or dogs are present in the area, the dozer should be used to turn and compact the waste in an effort to deter these pests. If this measure is ineffective, it may be necessary to cover the waste to prevent ongoing pest activity.</li> <li>- The presence of dogs may indicate a breach in the perimeter fence. A thorough inspection of the fence line should be initiated, and any identified damage should be repaired promptly.</li> <li>- If weeds are identified in the working areas of the landfill spraying or grading should be undertaken to limit their spread.</li> </ul> |
| Future Mitigation | Landscaping as part of the closure of cells may be required to suppress weed growth.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Documentation     | Complete appropriate section of "Daily Inspection Records and Site Diary" form.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Procedures        | Refer Actions and Future Mitigation above and Section 4.7 of Procedures document.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Responsibilities  | Voyages staff supplemented by independent inspections by the TPMT when present on site.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |

## 2.9 Air Quality

The primary sources of particulate matter (dust) are expected to be vehicle movements and wind erosion from exposed surfaces, particularly the soil stockpile generated during excavation of the current landfill cell. There is also expected to be sporadic and short lived potential dust generating events when a new cell is excavated and when stockpiled soil is utilised to cover waste.

The dispersion of dust will be dependent on wind speed and direction and the moisture condition of the soil. In addition, as the soil excavated from the cell is relatively clay rich it will generate less dust if the surface is initially watered, allowed to form a crust and left undisturbed.

Dust impacts are anticipated to be largely confined to on-site personnel, as the nearest sensitive off-site receptor is a school located approximately 2.2 kilometres to the east. For this reason and as the landfill is relatively small dust monitoring will be restricted to observations as opposed to machine based particulate monitoring.

In addition to the above EPL179-03 specifies the following with respect to dust:

42      *The activity must not cause or release, beyond the boundary of the premises:*

42.4      *dust or particulates*

On the basis of the above the following will apply:

| Task              | Details                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|-------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Objectives        | <ul style="list-style-type: none"> <li>- Minimise/avoid dust generation.</li> <li>- Minimise/avoid dust leaving the site.</li> </ul> <p>Note to the above: Due to the considerable distance to sensitive receivers the primary focus of dust management and monitoring is to avoid dust leaving the site. Hence some dust generation on site can be tolerated, for example on a windless day dust may be generated by traversing across the site but it may not leave the site. Stopping work and wetting a haul road would not be justified in this example. Monitoring and documentation should be employed with this in mind.</p> |
| Monitoring        | <ul style="list-style-type: none"> <li>- Daily assessment of actual and forecast wind conditions (direction and strength) at start of day and throughout the course of the day.</li> <li>- Daily and ongoing inspection of dust by site staff when on site and particularly while undertaking works on site.</li> <li>- Ongoing monitoring of vehicles speed and associated dust generation.</li> </ul>                                                                                                                                                                                                                              |
| Actions           | <ul style="list-style-type: none"> <li>- If strong winds are forecast move soil from the stockpile to the cell prior to the strong wind event.</li> <li>- Minimise site works particularly excavation/movement of soil during strong winds or moderate and strong winds on hot days.</li> <li>- Regular wetting of haul roads when vehicles are using the site in dry conditions and moderate to strong winds.</li> <li>- If excessive dust is being generated from vehicles have drivers reduce their speed.</li> </ul>                                                                                                             |
| Future Mitigation | <ul style="list-style-type: none"> <li>- The soil stockpile should be sufficiently wetted initially and with localised follow up wetting if disturbed so as to form a crust that inhibits dust generation. If this cannot be achieved then dust suppression agents should be applied.</li> <li>- Similarly if dust can not be managed on haul roads with just water then dust suppression agents should be applied.</li> </ul>                                                                                                                                                                                                       |
| Documentation     | Complete appropriate section of "Daily Inspection Records and Site Diary" form. There is no need to document ongoing monitoring when staff are on site unless winds are or may become problematic. At such times a comment about the conditions should be recorded and if an action is taken that should also be recorded.                                                                                                                                                                                                                                                                                                           |
| Procedures        | Refer Actions and Future Mitigation above and Section 2.2 and 2.6 of Procedures document.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Responsibilities  | Voyages staff supplemented by independent inspections by the TPMT when present on site.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |

## 2.10 Erosion

At present the site, with the exception of the soil stockpile is generally flat and erosion is not expected to be an issue. There may be minor erosion of the stockpile and the excavation walls but this is unlikely to leave site. There is minor stormwater flow mid way along the eastern boundary after major rainfall events which can result in washout under the fence. At this stage erosion monitoring is not proposed and the minor

washout that can occur will be monitored as part of the fence condition in Section 2.6. If the filling and cover form is to change in the future the need for erosion monitoring should be reviewed.

### **2.11 Noise**

As the nearest sensitive neighbours are 2.2km (Nyangatjatjara College) and 2.5km (workers accommodation) from the site, noise is unlikely to impact them. In addition the equipment on site (dozer, excavator and wood chipper) are only operated infrequently. At this stage noise monitoring is not proposed however if equipment on site or nearby receptors where to change the need for noise monitoring should be reviewed.

### 3 THIRD PARTY MONITORING

#### 3.1 Landfill Gas

##### 3.1.1 General

Landfill gas is produced by the breakdown of organic matter in waste as it decomposes under anaerobic conditions. Landfill gases typically consist of methane and carbon dioxide, and may also include trace amounts of hydrogen sulphide, carbon monoxide, and various volatile organic compounds (VOCs). Landfill gases can pose several issues at a landfill site. They may cause nuisance odours, inhibit plant growth, and contribute to greenhouse gas emissions. In confined or enclosed spaces (not currently present or in use at this site), landfill gases may also present explosion or asphyxiation risks, as well as potential health impacts. In addition, due to the depth of the landfill cells, there is a potential (albeit minor due to the large dimensions of the cells) risk of landfill gas accumulation at the base of the cell. Given that methane is lighter than air and carbon dioxide is heavier, the primary asphyxiation risk is associated with the accumulation of carbon dioxide in low-lying areas. A check of this will be undertaken as part of the monitoring.

Landfill gas generation is related to the moisture content within the fill for the majority of the life of a landfill. Generally an increase in moisture content results in an increase in landfill gas generation. In addition an increase in landfill gas which cannot diffuse through the cover over the fill can spread laterally. Knowledge of the expected moisture content from year to year (by moisture budget analysis) will be important for assessing long term trends in landfill gas levels.

##### 3.1.2 Objectives

The objective of the landfill gas monitoring is to assess the current and long term landfill gas and volatile gas levels at set locations within the fill and surrounding the fill. In addition undertake a check for potential gas accumulation in the operational cell.

##### 3.1.3 Monitoring Locations

Although there are three structures located on site, they are currently unused and secured with fencing. Additionally, these structures do not contain any ground penetrations, such as service connections or septic systems, that could serve as preferential pathways for landfill gas migration into the buildings. These structures will not be monitored. If in the future these structures are to be used or new structures are established they should be included in the list of monitoring locations.

Eleven landfill gas monitoring wells have been established on site in filled areas and at the periphery of filled areas. The wells and their purpose are as follows:

| Gas Well | Current Status | Depth                          | Comments                                                                                                                                                                                            |
|----------|----------------|--------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| MW1S     | In Service     | 4m                             | Periphery well west of the filled area.                                                                                                                                                             |
| MW2S     | In Service     | 10m                            | Periphery well east of the filled area.                                                                                                                                                             |
| MW3S     | In Service     | 11m                            | Periphery well south east of the filled area.                                                                                                                                                       |
| MW4S     | In Service     | 2.5m                           | Northern boundary in the fill.                                                                                                                                                                      |
| MW5S     | In Service     | 3.9m pipe in 12.5m sand column | North east corner of the landfill adjacent the fill. MW5S is established in the borehole for a groundwater well. The gas well is connected to 12.5m of sand backfill in the borehole.               |
| MW6S     | In Service     | 3.4m                           | In the northern filled area.                                                                                                                                                                        |
| MW7S     | In Service     | 4.2m                           | In the central east filled area.                                                                                                                                                                    |
| MW8S     | In Service     | 3.9m pipe in 14m sand column   | Periphery well west of the filled area. MW8S is located adjacent MW1S and is established in the borehole for a groundwater well. The gas well is connected to 14m of sand backfill in the borehole. |



| Gas Well     | Current Status | Depth      | Comments                                                                                                       |
|--------------|----------------|------------|----------------------------------------------------------------------------------------------------------------|
| MW9S         | In Service     | 15m        | Former dry groundwater well MW2D converted into a gas well.                                                    |
| LMW1         | In Service     | 6m         | Gas head on a leachate well.                                                                                   |
| LMW2         | In Service     | 8m         | Gas head on a leachate well.                                                                                   |
| Base of cell | NA             | 6m maximum | Measurement of landfill gas parameters in the ambient air from the top of the cell and to the base of the cell |

A plan of the landfill gas monitoring locations is presented as Figure 2 in Appendix B.

### 3.1.4 Monitoring Parameters and LORs

The following landfill gas parameters will be monitored and the limits of reporting will apply:

- Methane 0.1%
- Carbon dioxide 0.1%
- Oxygen 0.1%
- Hydrogen sulphide 1ppm
- Carbon monoxide 1ppm
- VOCs 0.1ppm
- Relative pressure 1mbar
- Flow 0.1L/hr

In addition to the field monitoring parameters above, a historic moisture budget for the landfill will be created from Bureau of Meteorology (BOM) data and each year this will be expanded with the new BOM data. Methane concentrations should be plotted with this moisture budget.

### 3.1.5 Monitoring Frequency

Monitoring will be undertaken every 6 months in February/March and August/September concurrently with groundwater monitoring. This is the schedule at the moment however based on a groundwater trend analysis and notification to the NT EPA this may be reduced to annually in February/March (refer Section 3.2.5).

### 3.1.6 Monitoring Methods

Available gas wells shall be monitored for relative pressure, flow rate, CH<sub>4</sub>, CO<sub>2</sub>, O<sub>2</sub>, H<sub>2</sub>S, CO and VOCs with a landfill gas analyser (QED GA5000 landfill gas analyser or equivalent) and a Photo Ionisation Detector (PID). The landfill gas analyser should be within factory calibration period and documented as such and the PID should have a 10.6eV gas discharge lamp and be calibrated in the field (or prior to travel when flying to site) with a 100ppm isobutylene calibration gas.

The monitoring of the parameters presented in Section 3.1.4 (except relative pressure and flow) should be undertaken for at least 15 minutes noting the parameters at the start, finish and regular intervals. Relative pressure and flow will be measured at commencement prior to the other parameters.

At this stage there is no monitoring of enclosed spaces as the three structures on site are currently unused, secured with fencing and do not contain any ground penetrations. If this status were to change then enclosed space should be monitored for instantaneous maximum concentrations by landfill gas analyser and PID.

The landfill cell shall be monitored by first measuring the ambient air conditions with the landfill gas analyser and PID and then progressing into the pit and walking to the base observing the readings as progressing.

### 3.1.7 QA/QC

Calibration certificates should be obtained from equipment suppliers and presented in annual monitoring reports. If the PID is calibrated in the field the results of the calibration should be presented in annual monitoring reports.

### 3.1.8 Assessment Criteria and Reporting

The acceptance criteria for landfill gas are as follows:

- Methane should be less than 1% by volume in periphery wells.
- CO<sub>2</sub> should be less than 1.5% by volume in periphery wells.

