# Decision Report

## Application for Licence Amendment

### Division 3, Part V *Environmental Protection Act 1986*

| | |
|---|---|
| **Licence Number** | L8949/2016/1 |
| **Licence Holder** | Bunbury Harvey Regional Council |
| **File Number** | DER2014/000052 |
| **Premises** | Stanley Road Class II Putrescible Landfill Site<br>51 Stanley Road<br>WELLESLEY WA 6233<br>Lot 45 on Deposited Plan 17161 |
| **Date of Report** | 19 December 2019 |
| **Status of Report** | Final |

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# 1. Definitions of terms and acronyms

In this Decision Report, the terms in Table 1 have the meanings defined.

**Table 1: Definitions**

| Term | Definition |
|---|---|
| AACR | Annual Audit Compliance Report |
| ACN | Australian Company Number |
| AER | Annual Environment Report |
| Category/ Categories/ Cat. | Categories of Prescribed Premises as set out in Schedule 1 of the EP Regulations |
| CS Act | *Contaminated Sites Act 2003* (WA) |
| Decision Report | refers to this document. |
| Delegated Officer | an officer under section 20 of the EP Act. |
| Department | means the department established under section 35 of the *Public Sector Management Act 1994* and designated as responsible for the administration of Part V, Division 3 of the EP Act. |
| DWER | Department of Water and Environmental Regulation<br><br>As of 1 July 2017, the Department of Environment Regulation (DER), the Office of the Environmental Protection Authority (OEPA) and the Department of Water (DoW) amalgamated to form the Department of Water and Environmental Regulation (DWER). DWER was established under section 35 of the *Public Sector Management Act 1994* and is responsible for the administration of the *Environmental Protection Act 1986* along with other legislation. |
| EPA | Environmental Protection Authority |
| EP Act | *Environmental Protection Act 1986* (WA) |
| EP Regulations | *Environmental Protection Regulations 1987* (WA) |
| EPBC Act | *Environment Protection and Biodiversity Conservation Act 1999* (Cth) |
| Existing Licence | The Licence issued under Part V, Division 3 of the EP Act and in force prior to the commencement of, and during this Review |
| Licence Holder | Bunbury Harvey Regional Council |
| $m^3$ | cubic metres |

| Term | Definition |
|---|---|
| Noise Regulations | *Environmental Protection (Noise) Regulations 1997* (WA) |
| Occupier | has the same meaning given to that term under the EP Act. |
| Prescribed Premises | has the same meaning given to that term under the EP Act. |
| Premises | refers to the premises to which this Decision Report applies, as specified at the front of this Decision Report |
| Primary Activities | as defined in Schedule 2 of the Revised Licence |
| Risk Event | As described in *Guidance Statement: Risk Assessment* |

# 2. Purpose and scope of assessment

On 13 March 2019 the Bunbury-Harvey Regional Council (BHRC) (the Licence Holder) submitted a licence amendment application under Part V, Division 3 of the *Environmental Protection Act 1986* (EP Act) for the construction of a new lined landfill cell (cell 2/3).

The Premises is currently licenced under L8949/2016/1 for the following categories and design capacities.

**Table 2: Classification of premises and proposed design capacity**

| Category number | Category description | Production or design capacity |
|---|---|---|
| 62 | Solid waste depot: premises on which waste is stored, or sorted, pending final disposal or re-use. | 10,000 tonnes per annual period |
| 64 | Class II or III putrescible landfill site: Premises on which waste (as determined by reference to the waste type set out in the document entitled "Landfill Waste Classification and Waste Definitions 1996" published by the Chief Executive Officer and as amended from time to time) is accepted for burial. | 100,000 tonnes per annual period |

This Decision Report is an assessment of the foreseeable Risk Events that have the potential to impact public health, public amenity and the environment, arising from the Primary Activities associated with the construction and operation of the proposed cell 2/3. The Delegated Officer has determined that the amendment will be granted.

## 2.1 Exclusions

This Decision Report assesses both operation and construction however only construction will be authorised under the amendment. Future operation of the cell is subject to compliance with construction requirements and a separate licence amendment.

The Licence Holder is not proposing any changes to the waste types, annual volumes of wastes accepted or day to day management practices at the Premises as part of this amendment.

The implementation of the proposed works is subject to clearing of native vegetation. The licence amendment does not authorise clearing of any native vegetation. Clearing has been assessed separately and is discussed further in section 4.4.

As part of this amendment, previous Amendment Notices 1, 2 and 3 have been amalgamated into the one instrument. Previous amendments have not been reassessed.

The Licence Holder currently has a number of other amendment applications active with DWER including proposals to undertake crushing and screening (as an application to amend Licence L8949/2016/1) and composting (as an application for works approval W6223/2019/1). These applications are being assessed separately and are not considered as part of this amendment.

The Licence Holder has also indicated that in future the landfill footprint may be extended north, and the Premises may undertake additional waste processing including waste to energy or materials recovery in the future. No applications for these activities have been made and these are not assessed as part of this amendment.

# 3. Overview of premises

## 3.1 Construction summary

The Licence Holder is proposing to construct two new, lined landfill cells, cell 2/3, next to and abutting the existing unlined landfill (cells A, B and 1). Figure 1 shows the proposed design and location of cell 2/3 in relation to the existing waste mass.

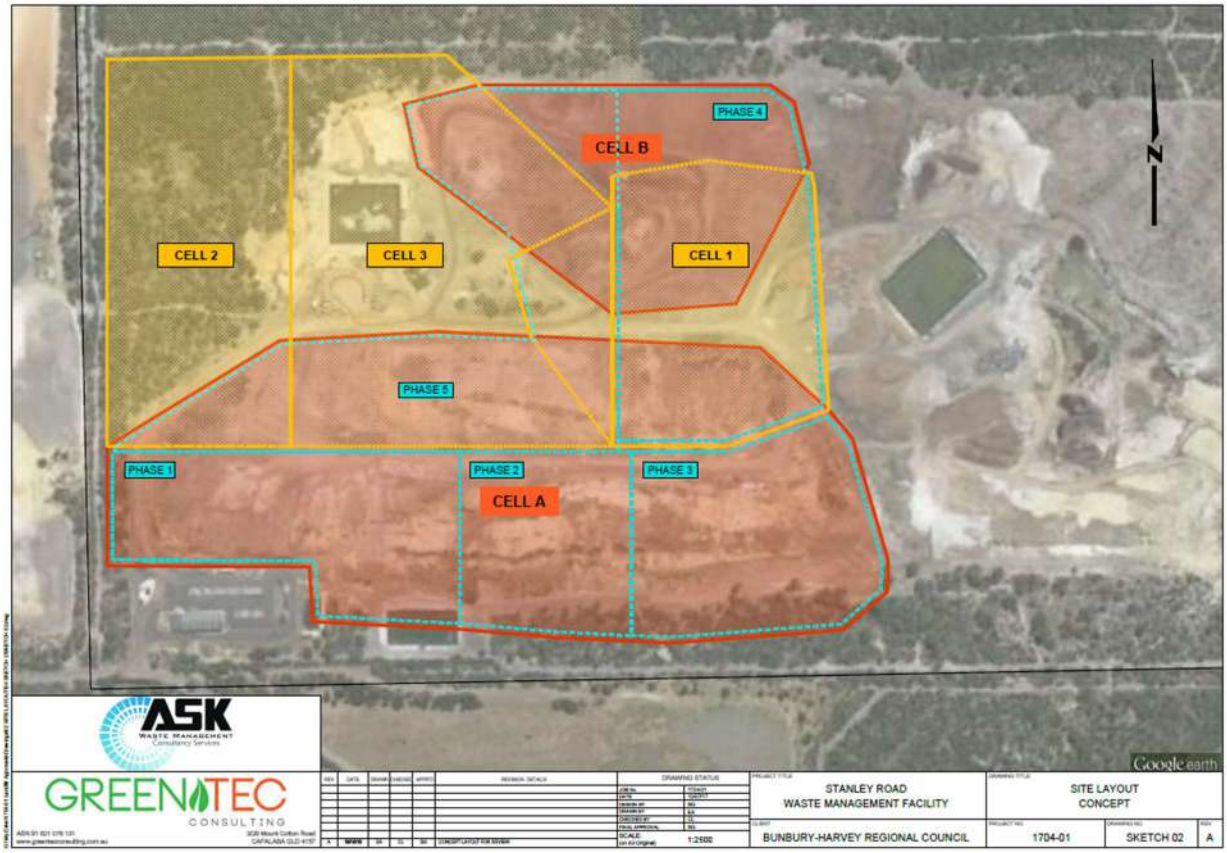



**Figure 1: Cell Design**

Cell 2/3 has a maximum footprint of 7.8 hectares and a capacity of approximately 1,050,000 cubic metres which is estimated to provide for an additional 16 years of operations at the current waste acceptance capacity. The unlined cell 1 is currently being filled and the final landform is proposed to be completed by 2021. Cell 2 to the west of the Premises will be filled first, with Cell 3 abutting Cell 1 will be filled second. Cell 2 and 3 will be separated with cell separation bund. The landfill design is discussed in detail in section 7.

Construction of cell 2/3 will also require the construction of a leachate management system including a leachate pond, as well as ancillary works including moving the current workshop location.

A Construction Quality Assurance (CQA) Plan for construction of cell 2/3 was provided with the Application (*Bunbury Harvey Regional Council Stanley Road Waste Management Facility, Construction Works Quality Assurance (CQA) Plan, Greentec Consulting, 15 March 2019*). The CQA Plan and accompanying Technical Specifications (*Bunbury Harvey Regional Council Stanley Road Landfill, Cells 2/3 Landfill Construction, Technical Specification ASK-1704-01-001 S01c, Greentec Consulting, 15 March 2019*) provide detail on the material and construction specifications, quality assurance testing methods and procedures required for the proposal.

## 3.2 Operations summary

The Licence Holder is proposing to maintain all current infrastructure and procedures related to the acceptance and handling of wastes through the transfer station. The Licence Holder has not requested any changes to current requirements as specified in the current licence conditions.

Table 3 summarises the current key operational elements. Specific controls as they relate to potential emissions are described in detail in section 9.

**Table 3: Current key operational elements**

| **Summary of activities and infrastructure as approved under L8949/2016/1** | |
|---|---|
| **Activities** | |
| 1) | Acceptance of up to 100,000 tonnes per year of domestic and commercial waste from Bunbury, Australind and surrounds. Waste types are limited to Inert Waste Type 1 and 2, Special waste type 1 (limited to cement bonded asbestos), Clean fill, contaminated solid wastes, putrescible wastes and hazardous wastes (limited to paints and resins). |
| 2) | Storage of wastes in a designated bunded hardstand area prior to landfilling, or removal off-site (tyres and green waste). |
| 3) | Landfilling of wastes including levelling, compacting and placement of daily cover. |
| 4) | Maintenance of security measures and contact information. |
| 5) | Maintenance of nuisance impacts including vermin treatment and windblown waste collection. |
| 6) | Clearing of vegetation as specified in the Licence. |
| 7) | Monitoring of inputs and outputs (each load). |
| 8) | Monitoring of surface water ponds. |
| 9) | Monitoring of groundwater. |
| 10) | Monitoring of landfill gas. |
| **Infrastructure** | |
| 11) | Landfill Cells A, B and 1 (unlined). |
| 12) | Stormwater Ponds 1 and 2. |
| 13) | Gabion Wall. |
| 14) | Aspiration landfill gas wells and perimeter landfill gas monitoring wells. |
| 15) | Groundwater monitoring bores. |

# 4. Legislative context and other approvals

## 4.1 Occupancy

The proprietors, as listed in DWER's Geographic Information System (GIS) of Lot 45 on Deposited Plan 17161 are the Shire of Harvey and the City of Bunbury. The City of Bunbury and Shire of Harvey established the Bunbury-Harvey Regional Council (BHRC) in 1990. The BHRC is a statutory local government authority and the legal occupier of the Premises.

## 4.2 Planning

The Shire of Harvey have advised DWER that the landfill expansion proposal is exempt from requiring development approval under the Greater Bunbury Regional Scheme.

## 4.3 Contaminated Sites Act 2003

The Premises (Lot 45 on Plan 17161) is classified under the Contaminated Sites Act 2003 (the CS Act) as *'possibly contaminated – investigation required'.*

The Premises was first classified under section 13 of the CS Act, based on information submitted to the former Department of Environment and Conservation in May 2007. Additional information submitted to the former Department of Environment Regulation in May 2017 prompted a review and reclassification of the Premises.

The 2017 review of the Premises classification identified that contamination originating from the unlined landfill had migrated, through groundwater, offsite towards a neighbouring sand mine located directly west (Lot 42 on Plan 67196). The Premises was identified as the 'Source Site' and Lot 42 as 'the Affected Site'. The groundwater contamination identified through groundwater monitoring at the Premises and at the Affected Site is indicative of leachate impacts from the unlined landfilling operations at the Premises.

The Premises is high priority for action under the CS Act, with further investigations required to characterise and delineate groundwater contamination and understand the potential for landfill gas migration. The BHRC is progressing staged investigations in accordance with DWER's contaminated sites guidelines. A Contaminated Site Auditor has been appointed and a Mandatory Auditors Report is expected to be submitted to the DWER in February 2020 for review and update of the classification if necessary.

## 4.4 Clearing

Two Clearing Permits have previously been granted for the Premises (CPS 5394/4 and CPS 7259/2) which relate to excavating for cover material and space for the existing unlined landfill cell. To accommodate the construction of cell 2/3 the Licence Holder applied for a third clearing permit at the site (CPS 8486/1) which is still under assessment by DWER.

# 5. Location and siting

## 5.1 Siting context

The Stanley Road Landfill is located on the Swan Coastal Plan, 14 km north-east of Bunbury in the suburb of Wellesley. The site is located within the Kemerton Industrial Park bushland buffer zone, and there are several industrial premises in the immediate vicinity. In recent years the urban development has encroached on the Premises, with the residential developments in the suburb of Leschenault now within 1 km of the premises. The vegetation in the area surrounding the premises is predominately banksia woodland and wetlands.

## 5.2 Residential and sensitive Premises

The distances to residential and sensitive receptors are detailed in Table 4.

**Table 4: Receptors and distance from activity boundary**

| Human receptors | Distance from activity or prescribed premises |
|---|---|
| Residential Premises | Approximately 535 m west south west from the western side of the premises boundary<br>Approximately 900 m east from the eastern side of the premises boundary. |
| Industrial premises | Directly adjacent to the west and south. |

# 6. Specified ecosystems and ecological receptors

Specified ecosystems are areas of high conservation value and special significance that may be impacted as a result of activities at or Emissions and Discharges from the Premises. The description of specified ecosystems and distances from the Premises are discussed in Table 5 and shown in Figure 2.