At this stage there is no monitoring of enclosed spaces as the three structures on site are currently unused, secured with fencing and do not contain any ground penetrations. If this status were to change then methane and CO<sub>2</sub> criteria for enclosed space would apply. Monitoring of the cell while not an enclosed space could behave as one in with long periods of light to no wind. Hence the monitoring criteria for enclosed spaces and the cell would be.

- Methane should be less than 2.5% by volume (half the lower explosive limit) in enclosed spaces.
- CO<sub>2</sub> should be less than 1% by volume (approximate point of drowsiness and shortness of breath) in enclosed spaces.

A monitoring report should be prepared after each round of monitoring.

### 3.1.9 Actions and Mitigation

If methane or CO<sub>2</sub> concentrations are exceeded at the periphery of the landfill this should be reported to the NT EPA. As there are no human health receptors in the immediate vicinity inhibition of plant growth is the most likely immediate impact. As such the TPMT flora and fauna consultant should be engaged to undertake an assessment of vegetation in the area of the exceedance. Based on the findings of this assessment further actions may be required based on an appropriate options assessment. The options assessment will assess such tasks as the need for additional observation wells, changes to capping or capping shape, installation of gas extraction/ventilation wells or installation of ventilation trenches.

If enclosed space criteria within the active cell are exceeded ongoing carbon dioxide (most likely issue gas as it is heavier than air) checks may be required.

### 3.1.10 Landfill Gas Summary

| Task              | Details                                                                                                                                                                                                                                                                                                                 |
|-------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Objectives        | <ul style="list-style-type: none"> <li>- Assess the current and long term landfill gas and volatile gas levels at set locations within the fill and surrounding the fill.</li> <li>- Undertake a check for potential gas accumulation in the operating cell.</li> </ul>                                                 |
| Monitoring        | <ul style="list-style-type: none"> <li>- Six monthly monitoring of landfill gas in permanent gas wells and within the operating cell.</li> </ul>                                                                                                                                                                        |
| Actions           | <ul style="list-style-type: none"> <li>- Notify NT EPA.</li> <li>- If exceedances of periphery criteria undertake a flora assessment.</li> <li>- Undertake an options assessment if flora is found to have been impacted.</li> <li>- Ongoing monitoring of CO<sub>2</sub> prior to entering the active cell.</li> </ul> |
| Future Mitigation | Engineering solutions as determined by the options assessment.                                                                                                                                                                                                                                                          |
| Documentation     | Monitoring report by TPMT                                                                                                                                                                                                                                                                                               |
| Procedures        | Refer Section 3.1.6                                                                                                                                                                                                                                                                                                     |
| Responsibilities  | TPMT                                                                                                                                                                                                                                                                                                                    |

## 3.2 Groundwater

### 3.2.1 General

The use of a site as a landfill has the potential to impact groundwater quality, primarily through the migration of leachate into the subsurface. The potential for leachate to impact groundwater depends on several factors, including the volume of leachate generated (which is influenced by climatic conditions and waste filling practices) the depth to the groundwater table, and the characteristics of the subsurface materials through which leachate must travel. The Yulara landfill benefits from relatively favourable site conditions, which reduce the likelihood of significant groundwater impact as follows:

- The landfill is located in a hot dry environment (net negative moisture budgets for extended periods of time) limiting wetting of waste and leachate generation. In addition waste which is wet when deposited can become desiccated or partly desiccated before burial also limiting leachate generation.
- The volume of leachate is expected to be low. The leachate wells on site have been dry since establishment.
- Waste is filled at the end of the day enabling drying throughout the day.
- The upper most groundwater aquifer is at least 27m to 31m below the surface with standing water levels around 20m to 23m below the surface.
- The strata below the base of the filled areas is predominantly low permeability mudstone and siltstone up to 20m thick. In the north east corner there was at the surface approximately 11.5m of higher permeability gravely silty sand however this was underlain by more than 20m of mudstone. Refer section 3.5 for monitoring to address this.

While it is expected that the risk of groundwater impact is low monitoring will be undertaken as a precautionary measure and the monitoring frequency will be reviewed once sufficient data for a trend analysis has been established.

### 3.2.2 Objectives

The objective of the groundwater monitoring program is to assess both current and long-term groundwater quality at designated locations surrounding the landfill, in order to evaluate any potential impacts resulting from the fill.

### 3.2.3 Monitoring Locations

Five groundwater wells have been established around the periphery of the site. The purpose of each based on the direction of groundwater flow (established in the February 2025 monitoring event) is presented in the following table.

| Well | Current Status | Depth | Standing Water Level | Comments                                                                                                                                                                                      |
|------|----------------|-------|----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| MW1D | In Service     | 36.1m | 21.4m                | Up hydraulic gradient of filled areas, west of the fill – <b>True Background Well</b>                                                                                                         |
| MW2D | In Service     | 33.2m | 23.2m                | Down hydraulic gradient of filled areas, east of the fill – <b>Indicator Well</b>                                                                                                             |
| MW3D | In Service     | 30.5m | 21.1m                | Down hydraulic gradient of filled areas to the east of fill including the current cell – <b>Indicator Well</b>                                                                                |
| MW4D | In Service     | 33.5m | 20.7m                | Up hydraulic gradient of filled areas however established in the northern extent of fill – <b>Possible Background Well</b> that may still be impacted by waste <b>Possible Indicator Well</b> |

| Well | Current Status | Depth | Standing Water Level | Comments                                                                                                                                                                                      |
|------|----------------|-------|----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| MW5D | In Service     | 35m   | 19.2m                | Up hydraulic gradient of filled areas however established in the northern extent of fill – <b>Possible Background Well</b> that may still be impacted by waste <b>Possible Indicator Well</b> |

A plan of the groundwater monitoring locations is presented as Figure 3 in Appendix C.

### 3.2.4 Monitoring Parameters and LORs

The most recent round of groundwater monitoring followed the historical scope of analysis, as a revised monitoring plan had not yet been implemented. This legacy suite of analytes included parameters with low solubility and mobility, making them poor indicators of potential landfill-related impacts on groundwater quality. In addition the analysis of short holding time parameters can be difficult at remote sites. Their analysis can lead to false negatives and should be avoided. Biochemical Oxygen Demand (BOD) is an example of an analyte with limited suitability for monitoring at Yulara, due to its short holding time of 48 hours. Given the site's remote location, it is not feasible to meet this requirement, and results obtained outside the holding time are likely to degrade, often leading to non-detectable values that do not accurately reflect actual conditions. The following scope of analytical testing is proposed with the above in mind.

| Parameter                        | Limits of Reporting | Parameter                                                                            | Limits of Reporting |
|----------------------------------|---------------------|--------------------------------------------------------------------------------------|---------------------|
| Alkalinity                       | 20mg/L              | TOC                                                                                  | 5mg/L               |
| Hardness                         | 5mg/L               | COD                                                                                  | 25mg/L              |
| Chloride                         | 1mg/L               | Ferrous/Ferric Fe                                                                    | 0.05mg/L            |
| Alkali Metals<br>(Ca, Mg, Na, K) | 0.5mg/L             | Metals<br>(Sb, As, Ba, Be, B, Cd, Cr, Cr 3+, Co, Cu, Fe, Pb, Mn, Hg, Ni, Se, Ag, Zn) | Various             |
| Sulphate                         | 5mg/L               | Cr VI                                                                                | 0.0005mg/L          |
| TKN                              | 0.2mg/L             | TRH                                                                                  | 0.02, 0.05, 0.1mg/L |
| Ammonia                          | 0.01mg/L            | BTEXN                                                                                | 1-3ug/L             |
| Nitrate/Nitrite                  | 0.1mg/L             | Total N                                                                              | 0.2mg/L             |
| Organic N                        | 0.2mg/L             |                                                                                      |                     |

In addition to the above scope of analytes **once every two years SVOC and VOC** shall also be included in the suite.

### 3.2.5 Monitoring Frequency

Groundwater monitoring is currently conducted biannually in February/March and August/September to coincide with landfill gas monitoring. While this schedule is in place at present, it may be reduced to annual monitoring in February/March, subject to a groundwater trend analysis and formal notification to the NT EPA.

To support any reduction in the scope of analysis, a statistical trend analysis should be undertaken once a sufficient number of monitoring events have been completed using the newly installed groundwater wells. A minimum of four monitoring rounds is required to conduct a Mann-Kendall trend analysis. On this basis, the earliest appropriate time for such a review would be following the August/September 2026 monitoring round.

The review should also take into account relevant site-specific factors, including climatic conditions, soil profiles, geology, and aquifer characteristics, consistent with the considerations outlined in Section 3.2.1.

### 3.2.6 Monitoring Methods

Groundwater wells shall be sampled as follows:

- All groundwater wells shall be gauged prior to purging and sampling activities.
- Purging of wells by use of a Waterra inertia pump<sup>1</sup> and dedicated tubing and foot valve until field readings (dissolved oxygen, redox potential, conductivity, pH and temperature) have stabilised (measured in the field using a multi parameter water meter). Wells which run dry before stabilisation should be left to recover (water returned to the well and back to a level similar to the starting level) prior to sampling.
- After the completion of purging activities collection of samples into appropriate sampling bottles.
- Storage of samples in an esky with ice prior to transportation to the laboratory to ensure optimal storage conditions.
- Submission of samples to the laboratory in the shortest time possible.
- Tracking of samples using Chain of Custody (COC) documentation.

### 3.2.7 QA/QC

The following quality control sampling should be undertaken at the rates indicated in the following table.

| Quality Sampling                         | Number of Samples to be Collected and Analysed |
|------------------------------------------|------------------------------------------------|
| Intra Laboratory Duplicate (groundwater) | 1 sample                                       |
| Inter Laboratory Duplicate (groundwater) | 1 sample                                       |
| Rinsate Sample                           | 1 sample                                       |
| Field Blank Sample                       | 1 sample                                       |
| Trip Blank Sample                        | 1 sample                                       |

The procedure for collecting quality samples shall be the same as for normal samples.

### 3.2.8 Assessment Criteria and Reporting

The assessment of data should be undertaken in two ways, firstly by direct comparison to appropriate criteria and secondly by trend analysis. The trend analysis will be by comparison to long term trends and by comparison of up hydraulic gradient (background) data to down hydraulic gradient data.

At present with respect to direct comparison to appropriate criteria results are compared with ANZG (2018) toxicant default guideline values for 95% level of species protection in freshwater. However this may not be the most appropriate criteria as the ANZG instructions for the selection of levels of protection states the following:

*“High Conservation or Ecological Value Systems – Effectively unmodified or other highly valued ecosystems, typically (but not always) occurring in national parks and conservation reserves, or in remote and inaccessible locations.*

*While there are no aquatic ecosystems in Australia and New Zealand entirely without some human influence, the ecological integrity of our high conservation or ecological value systems is regarded as ‘intact’.*”

This equates to a 99% level of species protection in freshwater which shall be adopted going forward.

Based on the February 2025 field measurement results for TDS direct comparison to Australian Drinking Water Guidelines – Health and Aesthetic criteria should also be included.

A monitoring report should be prepared after each round of monitoring.

<sup>1</sup> A Waterra inertia pump has been selected to be consistent with previous sampling methods. In the event an inertia pump is not available then low flow technique should be utilised.

### 3.2.9 Actions and Mitigation

In the event there is found to be groundwater impacted by fill from the landfill the NT EPA should be notified and an options assessment undertaken. The options assessment will be dependent on the contaminants detected and their concentrations and may include the installation of additional groundwater bores (plume delineation), capping upgrade and contouring changes, stormwater management and increased monitoring frequency.

### 3.2.10 Groundwater Summary

| Task              | Details                                                                                                                                                                       |
|-------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Objectives        | - Assess both current and long-term groundwater quality at designated locations surrounding the landfill, in order to evaluate any potential impacts resulting from the fill. |
| Monitoring        | - Six monthly monitoring of groundwater.                                                                                                                                      |
| Actions           | - Notify NT EPA.<br>- Undertake an options assessment if groundwater is found to have been impacted.                                                                          |
| Future Mitigation | Increased monitoring and engineering solutions as determined by the options assessment.                                                                                       |
| Documentation     | Monitoring report by TPMT                                                                                                                                                     |
| Procedures        | Refer Section 3.2.6                                                                                                                                                           |
| Responsibilities  | TPMT                                                                                                                                                                          |

### 3.3 Leachate

There are two leachate bores established onsite and they have been dry since establishment. As these wells are also gas wells, gas monitoring should be undertaken first so as to not to introduce ambient air into the well. After gas monitoring these wells should be gauged. If they are found to be dry no action should be taken. If they are found to contain liquid the procedure for sampling these wells will be different to groundwater as typically there is a finite amount of liquid in a leachate well and they do not recover quickly (can take many days to weeks). The process shall be as follows:

- Gauging of wells prior to sampling activities.
- Sampling by means of a grab sampler (bailer or equivalent).
- Collection of samples into appropriate sampling bottles. As the liquid available is limited the bottles with the most indicator analytes should be filled first. For example the order of bottle filling should be nutrients, metals, volatile vials followed by others.
- If after all bottles are filled there is sufficient sample field measurement for dissolved oxygen, redox potential, conductivity, pH and temperature using a multi parameter water meter should be undertaken.
- Storage of samples in an esky with ice prior to transportation to the laboratory to ensure optimal storage conditions.
- Submission of samples to the laboratory in the shortest time possible.
- Tracking of samples using Chain of Custody (COC) documentation.

The list of analytes will be as detailed in Section 3.2.4. Additional QA/QC samples are not required.

A plan of the leachate monitoring locations is presented in Appendix C.

| Task              | Details                                                                                                                                                                |
|-------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Objectives        | - Assess both current and long-term leachate quantity and quality (if present).                                                                                        |
| Monitoring        | - Six monthly monitoring of leachate.                                                                                                                                  |
| Actions           | If leachate generation at quantities sufficient to collect in leachate wells is observed a review of capping, contouring and stormwater controls should be undertaken. |
| Future Mitigation | Possible increased monitoring and engineering solutions as determined by the review detailed in Actions section above.                                                 |
| Documentation     | Monitoring report by TPMT                                                                                                                                              |
| Procedures        | Refer bullets above table.                                                                                                                                             |
| Responsibilities  | TPMT                                                                                                                                                                   |

### 3.4 Stormwater

At present there are no drainage lines or detention basins onsite due to the flatness of the landfill. If the landform of the landfill were to change and these features were required they should be included in the monitoring scope. Samples would be collected by means of a bailer cast into the water body and sample analysis undertaken as detailed in Section 3.2.4.

### 3.5 Cell/Slot Excavation Inspection

As the landfill is unlined it is important that each cell or slot within a cell is founded on a low permeability material such as silt and clay or siltstone and mudstone. While most material logs from well establishment identified low permeability siltstone and mudstone for at least 20m there was found to be a sand layer from 1.8m to 11.4m below the surface in the vicinity of MW5D. While there was 20m of siltstone and mudstone below that the sand could present an opportunity for lateral movement of both landfill gas and leachate and should be avoided.

To avoid establishing a cell over a sand rich layer test-pitting in advance of excavation should be undertaken. This was originally envisaged to be undertaken by TPMT however the method by which the cells are excavated it is not feasible for a TPMT to be present. The cell is not excavated in one operation but instead it is excavated in small slots perpendicular to the orientation of the cell. Numerous slots will be excavated, filled and covered before the end of the cell is ever excavated. To address this and still ensure that founding a slot over sand is avoided the Voyages Land and Environment Manager has been trained in the following inspection process. When the TPMT is on site they will meet with the Land and Environment Manager and undertake an inspection of the current slot(s) within the cell. Note if it is proposed that a cell will be excavated in one operation (i.e. not in slots) then the TPMT should be present to undertake the testpitting. The process should occur in a fashion similar to the following:

#### Background

- Due to limited resources and space restrictions the cell cannot be excavated in one operation.
- Cells at the landfill are now being orientated in an east to west orientation the full length of the landfill (approximately 550m long) and approximately 60m to 80m wide. The current cell is parallel and adjacent to the southern boundary, was started at the eastern boundary and has progressed approximately 200m westward.
- The excavation of the cell is undertaken in slots which are excavated perpendicular to the cell orientation (i.e. north to south) and or the order of 30m wide. Hence by the time the cell is finished it may be made of 15 to 20 individual slots.

### Inspection Process

- Establish a 2m deep test-pits in the middle of the proposed slot to confirm if the 1m to 2m interval is low permeability material.
- If the 1m to 2m interval is low permeability material proceed to excavate the upper 1m of material.
- From the base of the 1m deep excavations establish a 2m deep test-pit in the middle of the slot to confirm if the 2m to 3m interval is low permeability material.
- If the 2m to 3m interval is low permeability material proceed to excavate the 1m to 2m interval of material.
- From the base of the 2m deep excavations establish a 2m deep test-pit in the middle of the slot to confirm if the 3m to 4m interval is low permeability material.
- If the 3m to 4m interval is low permeability material proceed to excavate the 2m to 3m interval of material.

This process will be continued until the desired depth is achieved. If however higher permeability material (sand or sandstone) is identified in the test-pits then the excavation of the next layer should be abandoned and the slot depth limited to a level such that there is at least 1m of low permeability material below the base of excavations.

The process of assessing the materials should be undertaken by Voyages Land and Environment Manager. The current manager has been trained by the TPMT however if the manager does change the new manager shall be trained by the TPMT. That manager will advise if excavations can continue or if they should be stopped. The process should be documented with notes and photographs.

| Task              | Details                                                                                                                                                                                                |
|-------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Objectives        | - Identification of higher permeability (sand rich) layers and avoid excavation to within 1m or more of such layers (resulting in at least 1m of low permeability materials beneath the base of fill). |
| Monitoring        | - At commencement of each slots excavation. Final cell depth will be dependent on findings.                                                                                                            |
| Actions           | Halt excavations at least 1m above higher permeability layers.                                                                                                                                         |
| Future Mitigation | NA                                                                                                                                                                                                     |
| Documentation     | Voyages Land and Environment Manager                                                                                                                                                                   |
| Procedures        | Refer bullets above table.                                                                                                                                                                             |
| Responsibilities  | Voyages Land and Environment Manager supplemented by training by the TPMT as required and dual inspection when TPMT on site.                                                                           |

### **3.6 Weed and Pest Animals Monitoring**

A comprehensive weed and pest animal monitoring program is undertaken annually by a TPMT ecological consultant. This program includes the assessment of pest animals, disease vectors, and weed species within the boundaries of the Waste Management Facility and occurs typically in November. The format of this program should continue with the following suggested changes:

- Change of monitoring to March/April each year to occur after the period of seasonal heavy rains (November to March) and when weeds are most likely to be abundant.
- Provide commentary on long term trends.
- Inclusion in the recommendations a preferred method to eradicate each weed species and disease vectors (if identified).



In addition to aid Voyages staff in their monthly monitoring (refer Section 2.8) the TPMT should prepare a brief information document with photographs showing typical weed species and preferred eradication methods.

| Task              | Details                                                                                    |
|-------------------|--------------------------------------------------------------------------------------------|
| Objectives        | - Identification of weeds, pest animals and disease vector issues and recommended actions. |
| Monitoring        | - Annual monitoring of weeds, pest animals and disease vectors.                            |
| Actions           | Recommend eradication methods for weed species and disease vectors (if identified).        |
| Future Mitigation | NA                                                                                         |
| Documentation     | Monitoring report by TPMT                                                                  |
| Procedures        | NA                                                                                         |
| Responsibilities  | TPMT                                                                                       |

#### **4 SUMMARY OF MONITORING REQUIREMENTS**

The schedule of monitoring, actions and responsibilities as presented in Sections 2 (Voyages staff) and Section 3 (TPMT) is summarised in the table in Appendix D.

**APPENDIX A**  
ODOUR MONITORING LOCATIONS





Scale (m)  
0 200 400

 Approximate site boundary  
 Odour Monitoring Location

- Notes:
1. Base aerial photo by Google Maps, taken 22 February 2023.
  2. Site boundary approximate, based on coordinates from [strike.net.gov.au](https://strike.net.gov.au).
  3. Location of OM2 will change depending on where the tip face is onsite.

Figure 1 - Odour Monitoring Locations  
Environmental Monitoring, Action & Responsibilities Plan  
Yulara Landfill



**APPENDIX B**  
LANDFILL GAS MONITORING LOCATIONS





Scale (m)

0 20 40

Notes:

1. Base aerial photo by Google Maps, taken 22 February 2023.
2. Well locations based on surveyed coordinates.
3. Site boundary approximate, based on coordinates from strike.net.gov.au.

MW1S  Landfill Gas monitoring well

 Landfill boundary

Figure 2 - Landfill Gas Wells  
Environmental Monitoring, Action & Responsibilities Plan  
Yulara Landfill



## **APPENDIX C**

### **GROUNDWATER AND LEACHATE MONITORING LOCATIONS**





Scale (m)

0 20 40

Notes:

1. Base aerial photo by Google Maps, taken 22 February 2023.
2. Well locations based on surveyed coordinates.
3. Site boundary approximate, based on coordinates from strike.net.gov.au.