Table 5 and Figure 2 also describe other relevant ecosystem and environmental values considered in this assessment.

**Table 5: Environmental values**

| Specified ecosystems and ecological receptors | Distance from the Premises |
|---|---|
| Groundwater | Superficial aquifer 3-15 metres below ground level (bgl)<br>Leederville aquifer 35-40 m bgl |
| RIWI Act Groundwater Area | The Premises is within the Bunbury Groundwater Area (Proclaimed status) |
| Beneficial users of groundwater – predominately non-potable domestic and industrial uses | 19 privately owned bores are located within 1 km of the site boundary (DWER GIS – WIN Groundwater Sites)<br>The closest bore is located 690 m south west of the eastern site boundary.<br>One bore located at Sand Mine immediately west of the western site boundary, 210 m from the western site boundary.<br>One bore located at an Inert landfill 115 m south of the southern site boundary (DWER Water Register) |
| Public Drinking Water Source Areas | A Priority 3 Public Drinking Water Source Area is located approximately 14 km south west. |
| RIWI Act Irrigation Districts - | Collie River Irrigation District – 900 m east (proclaimed status) |
| RIWI Act Surface Water Area - | Brunswick River and Tributaries – 220 m south (proclaimed status) |

| Specified ecosystems and ecological receptors | Distance from the Premises |
|---|---|
| Rivers and Tributaries | Wellesley River 130 m south east of the southern site boundary<br><br>Brunswick River 430 m south of the southern site boundary.<br><br>Collie River 5.5 km south west of the southern site boundary |
| Leschenault Inlet | Leschenault Inlet 3 km west of the western boundary<br><br>Leschenault Inlet Management Area 151 m south and 1.9 km west. |
| Wetlands | Conservation category geomorphic wetlands within premises boundary (northern portion), 20 m south, 522 m south, 620 m east, 3 km west.<br><br>Management category geomorphic wetlands east of the premises extending approximately 27 m inside the premises boundary, directly adjacent to the north east premises boundary, 165 m south east, 2.9 km west. |
| Parks and Wildlife Managed Land – recreation, conservation of flora and fauna and or historical features. | Land reserved under section 5(1)(h) of the Conservation and Land Management Act 1984 directly north. |
| Priority 3 Threatened Ecological Community buffers (Banksia Woodland) | Within and surrounding the premises. |

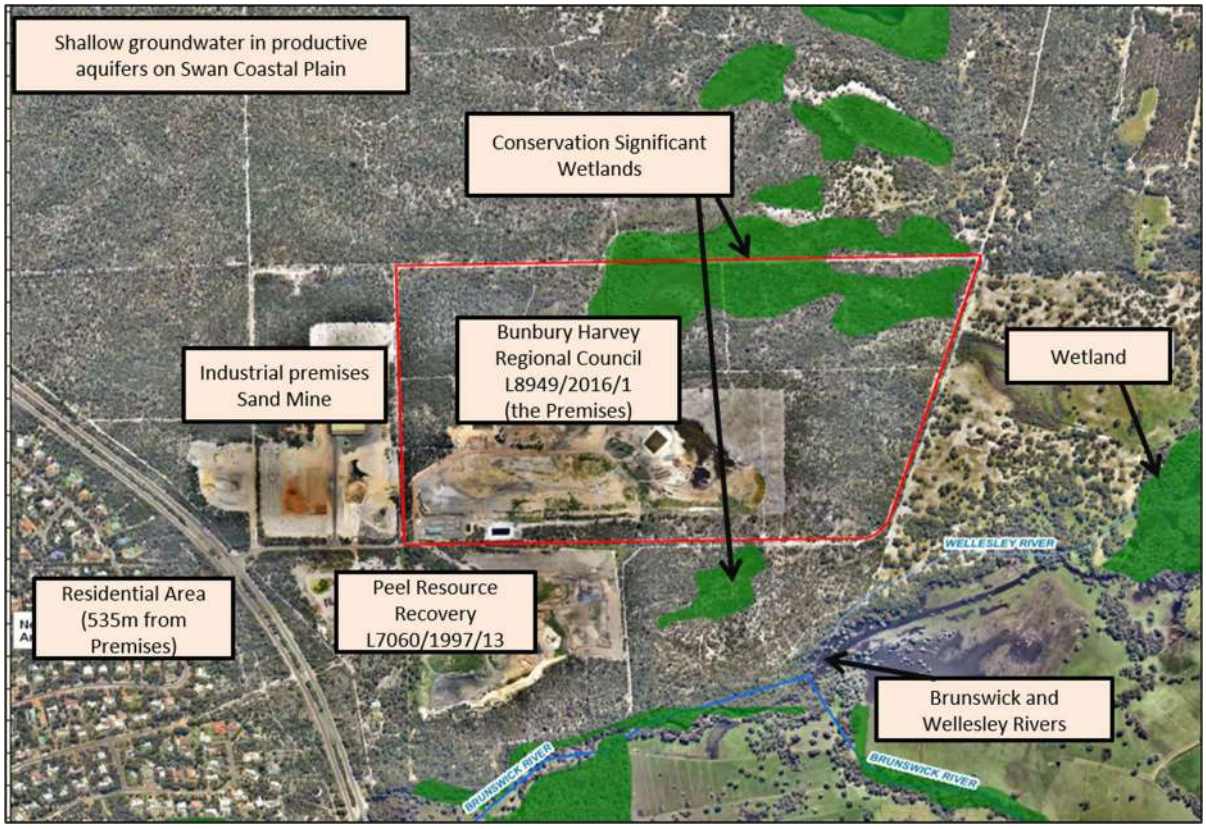



**Figure 2: Proximity of Premises to sensitive environmental receptors**

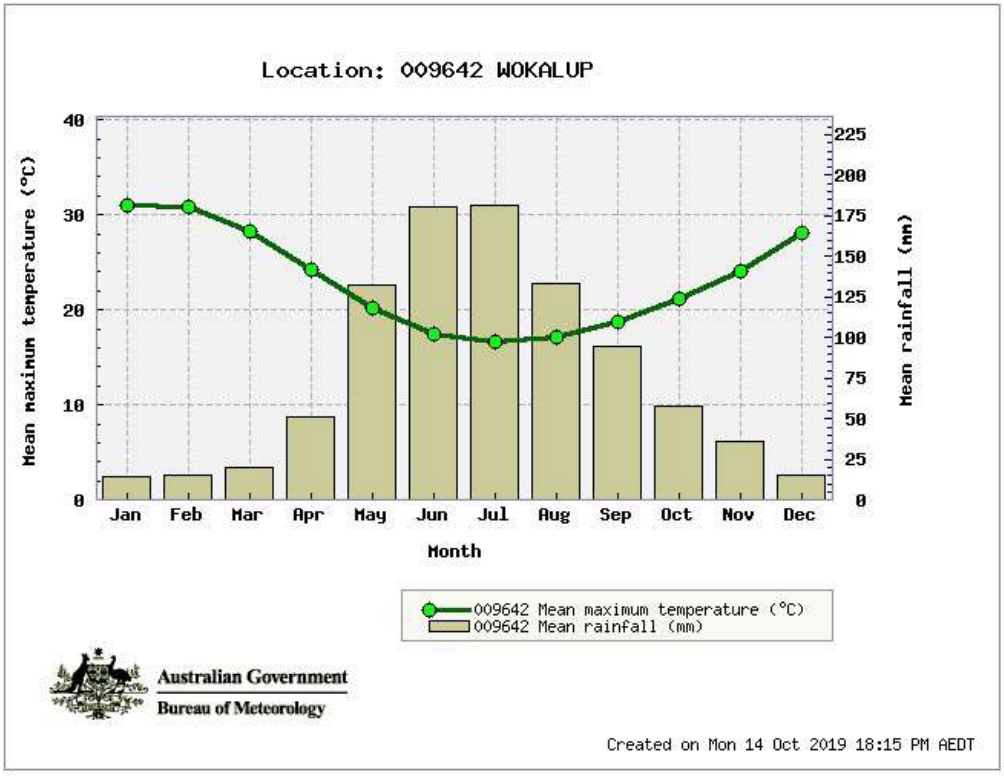
## 6.1 Climate

### 6.1.1 Rainfall and temperature

The nearest Bureau of Meteorology (BoM) station with rainfall and temperature data is Wokalup WA (station number 009642) located approximately 13.5 km from the Premises.

As shown in Figure 3, the BoM data for the Wokalup WA station shows that the area in the vicinity of the Premises has an annual average of 933.7 mm (based on data between 1951 and 2019), with the majority of rainfall received between May to September.

Temperatures average around 16-17 degrees Celsius in winter months, and up to 30 degrees Celsius in summer months, for an average annual temperature of 23.1 degrees.




| Statistics | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Annual | Years |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mean maximum temperature (°C) for years 1951 to 2000 | 31.0 | 30.8 | 28.3 | 24.2 | 20.2 | 17.5 | 16.7 | 17.1 | 18.7 | 21.1 | 24.0 | 28.1 | 23.1 | 38 |
| **Statistics** | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** | **Annual** | **Years** |
| Mean rainfall (mm) for years 1951 to 2019 | 14.5 | 15.3 | 20.5 | 51.0 | 132.8 | 180.4 | 181.6 | 133.7 | 95.1 | 57.7 | 35.7 | 15.3 | 933.7 | 65 |

**Figure 3: Wokalup WA mean rainfall and mean maximum temperature**

### 6.1.2 Wind direction and strength

The nearest BoM station with wind data is Bunbury (station number 009965) located approximately 20 km from the Premises.

Based on the climate data for the Bunbury station the prevailing wind directions are morning easterlies and afternoon westerlies. This is depicted in the wind roses shown in Figure 4.

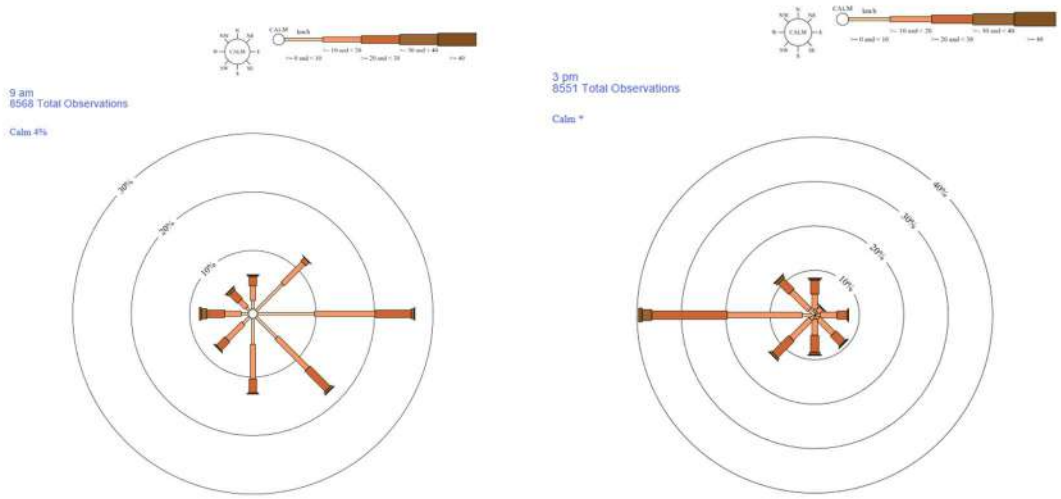



**Figure 4: Bunbury 9am and 3pm wind direction and strength**

It is important to note that these wind roses show historical wind speed and wind direction data for the Bunbury weather station and should not be used to predict future data.

## 6.2 Topography and soils

DWER's GIS mapping indicates that the Premises is underlain by Bassendean Sand and Tamala Limestone. Bassendean Sands are generally described as quartz sand and Tamala Limestone as limestone, calcarenite and sand, with minor clay. The Guildford formation comprising clay, loam, gravel, sand is present in the northern portion and alluvium in the south-eastern portion of the Premises.

The drilling of monitoring bores at 18 different locations across the site generally confirms the regional geological maps. The site is underlain by an unconfined sandy soil and unconsolidated rock, approximately 20 m to 40 m thick, with discontinuous clay layers and lenses.

The Premises is relatively flat, with contours between 15 and 25 Australian Height Datum (AHD).

## 6.3 Hydrology

Given the nature of sandy soils in the area, and the absence of perennial surface water channels on the premises it is unlikely that any surface water run off would migrate a significant distance from the premises, and instead would readily infiltrate to ground.

The Premises is located 130 m from Wellesley River. The Wellesley River joins the Brunswick River 430 m south of the site, flowing into the Leschenault Estuary via the Collie River.

Wetlands are located within and in close proximity to the Premises. They are positioned along the northern, eastern and southern boundaries. A conservation management category wetland located in the northern portion of the site covers approximately 14% of the Premises and continues outside of the Premises boundary (Figure 2). Additional conservation wetland areas are located north of the site within 1.5 km of the Premises northern boundary.

The site is located in close proximity to a surface water area and irrigation district that are proclaimed under the *Rights in Water and Irrigation Act 1914* (RIWI Act). The Collie River Irrigation District is located 900 m east of the site and the Brunswick River and Tributaries surface water area is 220 m south.

## 6.4 Hydrogeology

A number of site-specific hydrogeological investigations have been undertaken by BHRC over the past 10 years. A recent report submitted in support of the application is the *Bunbury Harvey Regional Council, Stanley Road Landfill Detailed Hydrogeological Investigation, GHD July 2018* (GHD, 2018). Previous assessments of the Premises by DWER have reviewed investigations undertaken at the site in March 2016 and reported in *Talis Phase 2 Hydrogeological Investigation, July 2016* (Talis, 2016). This section presents a summary of the hydrogeology as determined by these investigations.

Site investigations have identified a superficial aquifer that is made up of upper and lower sandy layers separated by a clay layer that ranges in thickness from 0.2 to 2.5 m (Talis, 2016). The more recent investigations by GHD 2018 indicate that there may be an additional intermediate clay layer, however groundwater bore drilling data has provided limited detail on this existence or extent of this layer. The superficial aquifer is underlain by the Leederville Aquifer which is located approximately 35-40 m below surface.

Groundwater levels in the superficial aquifer, measured in March 2016, were between approximately 3 m to 10 m below ground level (BGL) in bores screened within the upper superficial aquifer (GQ1S – GQ18S) and between approximately 8 m to 15 m BGL in bores screened within the lower superficial aquifer (GQ1D – GQ18D). Groundwater levels measured in 2018 were similar to those measured in 2016.