- MW1D Groundwater monitoring well
- LMW1 Leachate monitoring well
- Landfill boundary

Figure 3 - Groundwater & Leachate Monitoring Locations  
Environmental Monitoring, Action & Responsibilities Plan  
Yulara Landfill



## **APPENDIX D**

### **SCHEDULE OF MONITORING, ACTIONS AND RESPONSIBILITIES**

## Schedule of Monitoring, Actions and Responsibilities

| Task                            | Reference   | Monitoring Event                                                                            | Timing                                        | Associated Actions                                                                                                                                                                                                                                                                                                                                                                    | Form                                 | Responsible Persons/Organisation                        |
|---------------------------------|-------------|---------------------------------------------------------------------------------------------|-----------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------|---------------------------------------------------------|
| <b>Voyages Staff</b>            |             |                                                                                             |                                               |                                                                                                                                                                                                                                                                                                                                                                                       |                                      |                                                         |
| Site Condition                  | Section 2.1 | Dust, fence line, security cameras, litter                                                  | Daily and throughout day                      | Minimise or suspend site works particularly excavation/movement of soil during strong winds or moderate and strong winds on hot days.<br>Repair fence line if damaged.<br>Replace or order and replace damaged security cameras.<br>Pick up litter on boundary fence or if beyond boundary fence arrange a litter clean up program.                                                   | Daily site inspection and site diary | Voyages Staff                                           |
|                                 |             | Kerb site pickup                                                                            | As undertaken                                 | If wastes are not correctly separated notify resident on the appropriate disposal.                                                                                                                                                                                                                                                                                                    | Daily site inspection and site diary | Voyages Staff                                           |
|                                 |             | Filling progress                                                                            | Weekly on Wednesday                           | Set dates to undertake excavations of future portions of the cell with adequate time to accommodate delays, breakdowns or inclement weather.                                                                                                                                                                                                                                          | Daily site inspection and site diary | Voyages Staff                                           |
| Fuel Consumption                | Section 2.2 | Monitoring of fuel usage as used.                                                           | As fuel is used                               | NA                                                                                                                                                                                                                                                                                                                                                                                    | Fuel log                             | Voyages Staff                                           |
| Filled Volumes                  | Section 2.3 | Monitoring of available airspace or percentage filled.                                      | Weekly                                        | Schedule excavation works for next cell when filled volume at 50%. Maintain at least 3 months of filling capacity as a minimum.                                                                                                                                                                                                                                                       | Daily site inspection and site diary | Voyages Staff throughout the year and TPMT when present |
|                                 |             | Assessment of the filling to determine if it is adequately compacted.                       | Weekly                                        | Inadequate compaction – dozer to “push out” waste and make multiple passes over it – repeat as necessary.                                                                                                                                                                                                                                                                             | Daily site inspection and site diary | Voyages Staff throughout the year and TPMT when present |
| Cell/Slot Excavation Inspection | Section 2.4 | Assessment of materials for suitable permeability (low permeability clays and silts).       | At the commencement of each slot's excavation | Halt excavations at least 1m above higher permeability layers (if encountered).                                                                                                                                                                                                                                                                                                       | Daily site inspection and site diary | Voyages Staff (that have been trained by the TPMT.      |
| Litter                          | Section 2.5 | Inspection of fence lines for litter.                                                       | Daily                                         | Schedule collection within 48hrs.                                                                                                                                                                                                                                                                                                                                                     | Daily site inspection and site diary | Voyages Staff throughout the year and TPMT when present |
|                                 |             | Inspection of vegetation surrounding the site boundary for litter.                          | Daily                                         | Schedule collection within 48hrs.                                                                                                                                                                                                                                                                                                                                                     | Daily site inspection and site diary | Voyages Staff throughout the year and TPMT when present |
|                                 |             | Assessment of actual and forecast wind conditions.                                          | Daily and throughout day                      | Consider either stopping depositing of waste or immediately cover as deposited.                                                                                                                                                                                                                                                                                                       | Daily site inspection and site diary | Voyages Staff throughout the year and TPMT when present |
|                                 |             | Inspection of tip face for wind blown litter.                                               | Daily and throughout day                      | Stop depositing of waste until the existing waste can be covered and only deposit new waste if it can be covered immediately.                                                                                                                                                                                                                                                         | Daily site inspection and site diary | Voyages Staff throughout the year and TPMT when present |
| Fence Condition                 | Section 2.6 | Perimeter and internal fence integrity and the perimeter stormwater bund.                   | Daily                                         | Voyages staff to undertake repairs of fence and the perimeter stormwater bund in a timely fashion. As bund repairs are simply earthworks they must be completed as the first task of the day.<br>For substantial fence repairs engage a fencing contractor and in the meantime Voyages staff shall place temporary repairs such as temporary fence or orange barrier mesh and stakes. | Daily site inspection and site diary | Voyages Staff throughout the year and TPMT when present |
|                                 |             | Inspection of build up of litter on fence.                                                  | Daily                                         | Clear litter build up from fence.                                                                                                                                                                                                                                                                                                                                                     | Daily site inspection and site diary | Voyages Staff throughout the year and TPMT when present |
| Odour                           | Section 2.7 | Olfactory monitoring at the intersection of Yulara Rubbish Dump Road and Mala Road.         | Daily                                         | Investigate source and cover or apply additional cover.                                                                                                                                                                                                                                                                                                                               | Daily site inspection and site diary | Voyages Staff throughout the year and TPMT when present |
|                                 |             | Olfactory monitoring at the tip face for paints, solvents and odours not typically noticed. | Throughout day                                | Dig through the waste for the offending material and remove it from the cell. The waste shall be placed on plastic sheeting on an already filled area of the landfill until either the paint has dried (no longer mobile) or the solvent or unusual odour has volatilised.                                                                                                            | Daily site inspection and site diary | Voyages Staff throughout the year and TPMT when present |
| Weeds and Pests                 | Section 2.8 | Observation of bird numbers circling or on the ground at the tip face                       | Daily and throughout day                      | With the dozer turn and compact the waste in an effort to deter pests. If this measure is ineffective, it may be necessary to cover the waste to prevent ongoing pest activity.                                                                                                                                                                                                       | Daily site inspection and site diary | Voyages Staff throughout the year and TPMT when present |
|                                 |             | Observation of vermin and dogs at the tip face                                              | Daily and throughout day                      | As above plus – Presence of dogs, inspection of the fence line, and any identified damage should be repaired promptly.                                                                                                                                                                                                                                                                | Daily site inspection and site diary | Voyages Staff throughout the year and TPMT when present |

## Schedule of Monitoring, Actions and Responsibilities

| Task                               | Reference   | Monitoring Event                                                                                | Timing         | Associated Actions                                                                                                                                                                                                                                      | Form                                                                                           | Responsible Persons/Organisation                        |
|------------------------------------|-------------|-------------------------------------------------------------------------------------------------|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|---------------------------------------------------------|
|                                    |             | Assessment of vegetation in the working areas of the landfill                                   | Monthly        | Weed spraying or grading should be undertaken to limit their spread.                                                                                                                                                                                    | Daily site inspection and site diary                                                           | Voyages Staff throughout the year and TPMT when present |
| Air Quality                        | Section 2.9 | Inspection of dust by site staff when on site and particularly while undertaking works on site. | Daily          | Minimise site works particularly excavation/movement of soil during strong winds or moderate and strong winds on hot days                                                                                                                               | Daily site inspection and site diary                                                           | Voyages Staff throughout the year and TPMT when present |
|                                    |             | Assessment of actual and forecast wind conditions.                                              | Daily          | If strong winds are forecast move soil from the stockpile to the cell prior to the strong wind event                                                                                                                                                    | Daily site inspection and site diary                                                           | Voyages Staff throughout the year and TPMT when present |
|                                    |             | Monitoring of vehicles speed and associated dust generation.                                    | Throughout day | Regular wetting of haul roads when vehicles are using the site in dry conditions and moderate to strong winds.<br>If excessive dust is being generated from vehicles have drivers reduce their speed                                                    | Daily site inspection and site diary                                                           | Voyages Staff throughout the year and TPMT when present |
| Third Party Monitoring Team (TPMT) |             |                                                                                                 |                |                                                                                                                                                                                                                                                         |                                                                                                |                                                         |
| Landfill Gas                       | Section 3.1 | Landfill gas monitoring in 11 gas wells.                                                        | Bi-annually    | Preparation of a monitoring report.                                                                                                                                                                                                                     | Annual performance report                                                                      | TPMT                                                    |
| Groundwater                        | Section 3.2 | Groundwater monitoring in 5 groundwater wells.                                                  | Bi-annually    | Preparation of a monitoring report.                                                                                                                                                                                                                     | Annual performance report                                                                      | TPMT                                                    |
| Leachate                           | Section 3.3 | Leachate monitoring in 2 leachate wells.                                                        | Bi-annually    | Preparation of a monitoring report.                                                                                                                                                                                                                     | Annual performance report                                                                      | TPMT                                                    |
| Cell Excavation Inspection         | Section 3.5 | Training of Voyages staff                                                                       | As required    | Train Voyages staff in the inspection process and identification of high and low permeability materials.<br>If present on site while inspection process is being undertaken conduct inspection in conjunction with Voyages staff to assess performance. | Daily site inspection and site diary and Annual performance report (if present during process) | Voyages staff and TPMT                                  |
| Weeds and Pests                    | Section 3.6 |                                                                                                 | Annually       | Preparation of a monitoring report.                                                                                                                                                                                                                     | Annual weeds and pest report                                                                   | TPMT                                                    |

**APPENDIX E**  
DAILY INSPECTION RECORDS AND SITE DIARY

**Daily Inspection Records and Site Diary**  
**Yulara Landfill**  
**Environmental Monitoring, Mitigation, Action and Responsibilities Plan**

|                                |  |              |  |
|--------------------------------|--|--------------|--|
| Person Undertaking Inspections |  | Day and Date |  |
|--------------------------------|--|--------------|--|

**Inspections**

The following section references refer to each section within the Yulara Landfill Environmental Monitoring, Mitigation, Action and Responsibilities Plan document. This document should be reviewed prior to completing this form initially and if the understanding of a heading is not clear. Notes should be supplemented with times and names of other personnel if relevant.

| Section    | Inspection Description                                                                                                                                                                                                                                                                                                                                 | Observations | Actions Taken or To Be Implemented |
|------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|------------------------------------|
| <b>2.1</b> | <b>Site Condition</b> – The following items represent initial observations made during the morning perimeter inspection or while on site throughout the day. Certain aspects (for example, dust and litter) are addressed in dedicated sections of this plan and, where relevant, should be expanded upon in the corresponding sections of this table. |              |                                    |
|            | - Dust                                                                                                                                                                                                                                                                                                                                                 |              |                                    |
|            | - Filling progress                                                                                                                                                                                                                                                                                                                                     |              |                                    |
|            | - Fence line                                                                                                                                                                                                                                                                                                                                           |              |                                    |
|            | - Security cameras                                                                                                                                                                                                                                                                                                                                     |              |                                    |
|            | - Litter                                                                                                                                                                                                                                                                                                                                               |              |                                    |
|            | - Kerb side pickup                                                                                                                                                                                                                                                                                                                                     |              |                                    |
| <b>2.2</b> | <b>Fuel Consumption</b> – No specific notes required here. This is a reminder to complete the fuel consumption log/register if filling of a vehicle was undertaken                                                                                                                                                                                     |              |                                    |
| <b>2.3</b> | <b>Filled Volume</b> (inspection to be undertaken and recorded at least weekly on Wednesday)                                                                                                                                                                                                                                                           |              |                                    |
|            | - Available airspace                                                                                                                                                                                                                                                                                                                                   |              |                                    |
|            | - Adequacy of compaction                                                                                                                                                                                                                                                                                                                               |              |                                    |
| <b>2.4</b> | <b>Cell/Slot Excavation Inspection</b> (to be undertaken and recorded as required)                                                                                                                                                                                                                                                                     |              |                                    |
|            | - Summary of Material type per depth interval and final slot depth determination                                                                                                                                                                                                                                                                       |              |                                    |
| <b>2.5</b> | <b>Litter</b>                                                                                                                                                                                                                                                                                                                                          |              |                                    |
|            | - Forecast and actual wind conditions                                                                                                                                                                                                                                                                                                                  |              |                                    |
|            | - Along fence line                                                                                                                                                                                                                                                                                                                                     |              |                                    |
|            | - In surrounding vegetation                                                                                                                                                                                                                                                                                                                            |              |                                    |
|            | - At tip face                                                                                                                                                                                                                                                                                                                                          |              |                                    |
| <b>2.6</b> | <b>Fence Condition</b>                                                                                                                                                                                                                                                                                                                                 |              |                                    |
|            | - Fence (perimeter)                                                                                                                                                                                                                                                                                                                                    |              |                                    |
|            | - Fence (internal)                                                                                                                                                                                                                                                                                                                                     |              |                                    |
|            | - Cameras                                                                                                                                                                                                                                                                                                                                              |              |                                    |
|            | - Stormwater bund                                                                                                                                                                                                                                                                                                                                      |              |                                    |
| <b>2.7</b> | <b>Odour</b>                                                                                                                                                                                                                                                                                                                                           |              |                                    |
|            | - At intersection of Yulara Rubbish Dump Road and Mala Road                                                                                                                                                                                                                                                                                            |              |                                    |
|            | - At tip face for unusual/ unexpected odours                                                                                                                                                                                                                                                                                                           |              |                                    |