Previous site investigations have suggested that the upper and lower levels of the superficial aquifer are hydraulically linked. Based on the lateral continuity of the interbed clays (as identified in all drilling locations), and the difference in hydraulic head difference observed in groundwater monitoring bores, the most recent investigation (GHD, 2018) has inferred that the upper and lower aquifers are hydraulically separate. Erratic hydraulic head data, and the detection of leachate impacts in the lower aquifer have been attributed to poor groundwater bore integrity, and areas of thinning, or discontinuous clay in the western are of the Premises. It is noted that groundwater wells with poor integrity were decommissions and replaced as part of the recent hydrogeological investigations.

Groundwater flow direction within the superficial aquifer is complex. Talis 2016 suggested that groundwater flow in the upper aquifer, is complicated by mounding from the loading of the landfill, resulting in flow occurring to the north, west, southwest and south. GHD 2018 suggests that groundwater flow direction in the upper aquifer flows towards the northwest.

Both Talis 2016 and GHD 2018 indicate that the groundwater flow direction in the deeper aquifer is generally from northwest to southeast towards the Brunswick and Wellesley Rivers. Talis 2016 indicated that flow direction in the southwest area of the Premises is influenced by offsite abstraction wells located west and southwest of the Premises. Field tests indicate that the superficial aquifer permeability ranges between 0.34 m/day and 1.73 m/day.

**The Delegated Officer has reviewed the information regarding hydrogeology and notes the following for the purposes of the risk assessment:**

- The sandy, permeable nature of the superficial aquifer indicates that groundwater flow in the upper and lower levels of the aquifer are potential pathways for consideration in the assessment of risk. Based on the aquifer properties, there is unlikely to be significant potential for attenuation of contaminants within the superficial aquifer.
- While groundwater wells with poor integrity have been replaced, it is noted that there is the potential for downward leakage from the upper to the lower superficial aquifer clay is very limited in thickness or absent. Therefore, the superficial aquifer will be considered as a single entity in the assessment of risk to identified receptors.
- The Leederville Aquifer is located approximately 35 m below ground level and is typically overlain by a regionally extensive confining shale aquitard. This expected to restrict any downward migration of contaminants into the Leederville Aquifer and for the purposes of this assessment the aquifer will not be considered in the assessment of pathways or receptors for the risk assessment.
- Based on inferred groundwater flow directions in the superficial aquifer, it is considered likely that groundwater from beneath the Premises has the potential to be in connection with; wetland areas to the northeast and southeast; the Brunswick/Wellesley River system to the south; and groundwater abstraction wells to the west and southwest.

# 7. Proposed landfill engineering and design

The following sections provide a summary of the proposed cell construction and incorporate the Delegated Officer's key findings relevant to the assessment of risks related to potential emissions and discharges from the proposal.

The key aspects of the proposed cell are summarised in Table 6, and cross sections of the landfill design are shown in Figures 5 and 6.

**Table 6: Proposed Landfill Design**

| Landfill design aspect | Description |
|---|---|
| Footprint | Entire Cell 2/3 – 7.8 ha (cell floor 6.5 ha)<br>Cell 2 – 4.3 ha (cell floor 3.6 ha)<br>Cell 3 – 3.5 ha (cell floor 2.9 ha) |
| Capacity | Total capacity – 1,050,000 $m^3$ including cover material<br>Equating to approximately 890,000 tonnes in total. |
| Groundwater separation distance | Based on the base of the leachate sump - > 2.5 m |
| Cell lifespan | 17 years |
| Side slopes | 1V:5H |

| Landfill design aspect | Description |
|---|---|
| Basal gradient | Minimum 5% |
| Final slope profile | No steeper than 1V:5H and no shallower than 1V:20H |
| Maximum height | RL 40 m |
| Containment system | Basal and connection liner system, leachate collection system, gas management system and capping system (described in Sections 0 to 7.7) |

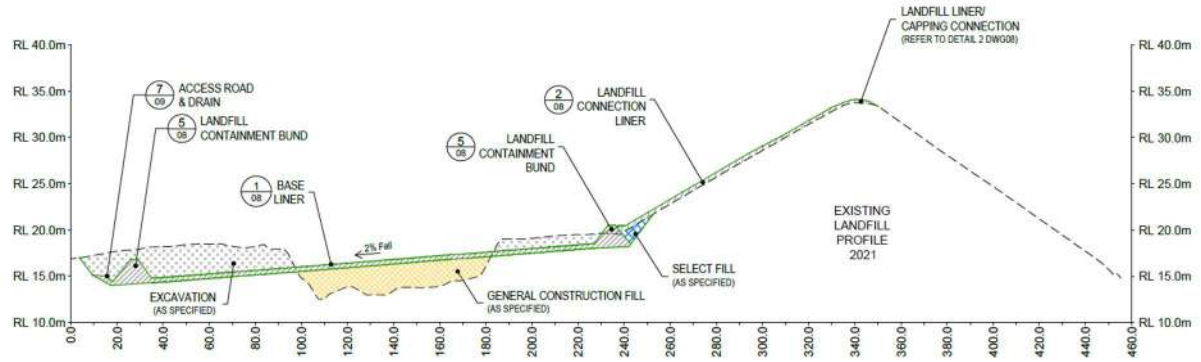



**Figure 5: North-South cross section**

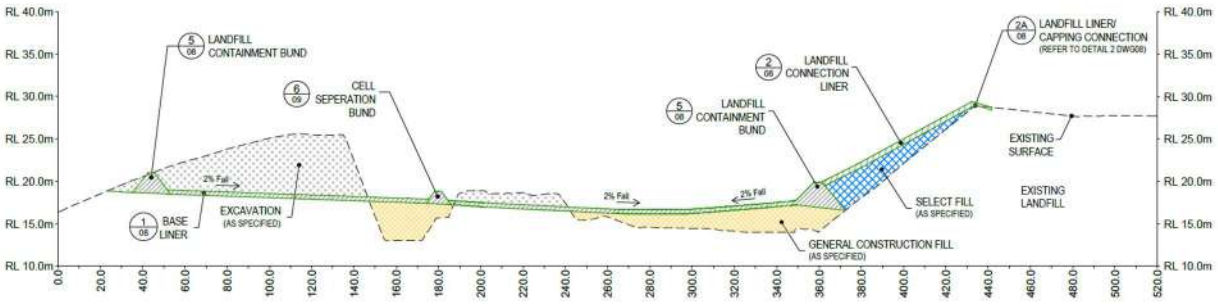



**Figure 6: East-West cross section**

## 7.1 Landfill liner system and performance

### 7.1.1 Landfill liner design

The Licence Holder has proposed a landfill liner configuration as follows. The liner is depicted in Figure 7.

- Groundwater depressurisation system consisting of a drainage layer beneath the entire cell floor underneath the landfill liner. In the event that groundwater reaches within 2 metres of the liner this system will relieve pressure on the underside of the liner.
- Compacted clay layer of at least 500 mm (material to be sourced from offsite) to provide robustness in the liner profile, protect the underside of the liner from hydration and subgrade intrusions and act as an additional a low permeability physical barrier.
- Geosynthetic clay liner (GCL) of 500 mm thickness with a minimum permeability of

<1x10$^{-9}$ m/s.

- Geomembrane which provides a liquid containment barrier and typically achieves a minimum permeability of <1x10$^{-14}$ m/s.
- Cushion geotextile which provides protection for the geomembrane from the leachate drainage aggregate that is placed on top of the liner.
- Drainage aggregate a minimum thickness of 300 mm to provide a leachate collection system. This aggregate will have a nominal grade of 2% to direct leachate to the recovery sump. A series of perforated leachate collection pipes will be place within the drainage aggregate and connect to recovery sumps.
- Separation geotextile provides separation between select waste and the drainage aggregate, as well as providing a sacrificial UV protection layer.

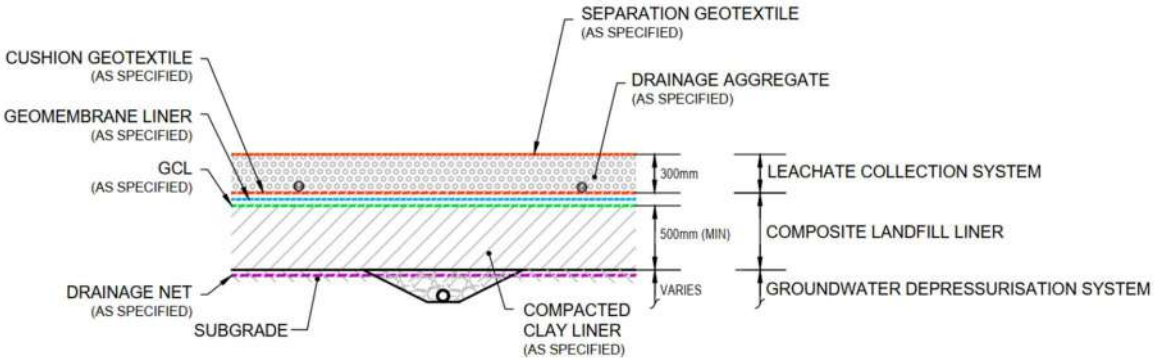



**Figure 7: Proposed landfill liner**

The Licence Holder has determined that there are no suitable clays available onsite and so all clay will be imported to site.

### 7.1.2 Landfill connection liner

The proposed cell 3 will connect to and abut against the existing unlined cell and therefore will require a connection liner to split the cells and contain leachate within the lined cell. The connection liner will extend from the base of the landfill operations and tie into the landfill capping and gas collection system on the upper surface of the existing cell.

The liner will be constructed similarly to the liner proposed for the rest of the landfill, however due to the slope of the batter being greater than the floor liner, there is less potential for leachate to pool on the liner and therefore, a reduced thickness of clay of 0.3 m is proposed for the connection liner.

The previous landfill operations used sand as cover material. Due to this material and the potential for consolidation of waste and differential settlement, a composite liner (geogrid) would be used supported by a geogrid to protect the landfill connection liner. Additionally, the connection liner will include a gas collection layer to capture gas from the existing landfill cell, and this connects to the landfill capping of the existing unlined cells. The layout of the connection liner is shown in Figure 8, and depicts the landfill connection liner layers as follows:

1. Drainage Net
2. Textured geomembrane
3. Compacted clay liner, 0.3 m thick
4. Separation geotextile

5. Gas collection layer drainage aggregate, 0.2 m thick
6. Geogrid
7. Select fill

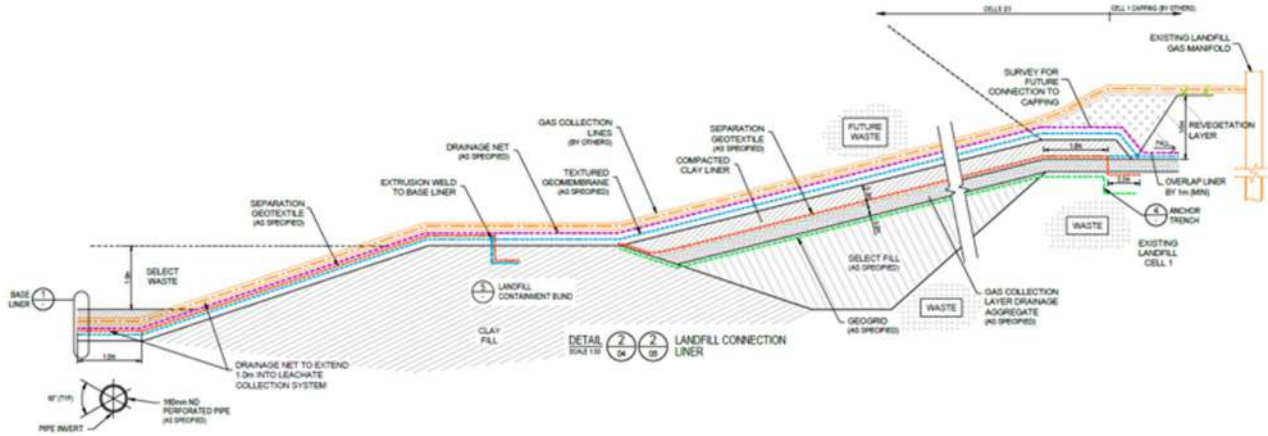



**Figure 8: Landfill connection liner**

### 7.1.3 Landfill liner performance

The Licence Holder provided a seepage and liner performance assessment with the Application as shown in Figure 9. Seepage modelling was undertaken using the Hydrologic Evaluation of Landfill Performance (HELP) software. The Licence Holder has compared modelled landfill liner performance against the *Best practice environmental management, siting, design, operation and rehabilitation of landfills* published by the Environment Protection Authority Victoria 2015 (EPA Victoria, 2015) (VIC BPEM). The VIC BPEM indicates that a liner system should control seepage rates to an amount not exceeding 10 L/ha/day.