## Daily Inspection Records and Site Diary

### Yulara Landfill

#### Environmental Monitoring, Mitigation, Action and Responsibilities Plan

|     |                                     |  |  |
|-----|-------------------------------------|--|--|
| 2.8 | <b>Weeds and Pests</b>              |  |  |
|     | - Bird numbers                      |  |  |
|     | - Vermin and dogs                   |  |  |
|     | - Vegetation in working areas       |  |  |
| 2.9 | <b>Air quality</b>                  |  |  |
|     | Forecast and actual wind conditions |  |  |
|     | Dust in work areas                  |  |  |
|     | Vehicle speed                       |  |  |

### Site Diary

The following shall be recorded in the Site Diary Section:

- Any unusual events or beyond the table above
- Fires – refer Section 3.1 of Procedures document for actions and reporting
- Flooding
- Fuel or hydraulic leaks – refer Section 2.10 of Procedures document
- Chemical spills – refer Section 3.2 of Procedures document
- Theft or vandalism
- Site visitors

|  |
|--|
|  |
|--|

Consulting Engineers and Scientists



**APPENDIX C**  
OPERATIONAL PROCEDURES



**Yulara Landfill  
Operational Procedures**

Prepared for  
Voyages Tourism Australia

**17 April 2026**

Tierra Environment Pty Ltd  
ABN 84 111 615 680

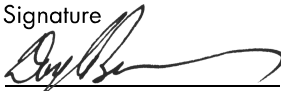
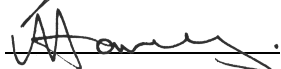
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## **Yulara Landfill Operational Procedures**

Prepared for  
Voyages Tourism Australia

**17 April 2026**

### **Document Status**

|                                                        | Name                             | Signature                                                                            | Date              |
|--------------------------------------------------------|----------------------------------|--------------------------------------------------------------------------------------|-------------------|
| Approved for Issue <input checked="" type="checkbox"/> | Prepared by <u>Daryl Burrows</u> |  | <u>17/04/2026</u> |
| Revision <u>B</u>                                      | Reviewed by <u>Lauren Harvey</u> |  | <u>17/04/2026</u> |

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## **1 INTRODUCTION**

### **1.1 General**

This Landfill Operational Procedures Manual has been developed for Voyages Tourism Australia (Voyages) to provide instruction for the day-to-day tasks and major tasks at the landfill facility. It outlines the standard operating procedures (SOPs), environmental controls, safety protocols, and compliance measures necessary to ensure the facility is operated in an environmentally responsible, safe, and efficient manner.

The manual serves as a practical reference for site operators and other personnel involved in landfill activities. Its content has been informed by historic operational practices, site constraints and equipment limitations, and has been refined where necessary to improve environmental outcomes.

All staff are required to be familiar with the procedures outlined in this manual and to implement them as part of their routine duties. Ongoing review and updating of the manual will ensure it continues to meet operational needs and evolving regulatory requirements.

This document has been prepared as a stand-alone document which forms a portion of the overall Landfill Environment Management Plan (LEMP). It is the intention that as a stand-alone document it will be kept at hand as a reference document for Voyages Staff and its detail and requirements will not be lost in the larger LEMP document. Some tasks are most appropriately addressed within this manual, while others are better suited to the Environmental Monitoring, Mitigation, Action and Responsibilities Plan. In some cases, tasks are relevant to both documents. As such, users of this manual should also be familiar with the Yulara Landfill Environmental Monitoring, Mitigation, Action and Responsibilities Plan, as aspects of that document, including supporting background information may apply directly to the content and implementation of this manual.

During the February 2025 round of groundwater bore installation a layer of higher permeability soil was identified higher in the stratigraphic profile than expected. Encountering this layer near the base of a cell or a slot within a cell would be detrimental to the performance of that cell to impede transmission of liquids. For this reason a method and an inspection process has been developed to ensure that at least 1.0m of suitably low permeability materials (mudstones or siltstones) are located beneath future cells (refer Section 4.6).

This document should be reviewed and updated as follows:

- In advance of a licence renewal.
- If a better alternative method of works is considered appropriate.
- If legislation or licence conditions change necessitating a corresponding change in procedures.
- If a method is found to no longer be effective.

### **1.2 Objectives**

The objectives of this operational procedures manual are as follows:

- Provide clear guidance and instruction to staff for each specific task in such a manner as to maintain workplace health and safety, comply with licence and regulatory conditions and achieve the best environmental outcomes (onsite and offsite) within the limit of site resources and equipment.

### **1.3 Format**

#### **1.3.1 General**

Consistent with the Environmental Monitoring, Mitigation, Action and Responsibilities Plan the procedures have been broken into procedures to be undertaken by Voyages Staff (Section 2) and procedures to be undertaken by the Third Party Monitoring Team (TPMT – refer Section 4).

### **1.3.2 Voyages staff procedures**

The following procedures will be managed or undertaken by Voyages staff:

#### General Procedures

- Hours of Operations
- Cell Excavation
- Cell excavation inspection
- Waste Collection
- Waste Placement
- Subgrade Placement
- Recycling
- Listed Waste Storage
- Contaminated Soils
- Grease Trap Waste
- Fuel Management
- Equipment Maintenance
- Fence Maintenance

#### Emergency Procedures

- Fire Response
- Chemical Spill Response
- Wet Weather/Flooding

### **1.3.3 Third party monitoring team procedures**

The following procedures will be undertaken by the TPMT:

- Landfill Gas Monitoring
- Groundwater Monitoring
- Leachate Monitoring
- Stormwater Monitoring
- Cell Excavation Inspection
- Weed and Pest Animal Monitoring

## **2 VOYAGES STAFF GENERAL PROCEDURES**

### **2.1 Hours of Operation and Access**

The landfill is not open to the public. Voyages Waste Management staff are authorised to access the landfill between 7:30 AM and 4:30 PM for waste disposal and routine site operations. At all times the access gate must remain locked to prevent un-authorised access. Non-routine or specialised tasks may be conducted outside standard operating hours with prior authorisation from the Land and Environment Manager.

Landfill staff are issued keys for site access. Voyages employees who are not part of the landfill team may access the site only with approval from the Land and Environment Manager and must sign out a key from the Technical Services Office and they must be inducted prior to access.

From time to time, project-specific requirements at the Voyages facility or in nearby areas may necessitate access to the landfill by third parties. The preferred method of access is via escort to and from the site by landfill staff. For larger projects where escorting is not feasible, a controlled access key may be issued. In such cases, users shall be appropriately inducted and briefed on site procedures, including access protocols and the requirement to secure the gate upon entry and exit.

In all instances, the detailed composition of the waste shall be determined prior to access. Site staff shall also undertake regular inspections of deposited waste. Where requirements are not met, access to the landfill shall be denied and the waste shall be removed by the depositing party.

### **2.2 Cell Excavation**

Fill has historically been placed at the landfill in excavations referred to as cells. However due to the limited equipment, staff and room they are not excavated in one operation. Instead they are excavated in multiple slots perpendicular to the length of the cell itself. Multiple slots are excavated and filled in each cell and multiple cells are ultimately created in each stage of the landfill (refer LEMP for staging plans). The cells generally run east west across the entire extent of the landfill and the slots run north south and are of the order of 40m to 50m wide. The depth of excavations are approximately 6m. Excavated materials are stockpiled and used for cover and final surface cover.

As the landfill is unlined, it is essential that each cell is constructed on a low-permeability foundation, such as silt, clay, siltstone, or mudstone. During the installation of a groundwater monitoring well in the northeast portion of the site, a zone of higher-permeability sandy material was encountered between 1.8m and 11.4m below the surface. Although approximately 20m of underlying siltstone and mudstone was present beneath the sand layer, the sandy zone may facilitate lateral migration of landfill gas and leachate. Accordingly, this material should be avoided as a foundation for new landfill cells.

The cell excavation procedure has been revised to include a protocol for pre-excavation assessment of subsurface materials. This ensures that landfill cells are not constructed over sand-rich layers and that a minimum of 1m of low-permeability material is maintained beneath each cell. This procedure will be undertaken in the presence of the Voyages Land and Environment Manager. The slot (portion of a cell) excavation procedures are as follows:

- Commencement of all works shall begin on a schedule such that the slot is completed at least 1 month (preferably 2 months) prior to it being required. This is to avoid having no available airspace in the event of equipment breakdown or staff movements.
- Place pegs at the four corners of the extent of the proposed slot and identify where spoil will be placed around the slot as it is excavated.
- Clear the vegetation in the area of the slot and the stockpiling areas.
- Clear the topsoil and stockpile separately from other excavated materials. Topsoil will be re-used at a later stage for revegetation works.
- At this point in the past the slot would have been excavated to the final depth of nominally 6m with ramp access on one side. Going forward the following process will be undertaken for the excavations:

- Establish a 2m deep test-pits in the middle of the proposed slot to confirm if the 1m to 2m interval is low permeability material.
- If the 1m to 2m interval is low permeability material proceed to excavate the upper 1m of material.
- From the base of the 1m deep excavations establish a 2m deep test-pit in the middle of the slot to confirm if the 2m to 3m interval is low permeability material.
- If the 2m to 3m interval is low permeability material proceed to excavate the 1m to 2m interval of material.
- From the base of the 2m deep excavations establish a 2m deep test-pit in the middle of the slot to confirm if the 3m to 4m interval is low permeability material.
- If the 3m to 4m interval is low permeability material proceed to excavate the 2m to 3m interval of material.

This process will be continued until the desired depth is achieved. If however higher permeability material (sand or sandstone) is identified in the test-pits then the excavation of the next layer should be abandoned and the slot depth limited to a level such that there is at least 1m of low permeability material below the base of excavations.

The process of assessing the materials should be undertaken by Voyages Land and Environment Manager. The current manager has been trained by the TPMT however if the manager does change the new manager shall be trained by the TPMT. That manager will advise if excavations can continue or if they should be stopped. The process should be documented with notes and photographs.

All excavations shall be carried out while monitoring climatic conditions and dust generation. If strong winds are forecast undertake earthworks prior to forecast strong winds and halt works if dust generation cannot be managed. Minimal site works (particularly excavation/movement of soil) shall be undertaken during strong winds or moderate and strong winds on hot days. Regular wetting of haul roads when vehicles are using the site in dry conditions and moderate to strong winds shall be undertaken. If excessive dust is being generated from vehicles drivers shall reduce their speed.

The above process may take a significant amount of time and has the potential due to equipment breakdown, staff absences and inclement weather to be delayed. For this reason Voyages staff shall have adequate volume slots already excavated to account for such contingencies. At a minimum three months of available filling space shall be available at all times, however a more conservative six months would be preferable.

### **2.3 Cell/Slot Excavation Inspection**

As the cell/slot excavation process is being undertaken to achieve a goal there is a need for an inspection process to assess if the goals have been met and document the process. The inspection process is presented in Section 2.4 and 3.5 of the Environmental Monitoring, Mitigation, Action and Responsibilities Plan.

### **2.4 Waste Collection**

The following details the procedures for kerb side pickup of waste from residential premises and the collection from the resort, other Voyages support facilities and related commercial facilities. Waste is separated into recyclable and non recyclable (general waste) at the source prior to collection.

- General waste from the resort, Voyages support facilities and related commercial facilities is to be collected using the compactor waste truck from the loading docks or the designated waste bin storage area at each facility.
- General waste from residential premises is to be collected from approved kerb side bins with the compactor waste truck.

- Green waste and recyclables are collected separately. Recyclables are separated by residents, collected via kerb side pickup and stored in the Voyages Landfill office yard (Berry Road) prior to being transported to Adelaide. Currently Contained deposit scheme vessels, milk bottles and other plastic bottles and cardboard are recycled. Green waste is collected from the kerb side and can also be deposited at the green waste facility by approved arrangement with Voyages landfill staff.
- At the landfill itself ferrous and non ferrous metals are crudely separated into general areas. A scrap merchant visits the landfill approximately once a year and further separates, transports and recycles the ferrous and non ferrous metals.
- To avoid litter the compaction scoop on the compactor waste truck must be lowered over the tail gate when the truck is in transit. This does not include short distances between residential premises but does include going from commercial premises to commercial premises or relocating from one residential street to another.
- If litter is exiting the truck collection should be halted and the source or reason for the litter rectified. Litter which exited the truck should be collected.
- If animals are struck by the waste truck the driver must stop. If the animal is dead it should be removed to the side of the road and not disposed of at the landfill. If the animal is alive and injured Uluru-Kata Tjuta National Park, Cultural Centre staff shall be contacted.
- If a spill from the truck occurs it should be cleaned up immediately using the on board spill kit. Appropriate personal protective equipment should be worn as required. The use of a spill kit must be reported to the Land and Environment Manager so the kit can be restocked.

## 2.5 Waste Placement

Airspace within a landfill is a valuable resource and should be utilised as efficiently as possible. At Yulara, the site's remote location limits opportunities to divert low-value recyclables from landfill (noting as presented in Section 2.4 there is still recycling occurring), as is commonly practiced in other parts of Australia. As a result, alternative strategies must be effectively implemented to minimise unnecessary airspace consumption. This procedure focuses on achieving optimal compaction using the available equipment. Waste shall be placed in the slot according to the following method:

- The compactor truck shall utilise the ramp into the slot to place the waste as close to the bottom as possible.
- Bulky goods shall be removed from the waste prior to commencing compaction. If possible and if safe they should be broken down out of the cell and any non-recyclable components returned to the cell for compaction.
- Timber or green waste shall be removed from the waste prior to commencing compaction and sent to the green waste area.
- The dozer or excavator shall spread waste into thin layers, nominally no more than 200 mm in thickness, before being compacted with multiple passes by the excavator or dozer. Once initial compaction is completed, the waste shall be reworked by turning it over and spreading it again, followed by additional compaction passes using the excavator or dozer. This process shall be repeated until little to no improvement in the compaction is being noted by the operator.
- The Land and Environment Manager shall conduct periodic spot checks to verify that plant operators are achieving the required level of waste compaction. Where compaction is deemed insufficient, the Land and Environment Manager may direct additional working of the waste, such as turning and re-compacting, or require further compaction passes using the available plant.
- The Land and Environment Manager shall conduct periodic spot checks of waste to verify that only appropriate waste is being placed, specifically ensuring that recyclable material and hazardous waste are not disposed of in filling areas.

- At the end of each day the waste must be compacted completely prior to placement of a minimum of 150mm of daily cover (stockpiled spoil from slot excavations). To minimise airspace usage this layer can be removed prior to the placement of additional waste however the Land and Environment Manager will need to consider the cost efficiency of this action.

## 2.6 Subgrade Placement

Upon completion, each landfill slot or cell will be covered with a temporary subgrade layer that serves as an interim cap until final capping and site rehabilitation are undertaken. This subgrade shall be considered a temporary measure, as it is not integrated with adjacent cell subgrades or the surrounding ground surface. It is prone to settlement and cracking and lacks the required contouring and stormwater control features of a traditional landfill cap. While it does not meet the standards of a formal landfill cap, it serves an important interim function in minimising exposure and facilitating site management until permanent capping is implemented. In addition, construction activities at Yulara are constrained by limited access to specialised professional services. As a result, interim subgrade layers are constructed using locally available resources and on-site equipment. In contrast, the final capping works will require the involvement of external specialists, including geotechnical and hydrological professionals, to ensure compliance with regulatory standards and long-term performance requirements. On this basis the procedure for placement of the 600mm subgrade has been kept simple and is as follows:

- Filling in the cell shall proceed as detailed in Section 2.5 above until 600mm below ground surface is reached. At this point the waste will be covered with just subgrade material (stockpiled spoil from cell excavations which should be low permeability silts and clays if procedures in Section 2.4 are followed). The 600mm layer shall be placed as detailed in the following bullets:
  - The subgrade shall be placed in 150mm thick compacted lifts. This layer is not proposed to be moisture conditioned as Voyages staff have advised their equipment is not capable to undertake this. How the layer is compacted will be dependent on available equipment. If a sheepsfoot roller is available that shall be used, if not the dozer shall be used. As moisture conditioning is not being undertaken additional passes and compactive effort will be required.
  - The top layer of each lift (except the last) shall be tracked over with a sheepsfoot roller (if available in Yulara) or the dozer to roughen the surface and achieve effective bonding between successive layers.
  - The final surface shall be trimmed with the excavator or dozer to be a consistent level with the surrounding land and to reduce pooling. As the surface will be flat water will not shed but the goal will be to level sufficiently to avoid concentrations of water in one particular area.

Voyages staff have advised that older areas of the landfill have been temporarily capped with a subgrade in excess of 600mm, possibly as much as 2m. This may be removed and the nominal 1.4m filled prior to placement of a new 600mm subgrade. Alternatively it could be left however this would not contribute to the future capping thickness as it has not been documented and as such its thickness and material type can not be confirmed.

All earthworks associated with subgrade placement shall be carried out while monitoring climatic conditions and dust generation. If strong winds are forecast undertake earthworks prior to forecast strong winds and halt works if dust generation cannot be managed. Minimal site works (particularly excavation of wetted/movement of soil) shall be undertaken during strong winds or moderate and strong winds on hot days. Regular wetting of haul roads when vehicles are using the site in dry conditions and moderate to strong winds shall be undertaken. If excessive dust is being generated from vehicles drivers shall reduce their speed.



## **2.7 Recycling**

### **2.7.1 General**

Due to the landfill's remote location, the recycling of low-value materials may not be feasible, as the cost of transporting them to market is prohibitive. In addition, some materials such as steel, while having a higher market value, are recycled without financial return, as the combination of weight and distance to market remains economically unviable. At Yulara the following materials are considered to be viable for recycling:

- Ferrous metals – refer section 2.7.2
- Non ferrous metals – refer section 2.7.3 and 2.8.2
- Ewaste – refer section 2.7.4
- Container deposit scheme (CDS) vessels (10c bottles and cans) – refer paragraphs below these bullets
- Milk bottles and other plastic bottles – refer paragraphs below these bullets
- Cardboard – refer paragraphs below these bullets
- Cooking oil – refer paragraphs below these bullets

Materials that can be recycled shall be stored in their designated areas. Care shall be taken by Voyages staff to ensure that recyclable materials are not mixed.

Baled cardboard, CDS vessels, milk bottles and other plastic bottles and waste cooking oil shall be transported directly to Yulara Freight Services and shall not enter the landfill. The Freight Manager shall be notified when materials require transport.

Other materials (concrete, glass, light plastics, waste oils) will be stored until there is sufficient material to make crushing or collection cost effective/efficient.

Further detail on selected recycled products is provided in the following sections.

### **2.7.2 Steel**

Steel (clean and dirty) shall be placed in the designated steel recycling area. As there is no financial benefit in separating clean steel from dirty steel they can be stored together. All vehicles and mechanical equipment must be drained of fluids prior to storage to prevent potential leaks and spills. Collected liquids shall be transported for disposal at an appropriately licensed facility. Car bodies shall be stored awaiting crushing and removal by a car body recycler.

Within the steel storage area, a designated section is allocated for white goods, as they typically contain a higher proportion of non-ferrous materials than other steel products. In addition, white goods require further decommissioning before being placed in this section of the steel pile. Prior to degassing, white goods such as refrigerators, freezers, and air conditioners shall be placed in the designated degassing area. They shall remain there until a degassing work order has been raised and a suitably qualified person has completed the degassing process and collected the gas for appropriate off-site disposal. Note Voyages contracts multiple refrigeration mechanics to maintain air-conditioners, refrigeration plant and ice makers and degassing is an ongoing part of their works on site.

### **2.7.3 Non ferrous metals**

Non ferrous materials are crudely separated into general areas. A scrap merchant visits the landfill approximately once a year and further separates, transports and recycles the non ferrous metals.

### **2.7.4 Ewaste**

Ewaste can be accepted and shall be stored in the ewaste holding area adjacent the northern fence line of the listed waste area. Ewaste shall be stored until such a time as there is sufficient to transport to a recycling facility.

## 2.8 Listed Waste Storage

### 2.8.1 General

According to NT EPA Environment Protection licence EPL 179-03 Table 1 the Yulara landfill can accept for storage, but not disposal (burial), the following wastes:

- Lead and lead compounds.
- Waste mineral oils unfit for their original intended use.
- Waste mixtures, or emulsions, of oil and water or hydrocarbon and water.
- Containers that are contaminated with residues of a listed waste.

In addition tyres can be accepted for either storage, treatment or disposal and grease trap waste can be accepted for treatment and disposal.

More information on each listed waste is discussed in the following sections.

Listed wastes shall be stored within the fenced listed waste area of the landfill site. A covered section is provided within this area to provide protection from stormwater ingress. Liquid listed wastes shall be stored in drums or sealed containers on self contained banded pallets.

### 2.8.2 Lead and lead compounds

Lead is most commonly found in the form of lead-acid batteries and, to a lesser extent, particularly in Yulara, in lead piping. Lead-acid batteries shall be stored upright in the designated battery storage area until sufficient quantities have been accumulated for transport to a recycling facility (currently Antons Recycling in Alice Springs). Lead pipe and other lead-containing products shall also be stored in the battery storage area and transported for recycling alongside the batteries.