The anticipated leakage rates through the liner have been estimated using HELP (Figure 9) and range between 0.072 to 0.075 L/ha/day for operational phases (uncapped) and 0.002941 L/ha/day once the landfill cell has been capped/closed. The landfill connection liner has also been modelled and is expected to range between 0.045 and 0.003 L/ha/day. A figure of 6.8 ha has been used for the site size which is larger than the combined cell floor footprints to provide a conservative value.

| Scenario | Description of Model | Peak Daily Leakage ($m^3$) | Annual Average Leakage ($m^3$) | Peak Daily Leakage (L/ha/day) | Annual Average Leakage (L/ha/day) | Maximum Allowable Leakage (BPEM, 2015) | General Notes |
|---|---|---|---|---|---|---|---|
| Cells 2 and 3 – Uncapped, pinholes and poor placement quality | Pinholes at 2 per hectare<br>Installation defects at 2 per hectare<br>Assumed poor placement quality<br>Max LAI = 1<br><br>Layer 1: 300mm intermediate cover (modelled as soil type SW)<br>Layer 2: 20m MSW<br>Layer 3: 300mm drainage aggregate (modelled as gravel)<br>Layer 4: 1.5mm HDPE Geomembrane<br>Layer 5: 4mm GCL<br>Layer 6 : 500mm clay (modelled as soil type CH) | 0.00051 (5.1x10-4) | 0.02 (2 x10-2) | 0.075 (7.5 x10-2) | 0.008058 (8.058E-3) | 10 L/ha/day | Site = 6.8ha = 68,000$m^2$<br><br>Evap zone depth = 70cm – See typical values<br><br>Runoff curve number calculated automatically based on top soil layer, assuming slope of 5% and a slope length of 100m and assuming 100% of the area allows runoff. |
| Cells 2 and 3 – Uncapped and no pinholes | No Pinholes<br>No installation defects<br>Assumed good placement quality<br>Max LAI = 1<br><br>Layer 1: 300mm intermediate cover (modelled as soil type SW)<br>Layer 2: 20m MSW<br>Layer 3: 300mm drainage aggregate (modelled as gravel)<br>Layer 4: 1.5mm HDPE Geomembrane<br>Layer 5: 4mm GCL<br>Layer 6 : 500mm clay (modelled as soil type CH) | 0.00049 (4.9x10-4) | 0.02 (2 x10-2) | 0.072058 (7.2058 x10-2) | 0.008058 (8.058 x10-3) | 10 L/ha/day | |

| Scenario | Description of Model | Peak Daily Leakage ($m^3$) | Annual Average Leakage ($m^3$) | Peak Daily Leakage (L/ha/day) | Annual Average Leakage (L/ha/day) | Maximum Allowable Leakage (BPEM, 2015) | General Notes |
|---|---|---|---|---|---|---|---|
| Cells 2 and 3 Pinholes and poor placement quality – including capping (Talis Design) | Pinholes at 2 per hectare<br>Installation defects at 2 per hectare<br>Assumed poor placement quality<br>Max LAI = 3<br><br>Layer 1: 1.2m of subsoil (modelled as soil type SW)<br>Layer 2: 6mm Geonet<br>Layer 3: 1.5mm LLDPE<br>Layer 4: 300mm of well graded sand (SW)<br>Layer 5: 20m of MSW<br>Layer 6: 300mm drainage aggregate (modelled as gravel)<br>Layer 7: 1.5mm HDPE Geomembrane<br>Layer 8: 4mm GCL<br>Layer 9: 500mm clay (modelled as soil type CH) | 0.00002 (2 x10-5) | 0.009 (9 x10-3) | 0.002941 (2.941 x10-3) | 0.0036261 (3.6261 x10-3) | 10 L/ha/day | Site = 6.8ha = 68,000$m^2$<br><br>Evap zone depth = 70cm – See typical values<br><br>Runoff curve number calculated automatically based on top soil layer, assuming slope of 5% and a slope length of 100m and assuming 100% of the area allows runoff. |
| Cells 2 and 3 No pinholes and capped (Talis Design) | No Pinholes<br>No installation defects<br>Assumed good placement quality<br>Max LAI = 3<br><br>Layer 1: 1.2m of subsoil (modelled as soil type SW)<br>Layer 2: 6mm Geonet<br>Layer 3: 1.5mm LLDPE<br>Layer 4: 300mm of well graded sand (SW)<br>Layer 5: 20m of MSW<br>Layer 6: 300mm drainage aggregate (modelled as gravel)<br>Layer 7: 1.5mm HDPE Geomembrane<br>Layer 8: 4mm GCL<br>Layer 9: 500mm clay (modelled as soil type CH) | 0.00002 (2 x10-5) | 0.00800 (8 x10-3) | 0.002941 (2.941 x10-3) | 0.0032232 (3.2232 x10-3) | 10 L/ha/day | |

| Scenario | Description of Model | Peak Daily Leakage ($m^3$) | Annual Average Leakage ($m^3$) | Peak Daily Leakage (L/ha/day) | Annual Average Leakage (L/ha/day) | Maximum Allowable Leakage (BPEM, 2015) | General Notes |
|---|---|---|---|---|---|---|---|
| Landfill Connection Liner - Pinholes/ poor placement quality | Pinholes at 2 per hectare<br>Installation defects at 2 per hectare<br>Assumed poor placement quality<br><br>Layer 1: 6mm drainage net<br>Layer 2: 2mm LLDPE Geomembrane<br>Layer 3: 300mm clay (soil type CH)<br>Layer 4: 200mm gas collection/drainage layer (gravel)<br>Layer 5: 300mm sand layer (SW) | 0.00031 (3.1 x10-4) | 0.004 (4 x10-3) | 0.04558 (4.558 x10-2) | 0.0016116 (1.6116 x10-3) | 10 L/ha/day | Site = 6.8ha = 68,000$m^2$<br><br>Evap zone depth = 1cm (Can't input 0)<br>LAI = 0 (no vegetation)<br><br>Runoff curve number calculated automatically based on top soil layer, assuming slope of 20% and a slope length of 100m and assuming 100% of the area allows runoff. |
| Landfill Connection Liner - No pinholes | No Pinholes<br>No installation defects<br>Assumed good placement quality<br><br>Layer 1: 6mm drainage net<br>Layer 2: 2mm LLDPE Geomembrane<br>Layer 3: 300mm clay (soil type CH)<br>Layer 4: 200mm gas collection/drainage layer (gravel)<br>Layer 5: 300mm sand layer (SW) | 0.00002 (2 x10-5) | 0.0000 | 0.002941 (2.941 x10-3) | 0.0000 | 10 L/ha/day | |

**Figure 9: HELP model scenarios**

## 7.2 Separation distance to groundwater

The lowest point of cell 2/3, being the leachate sump, is designed to be constructed at RL 13 metres. The maximum groundwater level observed in the location of the sump is RL 10.5 metres, providing a minimum separation distance to groundwater of 2.5 metres. Figure 10 shows the proposed leachate collection sump construction in relation to maximum groundwater level.

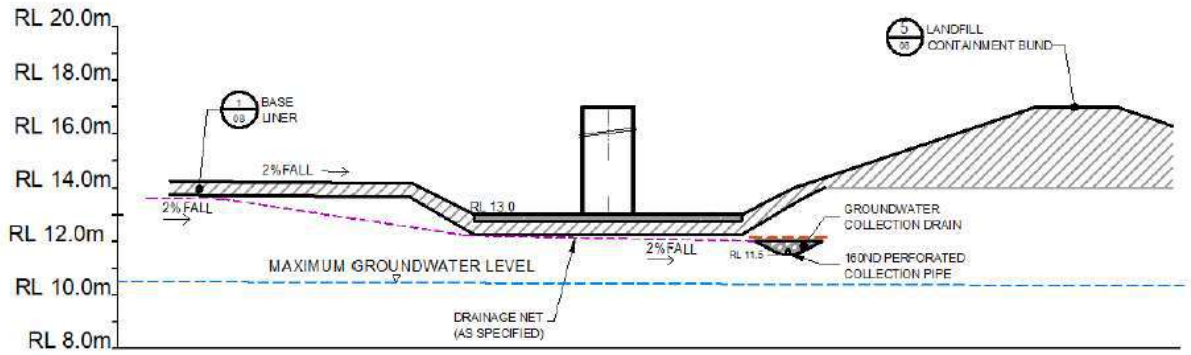



**Figure 10: Separation distance to groundwater**

## 7.3 Leachate collection and storage

### 7.3.1 Leachate collection

As described in section 7.1.1 and shown in Figure 7 the landfill liner will consist of a drainage aggregate a minimum thickness of 300 mm and a permeability of more than $1x10^{-3}$ m/s. A series of perforated leachate collection pipes will be place within the drainage aggregate and connect to recovery sumps. This aggregate will have a nominal grade of 2% to passively direct leachate to the recovery sump. Overall this provides a 4 metre fall from the highest to lowest points of the cell floor.

Two recovery sums (one for each cell) will be located in the north of the landfill cell and will connect to the leachate evaporation pond to the east of the cell via a leachate transfer pipe.

Leachate on the landfill connection liner is transmitted via the drainage net which has a permeability of $1x10^{-4}$ m/s. The drainage net will overlap the aggregate on the cell floor by 1 meter. As the drainage aggregate is more permeable than the drainage net it is considered highly unlikely that any leachate would back up in the connection liner.

Figure 11 shows the location of this infrastructure.

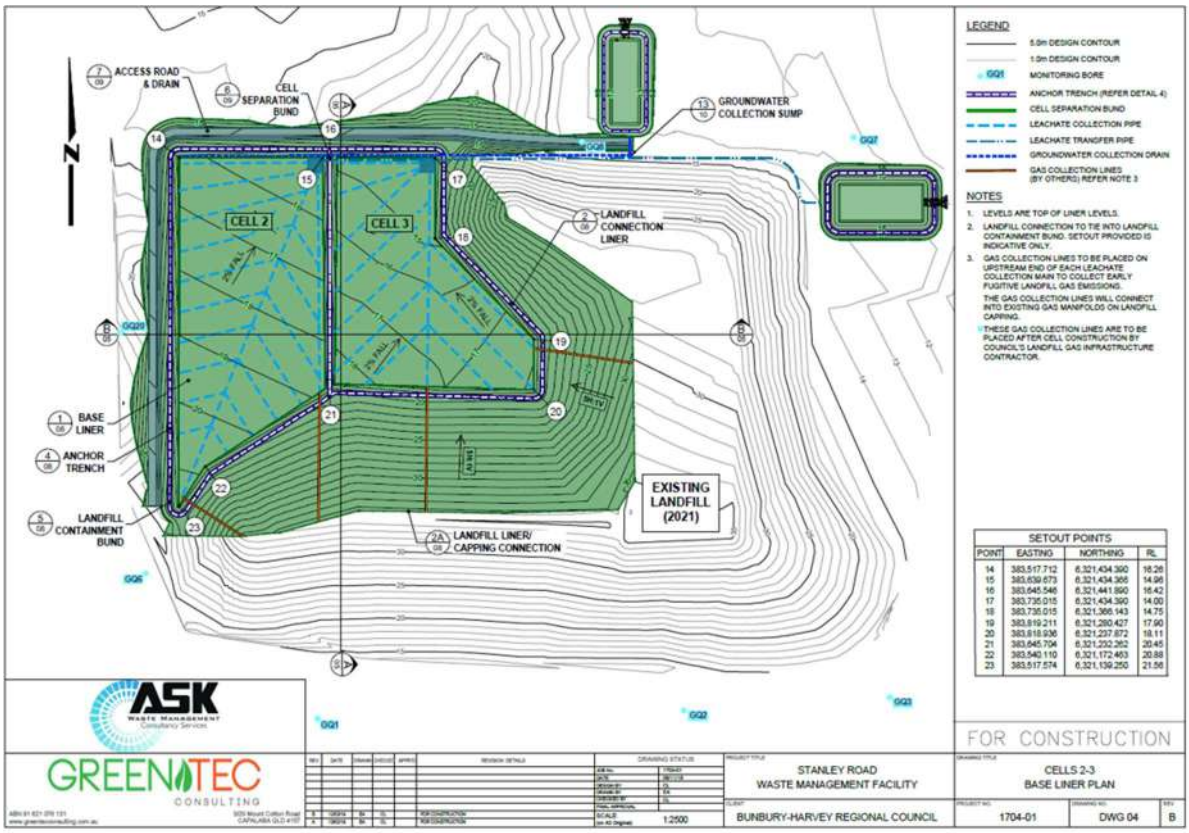



**Figure 11: Leachate collection infrastructure**

## 7.4 Leachate ponds

Following collection leachate is proposed to be stored within a leachate evaporation pond. The liner for the leachate evaporation pond will be the same as the landfill liner depicted in Figure 7, excluding the groundwater depressurisation system. No fencing has been proposed immediately surrounding the leachate pond however the perimeter of the site is fenced.

The Licence Holder has estimated that based on monthly rainfall and evaporation totals from a 15-year duration sequence that on average 1,162 $m^3$ of leachate will be generated, with a 90$^{th}$ percentile rate of 4,176 $m^3$ and a peak rate of 7,143 $m^3$ as shown in Figure 12.

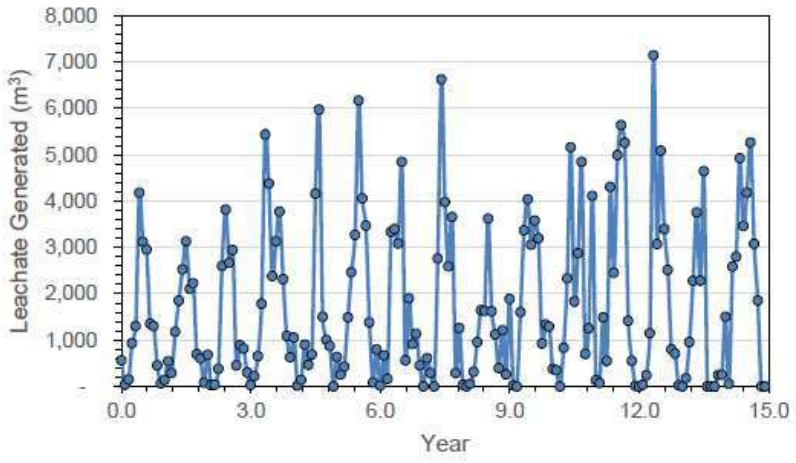



**Figure 12: Leachate generation model provided by Licence Holder**

The leachate pond has been designed to accommodate a 90$^{th}$ percentile rainfall scenario, and

has a total pond volume of 5700 $m^3$. The pond will have a surface area of 2000 $m^2$ with a depth of 2.8 m (0.3 m of which will contain aggregate), and batter slopes of 3(H):1(V). The Licence Holder has indicated that the full supply level is RL 16.0 m, with the embankment height at RL 16.5 m. The Licence Holder has not specifically stated the freeboard that will be maintained during operations however it appears a 0.5 m freeboard can be achieved.

From the information provided within the application, DWER is unable to verify the calculations provided by the applicant and in particular there are uncertainties related to the assumptions used for the rainfall scenarios and it is unclear if uncontaminated stormwater will be directed away from the active landfill areas prior to waste filling to reduce the volume of leachate that may be generated during operations.

DWER has undertaken a conservative water balance calculation assuming leachate must be collected and managed from the smaller cell 3 area (with the other cell's rainwater initially being diverted). The data and assumptions used are described in Table 7.

**Table 7: DWER water balance data and assumptions**

| **Data and Assumptions used for DWER water balance calculations** | |
|---|---|
| Entire Cell area Footprint | 3.5 ha |
| Leachate pond footprint | 2000 $m^2$ (0.2 ha) |
| Mean monthly rainfall | BOM Wokalup average data for each month |
| Run off assumption | 90% of all rainfall runs off the cell floor and needs to be captured by the leachate pond |
| Monthly evaporation | BOM Wokalup average data for each month |
| Pan factor | 0.75 |

Using these assumptions, the proposed pond size of 5,700 $m^3$ is considered likely to overtop during the first year of waste placement.

A second calculation assuming the entirety of cell 3 has final capping (using 20% runoff) still results in overtopping of a 5,700 $m^3$ pond within the first year.