### 2.8.3 Tyres

The landfill is permitted to accept tyres for storage, treatment or disposal. If accepted tyres shall be stored as per licence clause 36 which caps the stockpiles as follows:

- Maximum height – 3m with a maximum 45° side slope.
- Maximum width – 5m
- Maximum length – 10m
- Separation distance – 10m

### 2.8.4 Contaminated soils

The Yulara landfill is not licensed to accept contaminated soils. However, disposal of absorbent media used to clean up hydrocarbon spills shall be carried out in accordance with the *SA EPA Guidelines: Disposal of Used Hydrocarbon Absorbent Materials*. Under these guidelines, the maximum volume for any single landfill disposal is the lesser of 0.1m<sup>3</sup> or 100kg. Intermediate volumes (nominally up to 2m<sup>3</sup>) and larger volume (in excess of 2m<sup>3</sup>) of adsorbent materials or hydrocarbon impacted soils shall be stored in sealed containers (such as 205L drums) or stockpiled on and covered with UV stabilised plastic film respectively. At that point Voyages staff should consult with the TMPT to determine if it is more economical to transport to an appropriately licensed facility or to remediate on site. If remediation onsite is selected Voyages staff or the TMPT shall notify the NT EPA and advise of the nature and quantity of the hydrocarbon impacted soil and prepare a remediation plan. A basic outline of the hydrocarbon remedial approach will be as follows however the final details will be dependent on the type and concentration of the hydrocarbon and the soil type.

- A designated area of the landfill that has already been filled (i.e. not natural ground) and is at least 50m from a site boundary shall be used as a remediation area.
- The ground should be trimmed to level and any large stones removed.

- A top of the levelled ground a UV stabilised plastic marker layer (builders film with a minimum thickness of 200um) shall be placed.
- Contaminated material shall be stockpiled on the marker layer and the stockpile shall be smoothed/shaped so as to not collect water.
- A minimum 200um thick UV stabilised builders film shall be placed over the stockpile to eliminate water ingress and dust generation.
- A suitably experienced environmental consultant shall sample, analyse and quantify the nature of the hydrocarbon contamination and prepare a remediation approach. The remediation approach shall include at least the following.
  - A remediation method. For light fraction hydrocarbons time and turning may all that is recommend. For heavier fractions more intervention may be required.
  - Validation requirements and sampling and analytical regime.
  - Performance targets or compliance criteria which is likely to be Table 2 “Waste Fill” criteria listed in the SA EPA “Current Criteria for the Classification of Waste – Including Industrial and Commercial Waste (Listed) and Waste Soil”<sup>1</sup>.
- The TPMT shall prepare a report detailing the work undertaken and the validation process and classification of the soil for submission to the NT EPA. If the performance targets or compliance criteria are met and the NT EPA is satisfied with the works and validation undertaken then the material is no longer considered contaminated soil and can be placed in the landfill.

Other soils contaminated by or thought to be contaminated by chemicals other than hydrocarbons shall be handled as follows:

- A designated area of the landfill that has already been filled (i.e. not natural ground) and is at least 50m from a site boundary shall be used as a holding area.
- The ground should be trimmed to level and any large stones removed.
- A top of the levelled ground a UV stabilised plastic marker layer (builders film with a minimum thickness of 200um) shall be placed.
- Contaminated material shall be stockpiled on the marker layer and the stockpile shall be smoothed/shaped so as to not collect water.
- A minimum 200um thick UV stabilised builders film shall be placed over the stockpile to eliminate water ingress and dust generation.
- A suitably experienced environmental consultant shall sample, analyse and quantify the nature of the contamination and recommend either remedial measures, offsite disposal or onsite disposal (only after remediation and validation or if the soils were found to not be contaminated in the first place). Analytical results shall be compared to Table 2 “Waste Fill” criteria listed in the SA EPA “Current Criteria for the Classification of Waste – Including Industrial and Commercial Waste (Listed) and Waste Soil”<sup>1</sup>.
- Once the fate of the soil has been determined, the cover shall be removed and the stockpile excavated down to the marker layer, extending approximately 50 mm below it to ensure complete removal of all material.
- The site of the now removed stockpile shall be backfilled and levelled to make good.

<sup>1</sup> The SA EPA requirements have been adopted in this case instead of an NT EPA criteria such as Attachment 1 Waste Acceptance Criteria – City of Darwin. The Darwin criteria has been established for a composite liner or double liner landfill which is not in place at Yulara. The SA EPA requirements for Waste Fill criteria are more conservative and hence more appropriate for an unlined landfill.

## **2.8.5 Contaminated containers and paints**

### **Contaminated Containers**

Containers contaminated with residues of a listed waste shall be stored in a designated area in sealed containers to avoid spills. If containers are not adequately sealed they should be stored or transferred to a second container made of the same material as the original container to avoid use of unsuitable materials which may degrade or fail. Note mixing of residues should not occur as unknown detrimental reactions may occur. Once sufficient quantities of containers have been accumulated they should be transported to an appropriately licensed facility for disposal.

In addition to the above degassed gas cylinders (not a listed waste vessel but a hazardous waste vessel) shall be stored and when sufficient number transported to an appropriate facility for recycling. At present Elgas accept Voyages gas cylinders.

### **Paints**

Unused paint shall be placed in the listed waste area of the landfill in sealed containers and on bunded pallets until there is sufficient numbers to transport to an appropriate disposal facility such as a Paintback receiving site. The nearest Paintback site is The Rediscovery Centre, 80 Commonage Rd Ilparpa, NT.

## **2.8.6 Waste mineral oils**

Waste mineral oils unfit for their original intended use shall be stored in a dedicated area within the listed waste area in sealed containers on bunded pallets. If containers are not adequately sealed they should be stored or transferred to a second container made of suitable materials resistant to oil degradation (e.g., steel or approved plastic drums). An adequately sized spill kit should also be located in the storage area and spills shall be cleaned up immediately. Once sufficient waste mineral oils have been accumulated they should be transported to an appropriately licensed facility for disposal.

## **2.8.7 Waste mixtures, or emulsions**

Waste mixtures, or emulsions, of oil and water or hydrocarbon and water shall be handled as if they were mineral oil (refer Section 2.8.6) with the exception that mixtures of hydrocarbon and water shall be labelled accordingly for the benefit of the receiving facility.

## **2.9 Grease Trap Waste**

The Yulara landfill in mid 2025 constructed a dedicated grease trap waste treatment area. The area consists of 4 shallow decanting ponds and one large shallow evaporation pond. Waste collected from the Voyages grease traps (kitchen grease traps only, no fuel or mechanical related grease traps) shall be placed in one of the four decanting ponds. Once the waste has settled the water shall be decanted from below the oils and placed in the evaporation pond. Once partially dry the grease shall be removed from the pond and either mixed with green waste wood chip for mulch or placed in a stockpile for utilisation later. Any solids (food debris) in the evaporation pond shall be removed and can be placed directly in the landfill.

Grease traps are required to be cleaned every 8 weeks, which should be sufficient time to allow full evaporation of liquids. Petroleum based hydrocarbons or their synthetic equivalents can not be disposed of into the ponds. Auto mechanic waste must be disposed of to an appropriately licensed facility. Grease trap waste and auto mechanic waste cannot be disposed of onto any soil areas.

## **2.10 Fuel Management**

### **General**

All staff involved in fuel management shall be familiar with Section 3.2 – Chemical Spill Response. Emergency procedures in Section 3.2 override all actions in this section i.e. clean up of a spill is superseded by personal or public safety.

### **Collection and Transport of Fuel**

Prior to filling the dedicated external fuel tank on the site utility vehicle, the operator shall verify that both a fully stocked spill kit and a shovel are on board. Fuel shall be sourced from the town service station, and all

service station rules for filling shall be strictly observed. Any spills occurring during filling must be immediately reported to the service station attendant. Follow the service station attendant instructions from this point.

Fuel must not be transported unless the tank cap is securely fastened. Smoking in the vehicle is strictly prohibited. The vehicle shall be driven in a safe and controlled manner, with particular caution during cornering, where fuel movement may affect vehicle balance and handling, and braking, as stopping distances may be increased.

In the event of an accident during transit to the landfill, the fuel tank shall be inspected for leaks. Any small leaks shall be addressed using the absorbent spill materials provided in the vehicle's tray. If a spill on the road exceeds the capacity of the spill kit, the shovel shall be used to cover the affected area with soil to absorb the fuel. The hydrocarbon-impacted soil shall then be collected, transported to the landfill, and managed in accordance with Section 2.8.4. For larger spills that may present a fire or explosion risk the area should be evacuated. Any spills, leaks or accidents shall be documented in the Daily Inspection and Site Diary by the Voyages Land and Environment Manager.

#### *Fuelling of Landfill Machinery*

Fuelling of machinery shall not take place within the landfill cell but instead on level ground outside the cell. The utility vehicle shall be parked at a suitable distance from the machinery to ensure the fuelling hose is not overstretched, which could cause cracking or stress on fittings and result in leaks. Fuelling operations shall be conducted in a manner that prevents leaks or spills onto the soil.

If leaks occur, they shall be cleaned immediately using the spill kit. In cases where a significant leak impacts the soil, the affected soil shall be collected and managed in accordance with Section 2.8.4. Any spills, leaks or accidents shall be documented in the Daily Inspection and Site Diary by the Voyages Land and Environment Manager.

### **2.11 Equipment Maintenance**

Equipment maintenance shall be carried out in accordance with the manufacturer's recommendations. Any machinery components containing fluids, such as sumps, radiators, and hydraulic hoses, shall be fully drained prior to commencing work. Fluid draining shall be conducted on an impervious surface.

If maintenance is performed on soil surfaces, plastic sheeting shall be placed beneath the work area to capture any spills or leaks. This sheeting shall remain in place during the refilling of fluids following maintenance.

In the event of a leak or spill, the chemical spill procedure shall be followed for clean-up and disposal.

### **2.12 Fence Maintenance**

Voyages staff inspect the perimeter fence daily. A staff member drives around the perimeter at the start of the day to inspect the fence integrity, litter (refer Sections 2.5 and 2.6 of the Environmental Monitoring, Mitigation, Action and Responsibilities Plan) and cameras. The staff member responsible for this shall carry wire to undertake minor repairs as needed at the time of the inspection. Larger breaches which require additional resources shall be carried out the same day if fencing resources are available. If the breach is more significant than can be repaired on the same day then temporary fencing or barrier mesh shall be installed until such time as Voyages staff or a fencing contractor can undertake the work.

While undertaking the perimeter fence inspection the integrity of the onsite surveillance cameras shall also be checked and replaced if required.

To facilitate the above Voyages staff shall ensure there is an adequate supply of fencing resources in stock at all times. A spare camera shall also be kept in stock to enable same day replacement of damaged, defective or stolen onsite cameras.

Voyages staff have discussed the installation of a perimeter stormwater bund to contain stormwater. If this is established its integrity shall be inspected as part of the daily perimeter fence inspection. If the bund is damaged plant operators shall be notified for repair works. The repair shall be the first task undertaken on

the day and shall be completed prior to commencement of other works. In addition, where soil has been eroded or washed from beneath fence lines, it shall be reinstated. Depending on the extent of the erosion, reinstatement shall be undertaken either manually by infilling with soil or utilising plant to place and compact suitable material

### **3 VOYAGES STAFF EMERGENCY PROCEDURES**

#### **3.1 Fire Response**

##### **3.1.1 Roles and responsibilities**

Waste Services Manager – Ensure that staff are familiar with this procedure.