DWER notes that these assumptions may be overly conservative. DWER notes the figures representing leachate volumes generated (Figure 12) provided by the Licence Holder in the application show that on 4 occasions over a 15 year period the pond is expected to overtop.

The leachate pond has been designed to capture a 1% AEP 72 hr rainfall event and is proposed to be operated with a 500 mm freeboard.

**The Delegated Officer has reviewed the information regarding the leachate ponds and notes the following for the purposes of the risk assessment:**

- Based on the information provided, the leachate pond as currently proposed does not appear to have sufficient capacity to contain the volumes of leachate expected to be generated during average yearly rainfall during operation of the pond, and the potential for overtopping of the pond has been considered in the assessment of risk.
- The Delegated Officer will assess risk associated with the construction and operation of the proposed leachate pond design as applied for. It is noted that,

should the Licence Holder wish to change the proposed design that a subsequent licence amendment application may be considered by DWER if supporting information is provided to describe all inputs and assumptions used for the basis for the design.

## 7.5 Stability assessment

The applicant undertook a stability analysis of the proposed and existing landfill batters which abut the proposed cell. Three potential failure mechanisms were assessed being;

- proposed cell global batter failure,
- failure of proposed cell water management/leachate systems and
- landfill batter failure (landfill connection liner between the proposed and existing cells).

Each of these three mechanisms were assessed for the following two leachate conditions;

- The proposed landfill cell is saturated;
- The proposed landfill cell has varying groundwater/leachate levels including consideration of leachate system failure

The first two failure mechanisms were analysed subject to circular slip failure using finite slope stability analysis software SLOPE/W. Failure surfaces were defined with entry and exit ranges to determine the location of the slip surface for circular slip failure model outcomes.

The model adopted in this assessment is shown in Figure 13. The model comprises a typical batter slope of 1V:5H with a maximum batter height of 24 m. The batter extends between RL 16 m AHD and RL 40 m AHD. The Licence Holder has stated that they have used this cross section to represent the worst-case scenario profile and batter height.

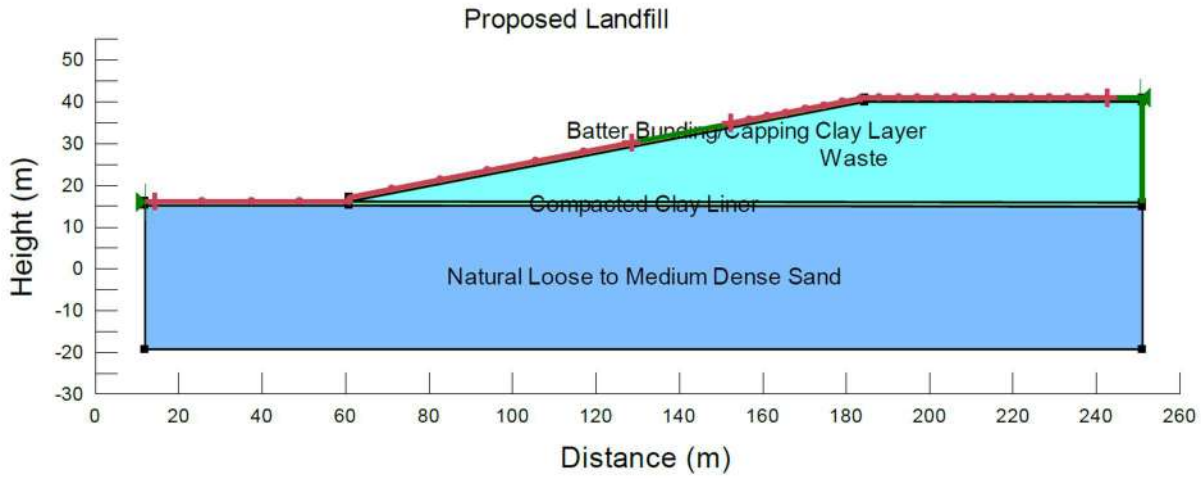



**Figure 13: Model adopted for the stability assessment**

The assessment considered that if failure were to occur it would be limited to the waste batter surfaces. Material parameters adopted for the slope stability assessment are shown in Figure 14. The Licence Holder has advised that these parameters are sourced from on-site geological reports, bore logs from groundwater monitoring bores and geological mapping. Earthquake PGA coefficient of 0.04 was adopted to represent seismic hazard.

| Material | Thickness (m) | Cohesion, c' (kPa) | Friction Angle, Φ' (°) | Unit Weight, γ' (kN/m³) |
|---|---|---|---|---|
| Waste | 24 | 0 | 18-24 | 10 |
| Batter Bunding/Capping Clay Layer | 0.3 | 5 | 27 | 15 |
| Compacted Clay Liner | 0.5 | 5 | 26 | 19 |
| Natural Loose to Medium Dense Sand (Subgrade Layer) | >20 | 0 | 30 | 18 |

**Figure 14: Material parameters adopted for the slope stability assessment**

The first leachate scenario (unsaturated) was assessed as the worst-case scenario under common conditions. Parameters for this model were a design waste friction angle of 21°, groundwater/leachate level 1 m below the toe, 0.3 m thick batter bunding/capping clay later and 0.5 m thick clay liner base. The results are shown in Figure 15.

| Analysis Area | Analysis Condition | Long Term Factor of Safety (FOS) Achieved | Required Long Term FOS Under Common Conditions |
|---|---|---|---|
| Typical Operating Conditions | 24m high, 1V:5H waste slope geometry with Leachate at RL 15m AHD | 2.02 (Figure 1) | 1.50 |
| | 24m high, 1V:5H waste slope geometry with Leachate at RL 15m AHD with PGA = 0.04 | 1.66 (Figure 2) | 1.00 |

**Figure 15: First leachate scenario factors of safety**

Leachate scenario two is used to assess the sensitivity of the batter condition by changing the friction angles and groundwater/leachate conditions including possible failure of the leachate system. Parameters and conditions used for this modelling were design friction angle between 18° to 24°, groundwater/leachate at RL 17 m AHD, RL 22 m AHD and rapid drawdown, 0.3 thick batter bunding/capping layer and 0.5 m thick clay liner at the base. The results are shown in Figure 16.

| Long Term Factor of Safety (FOS) Achieved | | | | Required Long Term FOS Under Common Conditions |
|---|---|---|---|---|
| Friction Angle (Φ') for Waste | Groundwater/Leachate Level | | | |
| | 17m AHD | 22m AHD | Rapid Drawdown | |
| 18 | 1.73 (Figure 2) | 1.30 (Figure 3) | 1.31 (Figure 4) | 1.30/1.50 |
| 20 | 1.93 (Figure 5) | 1.45 (Figure 6) | 1.46 (Figure 7) | |
| 22 | 2.14 (Figure 8) | 1.61 (Figure 9) | 1.62 (Figure 10) | |
| 24 | 2.35 (Figure 11) | 1.77 (Figure 12) | 1.79 (Figure 13) | |

**Figure 16: Second leachate scenario factors of safety**

The results indicate that the waste batter stability is sensitive to groundwater/leachate levels, however the applicant has stated that these conditions are unlikely to be present under normal operational scenarios as there is proposed to be a groundwater/leachate management system at the toe of the waste batter.

The same parameters were then assessed for earthquake conditions, using a PGA of 0.04. The results are shown in Figure 17.

| Long Term Factor of Safety (FOS) Achieved | | | | Required Long Term FOS Under Common Operating Conditions |
|---|---|---|---|---|
| Friction Angle (Φ') for Waste | Groundwater/Leachate Level | | | |
| | 17m AHD | 22m AHD | Rapid Drawdown | |
| 18 | 1.43 (Figure 15) | 1.06 (Figure 16) | 1.07 (Figure 17) | >1.00 |
| 20 | 1.59 (Figure 18) | 1.18 (Figure 19) | 1.20 (Figure 20) | |
| 22 | 1.76 (Figure 21) | 1.31 (Figure 22) | 1.33 (Figure 23) | |
| 24 | 1.93 (Figure 24) | 1.44 (Figure 25) | 1.46 (Figure 26) | |

**Figure 17: Earthquake parameters long term factor of safety**

Again, the waste batter stability appears to be sensitive groundwater/leachate levels, however the applicant has stated that these conditions are unlikely to be present on site due to the proposed infrastructure.

Liquification has not been considered in the assessment as it is not considered to be relevant due to the nature of the waste mass. Additionally, it was considered that a short term factor of safety more than or equal to 1.30 for local cell stability during construction is easily demonstrated with a slope geometry of 5H:1V.

The third failure mechanism was evaluated based on local batter stability and tensile capacity of the connection liner. The analysis undertaken by the Licence Holder demonstrates a geogrid with a tensile capacity of at least 117.71 kN/m is required to be incorporated into the landfill connection liner system. The product Secugrid 120/120 Q6 geogrid (or equivalent) which has a tensile strength of 120 kN/m is proposed. The Licence Holder acknowledges that the geogrid is essential to the performance of the landfill liner connection system.

The Licence Holder commissioned their own independent technical review which supported the use of a geogrid in the landfill connection liner. While the scope of the BHRC commissioned review considered the design basis for the proposed infrastructure and made comment on aspects that would promote or enhance stability, it did not provide any direct comment regarding the stability model outcomes for the proposed cells or assess the appropriateness of any stability calculations, inputs or assumptions.

DWER engaged an independent geotechnical consultant to review the landfill design basis and stability assessment. The independent consultant was provided with copies of the application documents. Raw data for the stability model was requested from the applicant and was not provided.

The independent review identified some aspects of the assessment that were considered to potentially impact stability outcomes predicted by the model, however as raw input data was not provided the consultant was unable to undertake a model analysis to validate any assumption or model outcomes. Items of note in the independent review, that will be considered in the assessment of risk events related to liner integrity are described in the key findings box below.

The independent consultant determined that based on the information available in the application, the sub-base and liner details are generally considered acceptable and are unlikely to pose a risk to the stability of the design. The independent consultant was not able to verify the assumptions made regarding the determination of critical failure surface given that the model outcomes (determined Factors of Safety) may be decided by the entry and exit ranges. DWER considers that, should the critical failure surface extend through the basal liner, and an unrestrained model outcome give a lower factor of safety outcome, that failure of the basal liner may result in a failure of leachate conveyance infrastructure function, and potentially unacceptable strain on geotextiles in the basal liner. It is noted that a depressurization system is included within the liner design (section 7.1.1) and upon failure of the basal liner, it may give an indication of malfunction or failure occurring, but is unlikely to provide any additional control of leachate migration in event of a breach of the liner system.

**The Delegated Officer has reviewed the information regarding the stability assessment and notes the following for the purposes of the risk assessment:**

- The landfill design meets the minimum factors of safety as presented in the application, it is noted that the Delegated Office considers that the minimum factors of safety provided by the application are not chosen as the most conservative values, for landfills of similar design sited in the southwest of Western Australia.
- As raw data was not provided, DWER was unable to replicate or verify all assumptions made in the generation of stability model outcomes. The Delegated Officer considers that, for the purposes of risk assessment, a degree of uncertainty is present in the outcomes related to the determination of the critical failure surface outside of the entry and exit ranges defined within the model. On this basis, a more conservative outcome has been adopted for the assessment of risks related to basal liner integrity.
- The Delegated Officer considers that the effectiveness of the liner infrastructure is dependent on construction methods and CQA outcomes, particularly due to the

piggyback design and settlement of the exiting waste mass. Any repairs, alterations or variations to the infrastructure or existing waste mass during construction has potential to change the risk outcomes during operation, both positively or negatively.

- DWER will defer assessment of risks associated with the operation of the cells based on construction of all infrastructure completed as described with no defects. On this basis, operation of the cell 2/3 will not be included as part of this amendment. Following construction and submission of compliance construction certificates DWER will review the operational risk assessment to determine operational controls

## 7.6 Capping system

The Licence Holder has proposed a final capping layer to consist of a gas collection layer, 1.5 mm LLDPE liner, Geonet and 1200 mm of subsoils with a topsoil/compost mix. Figure 18 depicts this capping system.

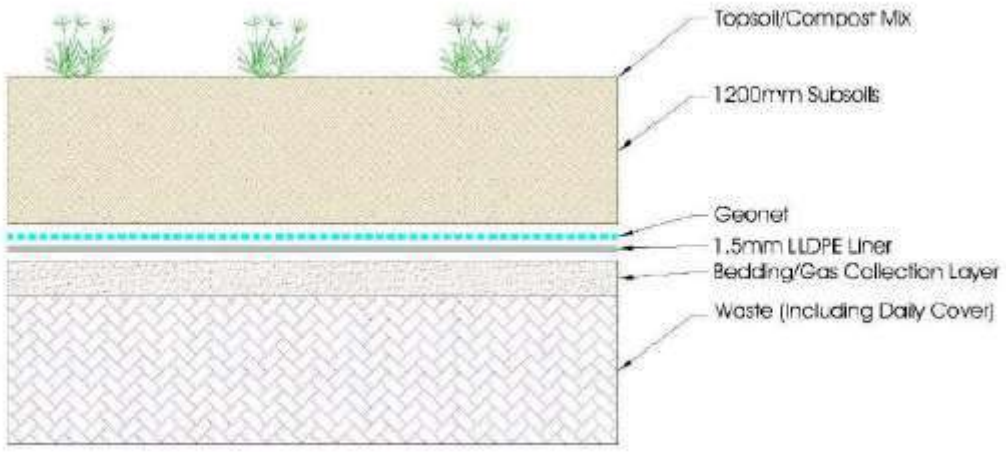



**Figure 18: Proposed final capping layer**

The Licence Holder has provided a Landfill Closure Management Plan with the amendment application (*Landfill Closure Management Plan, Stanley Road Waste Management Facility, ASK Waste Management Consultancy Services, Jan 2019*), however this document only refers to the proposed cell 2/3 in general details and does not contain the above proposed capping system.

## 7.7 Landfill gas infrastructure

The Licence Holder has estimated that methane gas generation would peak at 2,164 tonnes per annum after the last modelled year of operation (2037). Based on this calculation the Licence Holder has determined that a gas collection system is required.

The proposed cells 2/3 will be designed to allow capture of landfill gas in the initial stages of landfilling. Collection lines will be connected to the upstream section of the leachate collection pipe on the liner floor which will connect to the existing system located on the top of the existing waste mass. Ongoing gas collection in the proposed cell would be provided by the final capping configuration as shown in Figure 18.

The landfill gas system consists of an active system with gas extraction wells placed within the waste mass. This network will comprise of either horizontal collectors or vertical bores, or a combination of both, and this will be determined as the landfilling progresses. The system will operate under a small vacuum that promotes gas flow from the waste mass towards the gas

extraction wells, which would then be recovered through a series of headers exposed either at the landfill or batter surfaces.

A drop-in temperature associated with extracting gas from a landfill produces condensate. Condensate traps would be installed to allow for the capture and temporary storage of the condensate. Following collection and temporary storage, the condensate would be disposed of in the same way as leachate.

An enclosed landfill gas thermal combustor (flare) will continue to be used to dispose of the landfill gas.

# 8. Facility operations and management

No changes have been proposed to the current waste acceptance or general site operations, waste covering or fire management procedures.

The Licence Holder proposes to maintain all current environmental monitoring and sampling that occurs at the Premises in line with the current licence. Table 8 summarises these sampling parameters.

**Table 8: Summary of proposed environmental monitoring and sampling**

| Environmental aspect | Location | Frequency | Parameters |
|---|---|---|---|
| Landfill gas | Perimeter monitoring wells and in-cell aspiration wells | Monthly for 6 months following installation; then every 2 months for 6 months; then biannually for 29 years; then annually for 20 years. | Volumetric flow rate, methane, carbon dioxide, oxygen. |
| Surface water | Ponds 1 and 2. | Two sampling events between the months of June and September separated by at least 30 days. | pH, Electrical conductivity, Metals, Nutrients, Cations and anions, Total Soluble solids, total organic carbon and chemical oxygen demand. |
| Groundwater | Groundwater monitoring wells as described in Schedule 1 of the Licence | Quarterly | Standing water level, pH, electrical conductivity, redox potential, chemical oxygen demand, nitrate-nitrogen, ammonia-nitrogen, total nitrogen, total phosphorus, total dissolved solids, total organic carbon, dissolved oxygen, dissolved methane, major cations and anions, heavy metals. |
| | | Annually | Organics: Phenols, Polyaromatic hydrocarbons (PAH), Organochlorine pesticides, Organophosphate pesticides, polychlorinated biphenyls (PCB), Atrazine, BTEX, Total Petroleum Hydrocarbons and Trichlorethylene/Perchlorethylene |

# 9. Risk assessment

## 9.1 Determination of emission, pathway and receptor

In undertaking its risk assessment, DWER will identify all potential emissions pathways and potential receptors to establish whether there is a Risk Event which requires detailed risk assessment. Risk Events during operation have been assessed as part of this decision report, however final determination of risks during operation will be assessed during an amendment application to operate the facility.

To establish a Risk Event there must be an emission, a receptor which may be exposed to that emission through an identified actual or likely pathway, and a potential adverse effect to the receptor from exposure to that emission. Where there is no actual or likely pathway and/or no receptor, the emission will be screened out and will not be considered as a Risk Event.

The identification of the sources, pathways and receptors to determine Risk Events are set out in Table 9 and Table 10 below.

**Table 9: Identification of emissions, pathway and receptors during construction**

| Risk Events | | | | | | Continue to detailed risk assessment | Reasoning |
|---|---|---|---|---|---|---|---|
| Sources/Activities | | Potential emissions | Potential receptors | Potential pathway | Potential adverse impacts | | |
| **Construction of landfill cell, leachate evaporation ponds, supporting infrastructure** | Vehicle movements, earthworks, placement of equipment and infrastructure. | Noise | Residents (535 m west south west and 800 m east) | Air / wind dispersion | Amenity and Health Impacts | Yes | See section 9.4 |
| | | | Industrial premises immediately adjacent west and south | | | | |
| | | | Users of Parks and Wildlife managed lands directly north | | | | |

| Risk Events | | | | | | Continue to detailed risk assessment | Reasoning |
|---|---|---|---|---|---|---|---|
| **Sources/Activities** | | **Potential emissions** | **Potential receptors** | **Potential pathway** | **Potential adverse impacts** | | |
| **Construction of landfill cell, leachate evaporation ponds, supporting infrastructure** | Vehicle movements, earthworks, placement of equipment and infrastructure. | Dust | Residents (535 m west south west and 800 m east) | Air / wind dispersion | Amenity and Health Impacts | Yes | See section 9.5 |
| | | | Industrial premises immediately adjacent west and south | | | | |
| | | | Users of Parks and Wildlife managed lands directly north | | | | |

**Table 10: Identification of emissions, pathway and receptors during operation**

| Risk Events | | | | | | Continue to detailed risk assessment | Reasoning |
|---|---|---|---|---|---|---|---|
| Sources/Activities | | Potential emissions | Potential receptors | Potential pathway | Potential adverse impacts | | |
| ***Operation of Cell 2/3*** | Acceptance, storage, sorting, burial and decomposition of wastes<br>Collection, storage and management of leachate<br>Ongoing management of premises | Noise | Residents (535 m west south west and 800 m east)<br>Industrial premises immediately adjacent west and south<br>Users of Parks and Wildlife managed lands directly north | Air / wind dispersion | Amenity and Health Impacts | Yes | See section 9.4 |
| | | Dust (excluding asbestos) | | | | Yes | See section 9.5 |
| | | Odour | | | | Yes | See section 0 |
| | | Asbestos | | | | Yes | See section 9.7 |

| Risk Events | | | | | | Continue to detailed risk assessment | Reasoning |
|---|---|---|---|---|---|---|---|
| Sources/Activities | | Potential emissions | Potential receptors | Potential pathway | Potential adverse impacts | | |
| ***Operation of Cell 2/3*** | Acceptance, storage, sorting, burial and decomposition of wastes<br>Collection, storage and management of leachate<br>Ongoing management of premises | Landfill leachates from damage to liners or overtopping of leachate pond | Groundwater dependant vegetation (Banksia Woodland) | Seepage through soil and migration through groundwater. | Contamination of groundwater.<br>Increasing contaminant plume already present on site. | Yes | See section 9.8 |
| | | | Beneficial Users of groundwater (bores) | Seepage through soil and migration through groundwater.<br>Abstraction of groundwater<br>Direct exposure via irrigation and/or spraying | Degradation to the beneficial use of groundwater.<br>Health impacts to groundwater users. | Yes | See section 9.8 |
| | | | PDWSA 14 km south west | Seepage through soil and migration through groundwater<br>Abstraction of groundwater<br>Direct exposure via drinking of water | Degradation to the beneficial use of groundwater.<br>Health impacts to groundwater users. | Yes | See section 9.8 |

| Risk Events | | | | | | Continue to detailed risk assessment | Reasoning |
|---|---|---|---|---|---|---|---|
| Sources/Activities | | Potential emissions | Potential receptors | Potential pathway | Potential adverse impacts | | |
| ***Operation of Cell 2/3*** | Acceptance, storage, sorting, burial and decomposition of wastes<br>Collection, storage and management of leachate<br>Ongoing management of premises | Landfill leachates from damage to liners or overtopping of leachate pond | Wellesley River 130 m south east | Overland flow<br>Seepage through soil and migration through groundwater | Contamination of waters or deterioration of local/regional surface water ecosystems | Yes | See section 9.8 |
| | | | Brunswick River 430 m south | Overland flow<br>Seepage through soil and migration through groundwater | Contamination of waters or deterioration of local/regional surface water ecosystems | Yes | See section 9.8 |
| | | | Collie River 5.5 km south west | Overland flow<br>Seepage through soil and migration through groundwater | Contamination of waters or deterioration of local/regional surface water ecosystems | Yes | See section 9.8 |
| | | | Leschenault Inlet 3 km west and management area 151 m south and 1.9 km west | Overland flow<br>Seepage through soil and migration through groundwater | Contamination of waters or deterioration of local/regional surface water ecosystems | Yes | See section 9.8 |

| Risk Events | | | | | | Continue to detailed risk assessment | Reasoning |
|---|---|---|---|---|---|---|---|
| Sources/Activities | | Potential emissions | Potential receptors | Potential pathway | Potential adverse impacts | | |
| ***Operation of Cell 2/3*** | Acceptance, storage, sorting, burial and decomposition of wastes<br>Collection, storage and management of leachate<br>Ongoing management of premises | Landfill leachates from damage to liners or overtopping of leachate pond | Geomorphic wetlands – multiple within the premises boundary and within 3 km of the Premises | Overland flow<br>Seepage through soil and migration through groundwater | Contamination of waters or deterioration of local/regional surface water ecosystems | Yes | See section 9.8 |
| | | | In situ and surrounding soils | Direct contact<br>Overland flow<br>Seepage through soil and migration through groundwater | Contamination of soil.<br>Degradation of terrestrial habitat. | Yes | See section 9.8 |
| | | | Parks and Wildlife Managed Land directly north | Overland flow<br>Seepage through soil and migration through groundwater | Degradation of terrestrial habitat. | Yes | See section 9.8 |
| | | | Threatened Ecological community buffers (Banksia Woodland) within and surrounding premises. | Overland flow<br>Seepage through soil and migration through groundwater | Degradation of terrestrial habitat | Yes | See section 9.8 |

| Risk Events | | | | | | Continue to detailed risk assessment | Reasoning |
|---|---|---|---|---|---|---|---|
| Sources/Activities | | Potential emissions | Potential receptors | Potential pathway | Potential adverse impacts | | |
| ***Operation of Cell 2/3*** | Acceptance, storage, sorting, burial and decomposition of wastes<br>Collection, storage and management of leachate<br>Ongoing management of premises | Landfill gas from the breakdown of putrescible wastes | Residents (535 m west south west and 800 m east)<br>Industrial premises immediately adjacent west and south<br>Users of Parks and Wildlife managed lands directly north | Lateral migration through soil<br>Movement through groundwater<br>Passive venting through air | Health impacts including asphyxia<br>Amenity impacts<br>Explosion risk | Yes | See section 9.9 |
| | | Vermin/ pests and pathogens | Residents (535 m west south west and 800 m east)<br>Industrial premises immediately adjacent west and south<br>Users of Parks and Wildlife managed lands directly north | Direct contact | amenity and health impacts | Yes | See section 9.10 |
| | | Windblown waste/litter | Residents (535 m west south west and 800 m east)<br>Industrial premises immediately adjacent west and south<br>Users of Parks and Wildlife managed lands directly north | Air/wind dispersion and direct contact | amenity impacts | Yes | See section 0 |

| Risk Events | | | | | | Continue to detailed risk assessment | Reasoning |
|---|---|---|---|---|---|---|---|
| Sources/Activities | | Potential emissions | Potential receptors | Potential pathway | Potential adverse impacts | | |
| ***Operation of Cell 2/3*** | Acceptance, storage, sorting, burial and decomposition of wastes<br>Collection, storage and management of leachate<br>Ongoing management of premises | Fire (smoke) | Residents (535m west south west and 800m east)<br>Industrial premises immediately adjacent west and south<br>Users of Parks and Wildlife managed lands directly north | Residents (535m west south west and 800m east)<br>Industrial premises immediately adjacent west and south<br>Users of Parks and Wildlife managed lands directly north | Air / wind dispersion | Amenity and Health Impacts | See section 0 |

## 9.2 Consequence and likelihood of risk events

A risk rating will be determined for risk events in accordance with the risk rating matrix set out in Table 14 below.

**Table 11: Risk rating matrix**

| Likelihood | Consequence | | | | |
|---|---|---|---|---|---|
| | Slight | Minor | Moderate | Major | Severe |
| Almost certain | Medium | High | High | Extreme | Extreme |
| Likely | Medium | Medium | High | High | Extreme |
| Possible | Low | Medium | Medium | High | Extreme |
| Unlikely | Low | Medium | Medium | Medium | High |
| Rare | Low | Low | Medium | Medium | High |

DWER will undertake an assessment of the consequence and likelihood of the Risk Event in accordance with Table 15 below.

**Table 12: Risk criteria table**

| Likelihood | | Consequence | | |
|---|---|---|---|---|
| The following criteria has been used to determine the likelihood of the Risk Event occurring. | | The following criteria has been used to determine the consequences of a Risk Event occurring: | | |
| | | | Environment | Public health* and amenity (such as air and water quality, noise, and odour) |
| Almost Certain | The risk event is expected to occur in most circumstances | Severe | • **onsite impacts**: catastrophic<br>• **offsite impacts local scale**: high level or above<br>• **offsite impacts wider scale:** mid-level or above<br>• Mid to long-term or permanent impact to an area of high conservation value or special significance^<br>• Specific Consequence Criteria (for environment) are significantly exceeded | • Loss of life<br>• **Adverse health effects:** high level or ongoing medical treatment<br>• Specific Consequence Criteria (for public health) are significantly exceeded<br>• **Local scale impacts:** permanent loss of amenity |
| Likely | The risk event will probably occur in most circumstances | Major | • **onsite impacts**: high level<br>• **offsite impacts local scale**: mid-level<br>• **offsite impacts wider scale**: low level<br>• Short-term impact to an area of high conservation value or special significance^<br>• Specific Consequence Criteria (for environment) are exceeded | • **Adverse health effects:** mid-level or frequent medical treatment<br>• Specific Consequence Criteria (for public health) are exceeded<br>• **Local scale impacts**: high level impact to amenity |
| Possible | The risk event could occur at some time | Moderate | • **onsite impacts**: mid-level<br>• **offsite impacts local scale**: low level<br>• **offsite impacts wider scale**: minimal<br>• Specific Consequence Criteria (for environment) are at risk of not being met | • **Adverse health effects:** low level or occasional medical treatment<br>• Specific Consequence Criteria (for public health) are at risk of not being met<br>• **Local scale impacts:** mid-level impact to amenity |
| Unlikely | The risk event will probably not occur in most circumstances | Minor | • **onsite impacts**: low level<br>• **offsite impacts local scale**: minimal<br>• **offsite impacts wider scale**: not detectable<br>• Specific Consequence Criteria (for environment) likely to be met | • Specific Consequence Criteria (for public health) are likely to be met<br>• **Local scale impacts:** low level impact to amenity |
| Rare | The risk event may only occur in exceptional circumstances | Slight | • **onsite impact**: minimal<br>• Specific Consequence Criteria (for environment) met | • **Local scale**: minimal to amenity<br>• Specific Consequence Criteria (for public health) met |

^ Determination of areas of high conservation value or special significance should be informed by the *Guidance Statement: Environmental Siting.*

* In applying public health criteria, DWER may have regard to the Department of Health's *Health Risk Assessment (Scoping) Guidelines.*
"onsite" means within the Prescribed Premises boundary.