First person to scene – Assess the size and source of the fire and notify another person to ensure your own safety. If the fire is small, located on-site, and it is safe to do so, attempt to extinguish it using appropriate firefighting equipment. Immediately after, notify the Voyages Land and Environment Manager.

In the event of a large fire, immediately call the Fire Brigade by dialling 000, followed by immediate notification of the Voyages Land and Environment Manager.

##### **3.1.2 Evacuations**

In the event of a large fire, evacuate the area and ensure all personnel move to a safe distance. Follow the directions of emergency services at all times.

For bushfires, adhere strictly to instructions issued by the Fire Brigade and evacuate if directed. Landfill plant and equipment may be used to create firebreaks if requested or deemed necessary by emergency services.

##### **3.1.3 Actions, clean up**

Follow all directions issued by the Fire Brigade. Landfill plant and equipment may be used to create onsite firebreaks if required.

If the fire originates within the landfill, the site must be closed and remain so until the fire has self-extinguished. The affected area should be regularly monitored to ensure there is no risk of re-ignition. Access to the site must be restricted, and any debris of human origin, such as construction materials, firefighting equipment, or other refuse, must be removed once it is safe to do so.

##### **3.1.4 Actions, reporting**

The Waste Services Manager must maintain a log of fires occurring at the premises including the following information:

- The time and date of when the fire was reported.
- The circumstance which ignited the fire.
- The time and date of when the fire ceased and whether it burnt out or was extinguished.
- The location of the fire on the premises (e.g., timber stockpile, putrescible waste).
- Prevailing weather conditions.
- Observations made regarding smoke direction and dispersion.
- The amount of waste combusted by the fire.
- Action taken to extinguish the fire.

Waste Services / Environmental Manager must notify the NT EPA of any fires at the premises by contacting the Pollution Hotline on telephone number 1800 064 567 as soon as practicable after (and in any case, within 24 hours after) first becoming aware of the fire. The licensee must provide the status of the fire and the landfill licence number when contacting the Pollution Hotline. The incident is to be documented in the Daily Inspection and Site Diary by the Voyages Land and Environment Manager.

##### **3.1.5 Equipment**

Equipment available for use in a fire response are four portable extinguishers in the storage work yard and located on machinery and any landfill plant (water truck, excavator, dozer) that can be safely used.



## **3.2 Chemical Spill Response**

### **3.2.1 Roles and responsibilities**

Waste Services Manager – Ensure that staff are familiar with this procedure.

First person to scene – Assess the size of the spill. If the spill is small and can be safely managed on-site, proceed with the response actions outlined below. If the spill is large or poses a potential risk to health, safety, or the environment, immediately notify Emergency Services and inform the Voyages Land and Environment Manager.

### **3.2.2 Documentation**

Material Safety Data Sheets (MSDS) are maintained in the site office at the landfill. Prior to the acceptance of any hazardous waste, a current MSDS must be provided for review and approval to ensure compliance with applicable licence conditions.

### **3.2.3 Actions, immediate**

Refer to the MSDS to determine the appropriate spill response actions and required personal protective equipment (PPE). Isolate the affected area.

If the MSDS confirms it is safe to proceed, take measures to prevent the spill from entering the landfill cell or natural drainage lines. Where necessary, apply absorbent material to the spill surface. If possible, stop the source of the spill. For large spills, landfill plant and equipment may be used to construct earth bunds to contain the liquid.

All affected soil or absorbent material shall be collected and managed in accordance with Section 2.8.4.

### **3.2.4 Evacuations**

Refer to the MSDS to determine whether evacuation is necessary. If the chemical cannot be identified, immediately evacuate the area and notify emergency services. Further investigation, such as close inspection of the container or collection of a sample for laboratory analysis, shall only be undertaken once emergency services personnel have determined the appropriate level of PPE.

For fuel leaks near possible ignition sources, evacuate if spill is large - treat as a fire risk.

### **3.2.5 Actions, clean up**

In the event of a chemical spill, use an absorbent material specified in the product's MSDS to soak up the liquid. All affected soil and used absorbent material shall be collected and managed in accordance with Section 2.7.3. Appropriate PPE shall be worn throughout all clean-up activities.

### **3.2.6 Actions, remediation**

Any contaminated soil shall be collected and managed in accordance with Section 2.8.4.

### **3.2.7 Actions, reporting**

All chemical spills must be reported to the NT EPA by contacting the Pollution Hotline on 1800 064 567 as soon as practicable, and no later than 24 hours after becoming aware of the incident. When reporting, the licensee must provide the spill status and the licence number NT EPA EPL 179-03.

The incident shall be recorded in the Daily Inspection and Site Diary by the Voyages Land and Environment Manager.

### **3.2.8 Available equipment**

Spill kits and landfill plant can be utilised to action spills.

### **3.3 Wet Weather/Flooding**

#### **3.3.1 Definitions**

Small rain event – Rain events less than 4 hours or less than 50 mm

Large rain event – Events lasting more than 4 hours or greater than 50 mm

Flood event – Flood events are very large rain events that make access roads to the landfill impassable

#### **3.3.2 Small rain events**

During small rainfall events, landfill filling operations shall temporarily cease to prevent the spread of waste, deterioration of access points and ramps, and the creation of preferential stormwater pathways.

Waste dumping may continue during small rain events, provided vehicle access ramps remain safe to use and there is no risk of vehicles becoming bogged.

#### **3.3.3 Large rain events**

During large rainfall events, waste shall not be deposited in the active landfill cell due to the risk of machinery becoming bogged. Instead, waste is to be placed on a flat area near the landfill cell, positioned away from natural drainage lines and access roads.

Where practicable, waste should be placed against an earth bund to minimise litter movement. All dumped waste must be covered with a layer of soil immediately after placement to prevent windblown litter.

Once the rain event has ended and landfill areas are accessible to plant, the waste shall be transferred into the landfill cell and normal operations shall resume.

#### **3.3.4 Flood events**

Transport of waste shall cease during flood events until all access roads are fully passable by vehicles. Once roads are accessible, the procedures for large rain events shall be implemented until normal operations can safely resume without risk of vehicles or equipment becoming bogged.

Prior to resuming operations, earth bunds surrounding the landfill cell shall be inspected to ensure they remain intact and effective.

If the perimeter stormwater bund has been constructed its integrity shall be inspected and repaired if necessary.

#### **3.3.5 Notes**

Large rain events are anticipated to occur approximately once per year, based on statistical data analysis. Flood events are expected roughly every 24 to 36 months, according to site personnel experience.

## **4 THIRD PARTY PROCEDURES**

### **4.1 General**

Each third party monitoring team will have standard field procedures and equipment operation procedures. However the goal of this section is to define aspects of an investigation that must remain consistent from round to round and what is considered not acceptable.

### **4.2 Landfill Gas**

Specific requirements for landfill gas monitoring at Yulara Landfill are as follows:

- Well heads must be sealed and incorporate a sampling point with either a quick fit attachment or a push fit attachment. Between the seal and the attachment point must be a quarter turn tap to allow rapid transition from the closed to open position for internal pressure and flow measurements.
- Landfill gasses shall be co-monitored with a landfill gas analyser (such as a GA 5000 or equivalent) and a photo-ionisation detector with a "Y" sampling train.
- Landfill gasses shall be monitored for at least 15 minutes to ensure purge of stagnant gasses in the well head and stabilisation of gasses drawn from deeper in the well and representative of gasses in the waste.
- If methane and oxygen are present together in landfill gas the well head, surface completion and sampling train shall be inspected for leaks and fixed. Once fixed the well shall be purged for a minimum of 10 minutes prior to re-commencing monitoring.
- Confined spaces in any sheds established on the ground shall be inspected for the presence of volatiles and landfill gas using a PID and landfill gas analyser (such as a GA 5000 or equivalent) respectively.

### **4.3 Groundwater**

Specific requirements for groundwater monitoring at Yulara Landfill are as follows:

- All groundwater wells must be purged until field parameters stabilise (as measured every 10L) or run dry and recover prior to sampling. Both purging and sampling shall be conducted using the same method, specifically a Waterra inertia pump equipped with appropriate tubing and a foot valve.
- Every effort should be made to source a Waterra inertia pump for purging and sampling, including adjusting the monitoring schedule if necessary. However, if a Waterra pump is unavailable, a low-flow water sampling kit may be used as an alternative. When a low-flow sampling kit is employed, its tubing must be removed from the well upon completion, and the Waterra tubing and foot valve must be reinstated in the well.
- Bailing, air lift, peristaltic pumping, grab sampling, and Hydrasleeve (or equivalent) methods are not considered appropriate for groundwater sampling at the landfill and shall not be used.
- The sampling program should be scheduled to ensure groundwater sampling is conducted as close as possible to the date of sample transportation, avoiding transport over weekends. For example, groundwater sampling should not be performed before landfill gas monitoring if sample transportation is planned to occur after gas monitoring.
- Laboratory analysis shall be as detailed in the Yulara Landfill Environmental Monitoring, Mitigation, Action and Responsibilities Plan.
- Samples shall be stored in eskies with significant amounts of ice (more ice than sample bottles) so as to rapidly cool samples and ensure they are adequately cool for transport. Ice bricks are not to be used.

#### **4.4 Leachate**

Specific requirements for leachate monitoring at Yulara Landfill are as follows:

- Leachate sampling shall be conducted using a bailer. Due to the typically limited volume and slow recharge rate of leachate (ranging from days to weeks, rather than minutes or hours), grab sampling is generally the only practical method for sample collection.
- The bailer shall be lowered into the well allowed to sink and recovered. The sampling bottles shall be filled in a priority order as follows:
  - Nutrients and metals
  - VOC
  - SVOC
  - Physical properties
- Field parameters shall only be measured once all sampling bottles have been filled.

#### **4.5 Stormwater**

Specific requirements for stormwater monitoring at Yulara Landfill are as follows:

- Currently, there are no stormwater basins or drainage lines on site, as the terrain is generally flat. However, if stormwater features are present during or after a significant rain event and ponded water is deep enough to submerge a bailer or a sampling vessel (such as an un-preserved physical parameters bottle), samples shall be collected.
- Sample bottles containing preservatives shall not be submerged during collection, as this may wash out or excessively dilute the preservative.
- Samples shall be collected from mid-water, avoiding the surface and any areas of disturbed sediment. For example, if wading into the water, samples must be taken beyond the zone of cloudiness created by disturbance of the bottom sediment.

#### **4.6 Cell Excavation Inspection**

A cell excavation inspection shall be carried out by the Voyages Land and Environment Manager once they have been trained by the TPMT. The procedure that the trained Voyages Land and Environment Manager, shall follow is detailed in Section 2.2. In addition to this section and Section 2.2 above, objectives, management, documentation and reporting requirements are presented in Sections 2.4 and 3.5 of the Yulara Landfill Environmental Monitoring, Mitigation, Action and Responsibilities Plan.

#### **4.7 Weed and Pest Animals Monitoring**

As a condition of the landfill licence issued by the Northern Territory Government, Voyages is required to undertake an annual monitoring program for animal pests, disease vectors, and weeds within the premises of the Waste Management Facility. The contents of this report should be consistent with the current format (2026 report) with the addition of the recommended tasks as presented in Section 3.6 of the Yulara Landfill Environmental Monitoring, Mitigation, Action and Responsibilities Plan.