## 9.3 Acceptability and treatment of Risk Event

DWER will determine the acceptability and treatment of Risk Events in accordance with the Risk treatment table 16 below:

**Table 13: Risk treatment table**

| Rating of Risk Event | Acceptability | Treatment |
|---|---|---|
| **Extreme** | Unacceptable. | Risk Event will not be tolerated. DWER may refuse application. |
| **High** | May be acceptable.<br>Subject to multiple regulatory controls. | Risk Event may be tolerated and may be subject to multiple regulatory controls. This may include both outcome-based and management conditions. |
| **Medium** | Acceptable, generally subject to regulatory controls. | Risk Event is tolerable and is likely to be subject to some regulatory controls. A preference for outcome-based conditions where practical and appropriate will be applied. |
| **Low** | Acceptable, generally not controlled. | Risk Event is acceptable and will generally not be subject to regulatory controls. |

## 9.4 Risk assessment – noise impacts

### 9.4.1 Hazard characterisation and impact

During construction, noise emissions may occur from vehicle movement, excavation of soil, placement of the liner and general earthworks. Construction is expected to be limited to a period of 12 months.

Once operating, noise emissions will be similar to current operations and may occur from vehicle movement, placement and compaction of waste. The facility operates 8 am to 5 pm, 7 days per week excluding Christmas day, New Year's Day and Good Friday.

Noise emissions may cause amenity and health impacts. The industrial premises directly adjacent to the premises is considered to be most affected by potential noise emissions. It is noted that during longer term operations, residential receptors are more likely to lodge complaints related to amenity impacts.

### 9.4.2 Criteria for assessment

The criteria for the assessment of noise emissions is the *Environmental Protection (Noise) Regulations 1997* (Noise Regulations) and the premises activities will be subject to these regulations.

### 9.4.3 Licence Holder controls

The current licence contains controls to manage noise emissions including limiting where waste processing can occur. The Licence Holder has not proposed any specific noise controls during construction.

This amendment application does not propose any changes to these control measures.

### 9.4.4 Consequence

***Construction***

Based upon the sensitivity of the most affected receptor (adjacent industrial premises) the Delegated Officer has determined that the impact of noise emissions during construction will be minimal impacts to amenity. Therefore, the Delegated Officer considers the consequence to be **Slight**.

***Operation***

Based upon the sensitivity of the most affected receptors (adjacent industrial premises and residential areas) the Delegated Officer has determined that the impact of noise emissions during operation will be minimal impacts to amenity. Therefore, the Delegated Officer considers the consequence to be **Slight**.

### 9.4.5 Likelihood of Risk Event

**Construction**

Based upon the Licence Holder's controls and the duration of construction activity the Delegated Officer has determined that the likelihood of slight noise impacts during construction could occur at some time. Therefore, the Delegated Officer considers the consequence to be **Possible**.

**Operation**

Based upon the Licence Holder's controls and current operations the Delegated Officer has determined that slight noise impacts during operation could occur at some time and are not likely to differ from current operations. Therefore, the Delegated Officer considers the consequence to be **Possible**.

### 9.4.6 Overall rating

***Construction***

The Delegated Officer has compared the consequence and likelihood rating described above for the Risk Criteria and determined that the overall rating for the risk of noise impacts on receptors during construction is **Low**.

***Operation***

The Delegated Officer has compared the consequence and likelihood rating described above for the Risk Criteria and determined that the overall rating for the risk of noise impacts on receptors during operations is **Low**.

### 9.4.7 Acceptability of Risk Event

As per DWER's acceptability and treatment of Risk Events the Delegated Officer has determined that the Risk Event is acceptable and will generally not be subject to regulatory controls.

### 9.4.8 Regulatory controls for noise emissions

The Delegated Officer considers that the current licence conditions are sufficient in managing potential noise emissions during both construction and operation. No additional conditions related to noise will be added as part of this amendment to permit construction, and no additional conditions related to noise are likely to be added as part of a future amendment to permit operation.

## 9.5 Risk assessment – dust impacts

### 9.5.1 Hazard characterisation and impact

Dust may be generated during construction activities from vehicle movement on unsealed access roads, earthworks and stockpiling of material. Construction is expected to be limited to a 12 month period. Sources of dust during operation include vehicle movement, placement and compaction of waste.

Dust may cause reduced local air quality and nuisance impacts and may also cause public health impacts if particulate matter is inhaled. Wind direction and strength may impact the intensity and direction of dust impacts. The industrial premises directly adjacent to the premises are considered to be most affected by potential dust emissions.

### 9.5.2 Criteria for assessment

The relevant criteria for assessment of dust emissions as $PM_{10}$ is 50 µg/$m^3$ over 24 hours as specified in the *National Environment Protection (Ambient Air Quality) Measure* (NEPM). The NEPM is the relevant criteria for assessment in relation to human health and wellbeing.

Amenity impacts can also be assessed against the general provisions of the EP Act, specifically whether fugitive dust unreasonable interferes with the health, welfare, convenience, or comfort of any person.

### 9.5.3 Licence Holder controls

The current licence contains a number of controls to minimise the likelihood of dust emissions during operations, including capping, daily cover, processing and compaction requirements.

This amendment application does not propose any changes to these control measures.

The Licence Holder has indicated that during construction water trucks will be used to minimise dust emissions.

### 9.5.4 Consequence

***Construction***

Based upon the sensitivity of the most affected receptor (adjacent industrial premises) the Delegated Officer has determined that the impact of dust emissions during construction will be minimal impacts to amenity. Therefore, the Delegated Officer considers the consequence to be **Slight.**

***Operation***

Based upon the sensitivity of the most affected receptor (adjacent industrial premises) the Delegated Officer has determined that the impact of dust emissions during operation will be minimal impacts to amenity. Therefore, the Delegated Officer considers the consequence to be **Slight.**

### 9.5.5 Likelihood of Risk Event

**Construction**

Based upon the Licence Holder's controls and the duration of construction activity the Delegated Officer has determined that the likelihood of slight dust impacts during construction could occur at some time. Therefore, the Delegated Officer considers the consequence to be **Possible.**

**Operation**

Based upon the Licence Holder's controls and current operations the Delegated Officer has determined that slight dust impacts during operation could occur at some time. Therefore, the Delegated Officer considers the consequence to be **Possible.**

### 9.5.6 Overall rating

***Construction***

The Delegated Officer has compared the consequence and likelihood rating described above for the Risk Criteria and determined that the overall rating for the risk of dust impacts on receptors during construction is **Low.**

***Operation***

The Delegated Officer has compared the consequence and likelihood rating described above for the Risk Criteria and determined that the overall rating for the risk of dust impacts on receptors during operations is **Low.**

### 9.5.7 Acceptability of Risk Event

As per DWER's acceptability and treatment of Risk Events the Delegated Officer has determined that the Risk Event is acceptable and will generally not be subject to regulatory controls

### 9.5.8 Regulatory controls for dust emissions

The Delegated Officer considers that the current licence conditions are sufficient in managing potential dust emissions during both construction and operation. No additional conditions related to dust will be added as part of this amendment to permit construction, and no additional conditions related to dust are likely to be added as part of a future amendment to permit operation.

## 9.6 Risk assessment – odour impacts

### 9.6.1 Hazard characterisation and impact

Odour may be generated during operation of the landfill due to the movement and decomposition of putrescible waste.

Individual responses to odour emissions may vary depending on age, health status, sensitivity and odour exposure patterns. Perceived odour intensity may increase or decrease on exposure. Exposure times and frequency of odour emissions depend on day to day activities and weather conditions including wind direction. Odour emissions may cause health and amenity impacts.

Prevailing wind conditions suggest that odour will most likely be carried to the west in the mornings and to the east in the afternoons.

The industrial premises directly adjacent to the premises are considered to be most affected by potential odour emissions. It is noted that during longer term operations, residential receptors are more likely to lodge complaints related to amenity impacts.

### 9.6.2 Criteria for assessment

There are no specific criteria for the assessment of odour emissions. The general provisions of the EP Act make it an offence to cause or allow unreasonable emissions that unreasonably interfere with the health, welfare, convenience, comfort or amenity of any person.

### 9.6.3 Licence Holder controls

The current licence contains a number of controls to minimise the likelihood of odour emissions including capping, daily cover, processing and compaction requirements.

This amendment application does not propose any changes to these control measures.

### 9.6.4 Consequence

Based upon the sensitivity of the most affected receptor (adjacent industrial premises and residential areas) the Delegated Officer has determined that the impact of odour emissions during operation will be minimal impacts to amenity. Therefore, the Delegated Officer considers the consequence to be **Slight**.

### 9.6.5 Likelihood of Risk Event

Based upon the Licence Holder's controls and current operations the Delegated Officer has determined that slight odour impacts during operation could occur at some time and are not likely to differ from current operations. Therefore, the Delegated Officer considers the consequence to be **Possible**.

### 9.6.6 Overall rating

The Delegated Officer has compared the consequence and likelihood rating described above for the Risk Criteria and determined that the overall rating for the risk of odour impacts on receptors during operations is **Low**.

### 9.6.7 Acceptability of Risk Event

As per DWER's acceptability and treatment of Risk Events the Delegated Officer has determined that the Risk Event is acceptable and will generally not be subject to regulatory controls

### 9.6.8 Regulatory controls for odour emissions

The Delegated Officer considers that the current licence conditions are sufficient in managing potential odour emissions during operations, and no additional conditions related to odour are likely to be added as part of a future amendment to permit operation.

## 9.7 Risk assessment – asbestos impacts

### 9.7.1 Hazard characterisation and impact

During operation the premises may accept and bury asbestos materials (limited to cement products). There is also potential for asbestos or asbestos contaminated material to be present as non-conforming waste within waste delivered to the Premises.

Asbestos poses a significant health risk and may cause mesothelioma or other health impacts.

The industrial premises directly adjacent to the premises are considered to be most affected by potential asbestos emissions.

### 9.7.2 Criteria for assessment

The Department of Health *Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia (May 2009)* specify criteria for assessment of asbestos emissions.

Asbestos impacts can also be assessed against the general provisions of the EP Act, specifically whether fugitive dust unreasonable interferes with the health, welfare,

convenience, or comfort of any person.

### 9.7.3 Licence Holder controls

The current licence contains controls to limit the types of asbestos containing waste that can be received, and requires actions to be taking in the event of any non-conforming wastes identified.

This amendment application does not propose any changes to these control measures.

### 9.7.4 Consequence

Based upon the sensitivity of the most affected receptor (adjacent industrial premises) the Delegated Officer has determined that the impact of asbestos emissions during operation could be up to loss of life. Therefore, the Delegated Officer considers the consequence to be **Severe**.

### 9.7.5 Likelihood of Risk Event

Based upon the Licence Holder's controls and current operations the Delegated Officer has determined that severe impacts during operation may only occur in exceptional circumstances. Therefore, the Delegated Officer considers the consequence to be **Rare**.

### 9.7.6 Overall rating

The Delegated Officer has compared the consequence and likelihood rating described above for the Risk Criteria and determined that the overall rating for the risk of asbestos impacts on receptors during operations is **High**.

### 9.7.7 Acceptability of Risk Event

As per DWER's acceptability and treatment of Risk Events the Delegated Officer has determined that the Risk Event may be tolerated and may be subject to multiple regulatory controls.

### 9.7.8 Regulatory controls for asbestos emissions

The Delegated Officer considers that the current licence conditions are sufficient in managing potential asbestos emissions during operations, and no additional conditions related to asbestos are likely to be added as part of a future amendment to permit operation.

## 9.8 Risk assessment – leachate impacts

### 9.8.1 Hazard characterisation and impact

Leachate seepage to groundwater from landfilling operations may arise if defects occur during placement and/or over time in the liner or leachate management system, including leachate storage ponds. Defects may occur due to manufacturing faults, poor installation, failure to conduct adequate CQA checks and instability of subbase or internal waste. Landfill liner systems cannot be made completely impermeable and all liners will therefore experience a certain level of leachate seepage over time. Adequate capping of a landfill cell at closure is required to reduce ingress of stormwater and reduce the potential for leachate generation over the long term. Overtopping of the leachate pond due to inadequate design capacity or higher than average rainfall, may also result in leachate emissions directly to land.

Landfill leachate from a putrescible landfill mainly consists of dissolved organic matter and inorganic compounds such as sulphates, chlorides and ammonium salts. Leachate may also contain heavy metals including lead, nickel and copper, hydrocarbons and synthetic organic

compounds. Leachate generated from the facility is also likely to have a high biochemical oxygen demand.

Emissions of leachate to land onsite may result in subsequent seepage to groundwater or overland flow to adjacent lands and waterways. The soil at the premises is sandy which is considered likely to allow leachate seepage to move through the soil profile to reach groundwater located approximately 3 m below ground level. This may result in contamination of the soils and may impact groundwater quality. The groundwater in the area is likely to be used for potable, non-potable and irrigation purposes as well as potentially discharging to surface water bodies. Non-potable uses are likely to include groundwater abstracted for dust suppression in the adjacent industrial premises. As the Premises is already considered to be contaminated, any emissions of leachate from the new proposed cell would exacerbate impacts from the existing contaminant plume.

There are multiple potential receptors present. Groundwater is considered to be a pathway to the identified receptors. For the purposes of this assessment, the shallow aquifer directly below the premises is considered to be the most affected receptor due to its beneficial value and the pathway groundwater provides to other groundwater receptors (groundwater users and terrestrial ecosystems).

As discussed in section 4.3 the Premises is already contaminated from the previous unlined landfill cells. It is noted that any leachate impacts from the proposed lined cell will be in considered as a separate contamination event and will not be assessed in relation to any impact associated with the existing plume.

### 9.8.2 Criteria for assessment

Groundwater in the area is likely used for potable uses. Therefore, the *National Health and Medical Research Council & National Resource Management Ministerial Council Australian Drinking Water Guidelines 6, 2011 (as amended),* (ADWG) are considered the appropriate criteria for assessing impacts to groundwater.

Other guidelines which are considered appropriate for the known and potential beneficial uses of groundwater in the vicinity of the premises include *Contaminated Sites Ground and Surface Water Chemical Screening Guidelines, Department of Health* (DOH 2014) for non-potable uses, *Long Term Irrigation Water ANZECC & ARMCANZ (2000)* for irrigation and *Australian Water Quality Guidelines for Fresh and Marine Water Quality ANZECC & ARMCANZ (2000)* for slightly–moderately disturbed ecosystems (95% protection level trigger values) for freshwater ecosystems and surface water quality.

### 9.8.3 Licence Holder controls

The Licence Holder's proposed controls to minimise the potential for leachate impacts include:

- Construction of an engineered liner and leachate collection system including a depressurization system;
- Directing clean stormwater away from the active landfill area;
- Regular compaction and covering of the landfilled waste;
- Only operating one active landfill face;
- Groundwater and surface water monitoring; and
- Final capping.

DWER notes that limited information is provided in the application relating to management of the leachate pond freeboard.

### 9.8.4 Key findings

**The Delegated Officer has reviewed the information regarding leachate emissions and notes the following for the purposes of the risk assessment:**

- Due to the uncertainty provided by the assessment of landfills stability model outcomes (section 7.5). DWER will consider a conservative assessment regarding the likelihood of leachate emissions occurring.
- In order to distinguish between old and new sources of any groundwater contamination, additional bores would need to be installed to provide up-gradient and down-gradient measurements for the cells. However, doing so may cause health and safety or environmental risks due to the location of these bores needing to be in areas that would disturb landfilled material or may ignite landfill gas. Therefore, the primary method for detecting a liner breach is testing the drainage layer within the groundwater depressurisation system beneath the cell floor.
- As a contaminant plume is already present at the Premises, any additional leachate emissions must be considered in addition to this plume. DWER consider that due to the existence of the current contamination plume, groundwater monitoring may not detect any breach of the cell liner in the short to medium term.
- DWER assessment of the leachate pond indicate that the storage capacity may be insufficient to provide for cumulative volumes of leachate over a number of years.
- Limited information has been provided to date in relation to managing the leachate pond freeboard.
- The Landfill Closure Plan provided in the application does not provide detail on the final capping design for cells 2/3 including how leachate generation rates in a post-operational environment will be controlled by the intended capping design.

### 9.8.5 Consequence

Based upon the proximity of receptors beneficial use of groundwater particularly as a drinking water source and the existing contamination plume the Delegated Officer has determined that the impact of leachate emissions to groundwater would be high level on-site impacts, with specific consequence criteria being exceeded as demonstrated by current groundwater impacts. Therefore, the Delegated Officer considers the consequence to be **Major**.

### 9.8.6 Likelihood of Risk Event

Based upon the Licence Holder's proposal for an engineered lined cell the Delegated Officer has determined that major impacts during operation of the landfill cell could occur at some time. Therefore, the Delegated Officer considers the consequence to be **Possible**.

This rating has been determined on the basis of uncertainties related to potential failure of containment system, and that based on the current design, the leachate pond could overtop in a high-rainfall scenario during operations if appropriate management measures are not implemented.

### 9.8.7 Overall rating

The Delegated Officer has compared the consequence and likelihood rating described above for the Risk Criteria and determined that the overall rating for the risk of leachate impacts on receptors during operations is **High**.

### 9.8.8 Acceptability of Risk Event

As per DWER's acceptability and treatment of Risk Events a High Risk Event may be tolerated and may be subject to multiple regulatory controls.

The Delegated Officer notes that the High Risk rating is predominately a result of the likelihood of the leachate pond overtopping and the potential for the function of the liner system to be compromised. The Delegated Officer considers that these risks may be appropriately managed through stringent regulatory controls relating to CQA requirements and control of operation of the leachate pond to require a freeboard to be maintained at all times.

The Delegated Officer considers that for the purpose of an operational risk assessment of the proposed activity, the Risk Event will be tolerated. Any additional information or proposed redesign of the leachate pond provided by the Licence Holder prior to or with submission of the final construction compliance documentation may alter a future operational risk assessment of the Premises.

### 9.8.9 Regulatory controls for leachate emissions

The following controls will be implemented as part of this amendment to permit construction of the proposed landfill cell and associated infrastructure. These controls are considered necessary to specify the infrastructure to be constructed and the specifications to be met during construction.

- Infrastructure controls including construction, testing and maintenance of liners for cell 2/3 and the leachate pond;
- Infrastructure controls for the construction and maintenance of the leachate collection system and groundwater monitoring systems;

Any future amendment to permit the operation of the landfill cell is likely to contain the following controls to manage the potential impacts from leachate emissions:

- Maintenance of surface water diversion and control structures;
- The leachate pond shall not be allowed to overtop during operations;
- Maintenance of a freeboard on the leachate pond;
- Maintenance of equipment on site capable of pumping out the leachate pond in the event of significant rainfall, and storage of leachate waste prior to removal offsite.
- Undertake groundwater and surface water monitoring during operations.
- The Licence Holder will also be required to submit an updated Landfill Closure Plan outlining how leachate emissions will be controlled in closure of the landfill infrastructure.

## 9.9 Risk assessment – landfill gas impacts

### 9.9.1 Hazard characterisation and impact

Landfill gases are generated through the decomposition of waste within the landfill cell. Landfill gas typically comprises of methane, carbon dioxide, nitrogen, oxygen, hydrogen and many trace gases such as hydrogen sulphide, carbon monoxide, halogenated organics and aromatic hydrocarbons.

Landfill gas can migrate through soil, move through groundwater or passively vent to air and cause amenity impacts to nearby receptors due to odour. Landfill gas in large quantities can also cause adverse health impacts such as asphyxia, or when confined may create an explosion risk. The design of landfill cell capping systems should include consideration of landfill gas generation rates and adequate controls for capture and management of landfill gas

in a post-operational environment.

The proposal is located to the western boundary of the premises which is adjacent to a commercial property with enclosed buildings. This property is subject to planning conditions that require mitigation measures for any additional buildings. Therefore, the Delegated Officer considers that the adjacent industrial property is the nearest affected receptor.

### 9.9.2 Criteria for assessment

There are no specific criteria for the assessment of landfill gas emissions. The general provisions of the EP Act make it an offence to cause or allow unreasonable emissions that unreasonably interfere with the health, welfare, convenience, comfort or amenity of any person.

### 9.9.3 Licence Holder controls

The Licence Holder has proposed infrastructure to capture landfill gas and will monitor for landfill gas as described in sections 7.7 and 8.

### 9.9.4 Key findings

**The Delegated Officer has reviewed the information regarding landfill gas and notes the following for the purposes of the risk assessment:**

- The proposed monitoring parameters will sufficiently identify if off-site migration is occurring. However, a broader analytical suite (e.g. volatile organic compounds, carbon monoxide and hydrogen sulfide) would be required to fully assess risks in the event that landfill gas is identified close to receptors. Pending ongoing monitoring results DWER may review the landfill gas requirements.
- The Landfill Closure Plan provided in the application does not provide detail on the final capping design for cells 2/3 including how leachate generation rates in a post-operational environment will be controlled by the intended capping design.

### 9.9.5 Consequence

Based upon the sensitivity of the most affected receptor (adjacent industrial premises) the Delegated Officer has determined that the impact of landfill gas during operation may be high level or ongoing medical treatment. Therefore, the Delegated Officer considers the consequence to be **Severe.**

### 9.9.6 Likelihood of Risk Event

Based upon the Licence Holder's controls and current operations the Delegated Officer has determined that severe landfill gas impacts during operation will probably not occur in most circumstances. Therefore, the Delegated Officer considers the consequence to be **Unlikely.**

### 9.9.7 Overall rating

The Delegated Officer has compared the consequence and likelihood rating described above for the Risk Criteria and determined that the overall rating for the risk of landfill gas impacts on receptors during operations is **High.**

### 9.9.8 Acceptability of Risk Event

As per DWER's acceptability and treatment of Risk Events the Delegated Officer has determined that the Risk Event may be tolerated and may be subject to multiple regulatory controls.

### 9.9.9 Regulatory controls for landfill gas emissions

The Delegated Officer considers that the current licence conditions are sufficient in managing potential landfill gas emissions during operations, and no additional conditions related to landfill gas are likely to be imposed on a future amendment to permit operation. The current landfill gas monitoring parameters are likely to remain on a future amendment provided there are no changes to receptors or additional information received by DWER in relation to landfill gas risk.

The Licence Holder will be required to submit an updated Landfill Closure Plan outlining how landfill gas emissions will be controlled in closure of the landfill infrastructure.

## 9.10 Risk assessment – vermin (pathogen) impacts

### 9.10.1 Hazard characterisation and impact

The landfilling of waste may attract vermin and pests such as rats, mice, flies, mosquitoes, feral cats, foxes, birds and cockroaches which provide a pathway to transport pathogens and diseases from the Premises, as well as causing amenity impacts.

The most affected receptor is considered to be the neighbouring industrial property.

### 9.10.2 Criteria for assessment

Amenity impacts and impacts to ecosystems from pests and vermin can be assessed against the general provisions of the EP Act.

### 9.10.3 Licence Holder controls

The current licence contains a number of controls to minimise the likelihood of vermin (pathogen) impacts including waste processing requirements, daily cover requirements, security measures and a specific requirement to implement control measures to prevent infestations of pests, flies and vermin at the Premises.

This amendment application does not propose any changes to these control measures.

### 9.10.4 Consequence

Based upon the sensitivity of the most affected receptor (adjacent industrial premises) the Delegated Officer has determined that the impact of vermin during operation will be low level impacts to amenity. Therefore, the Delegated Officer considers the consequence to be **Minor**.

### 9.10.5 Likelihood of Risk Event

Based upon the Licence Holder's controls and current operations the Delegated Officer has determined that minor vermin impacts during operation will probably not occur in most circumstances. Therefore, the Delegated Officer considers the consequence to be **Unlikely**.

### 9.10.6 Overall rating

The Delegated Officer has compared the consequence and likelihood rating described above for the Risk Criteria and determined that the overall rating for the risk of vermin impacts on receptors during operations is **Medium**.

### 9.10.7 Acceptability of Risk Event

As per DWER's acceptability and treatment of Risk Events the Delegated Officer has determined that the Risk Event is tolerable and is likely to be subject to some regulatory controls

### 9.10.8 Regulatory controls for vermin (pathogens)

The Delegated Officer considers that the current licence conditions are sufficient in managing potential vermin (pathogen) emissions during operations, and no additional conditions related to vermin (pathogen) are likely to be added as part of a future amendment to permit operation.

## 9.11 Risk assessment – windblown waste impacts

### 9.11.1 Hazard characterisation and impact

Wastes landfilled at the Premises may be blown from the cell during placement and prior to capping. Wastes may also be blown from vehicles moving waste at the Premises. Windblown wastes may cause amenity impacts to nearby human receptors.

The most affected receptor is considered to be the adjacent industrial properties.

### 9.11.2 Criteria for assessment

The criteria for assessment of windblown emissions is the Litter Act 1979 (Litter Act).

### 9.11.3 Licence Holder controls

The current licence contains a number of controls to minimise the likelihood of windblown waste emissions including waste processing requirements, daily cover requirements, security measures and a specific requirement to ensure no windblown waste escapes from the premises and to collect windblown waste on a weekly basis.

This amendment application does not propose any changes to these control measures.

### 9.11.4 Consequence

Based upon the sensitivity of the most affected receptor (adjacent industrial premises) the Delegated Officer has determined that the impact of windblown waste during operation will be low level impacts to amenity. Therefore, the Delegated Officer considers the consequence to be **Minor**.

### 9.11.5 Likelihood of Risk Event

Based upon the Licence Holder's controls and current operations the Delegated Officer has determined that minor windblown waste impacts during operation could occur at some time. Therefore, the Delegated Officer considers the consequence to be **Unlikely**.

### 9.11.6 Overall rating

The Delegated Officer has compared the consequence and likelihood rating described above for the Risk Criteria and determined that the overall rating for the risk of windblown waste impacts on receptors during operations is **Medium**.

### 9.11.7 Acceptability of Risk Event

As per DWER's acceptability and treatment of Risk Events the Delegated Officer has determined that the Risk Event is tolerable and is likely to be subject to some regulatory controls.

### 9.11.8 Regulatory controls for windblown waste emissions

The Delegated Officer considers that the current licence conditions are sufficient in managing potential windblown waste emissions during operations, and no additional conditions related to

windblown waste are likely to be added as part of a future amendment to permit operation.

## 9.12 Risk assessment – fire (smoke) impacts

### 9.12.1 Hazard characterisation and impact

Normal operations are unlikely to cause smoke emissions. Wastes being buried at the Premises provide a source for a potential fire to occur. In the event of a fire at the premises smoke may be emitted which is likely to contain carbon monoxide, free radicals, particulates, heavy metals and polyaromatic hydrocarbons among other contaminants. Smoke emissions from a fire would create localised air pollution and cause short-term high-level amenity impacts and may potentially cause mid-level health impacts to nearby human receptors.

Smoke impacts would be influenced by wind direction at the time of the event, therefore the nearby residential properties are considered the most affected receptor based on being the most sensitive land use of the surrounding human receptors.

### 9.12.2 Criteria for assessment

There are no specific criteria for smoke emissions. The general provisions of the EP Act make it an offence to cause or allow unreasonable emissions that unreasonably interfere with the health, welfare, convenience, comfort or amenity of any person.

### 9.12.3 Licence Holder controls

The current licence contains a number of controls to minimise the likelihood of a fire at the premises. These include waste acceptance criteria, process limits including limits on tyre storage, cover requirements, security measures, signage, contact information in the event of a fire, and a restriction on burning waste at the premises.

This amendment application does not propose any changes to these control measures.

### 9.12.4 Consequence

Based upon the sensitivity of the most affected receptor (residential properties) the Delegated Officer has determined that the impact of smoke emissions from a fire during operation will be mid-level impacts to amenity and potentially occasional medical treatment. Therefore, the Delegated Officer considers the consequence to be **Moderate**.

### 9.12.5 Likelihood of Risk Event

Based upon the Licence Holder's controls and current operations the Delegated Officer has determined that moderate smoke impacts during operation would only occur in exceptional circumstances. Therefore, the Delegated Officer considers the consequence to be **Unlikely**.

### 9.12.6 Overall rating

The Delegated Officer has compared the consequence and likelihood rating described above for the Risk Criteria and determined that the overall rating for the risk of smoke impacts on receptors during operations is **Medium**.

### 9.12.7 Acceptability of risk event

As per DWER's acceptability and treatment of Risk Events the Delegated Officer has determined that the risk event may be tolerated and may be subject to multiple regulatory controls.

### 9.12.8 Regulatory controls for fire (smoke) emissions

The Delegated Officer considers that the current licence conditions are sufficient in managing potential fire (smoke) emissions during operations, and no additional conditions related to fire (smoke) are likely to be added as part of a future amendment to permit operation.

# 10. Determination of Licence conditions

The conditions in the issued Licence in Attachment 1 have been determined in accordance with the *Guidance Statement: Setting Conditions*. Sections 9.4 to 9.12 provide a summary of the regulatory conditions to be applied to this works approval.

DWER notes that it may review the appropriateness and adequacy of controls at any time and that, following a review, DWER may initiate amendments to the Licence under the EP Act.

As part of this amendment the licence has been changed to include previous amendment notices, make minor changes to wording and remove redundant conditions. Table 14 provides a summary of changes to the licence conditions.

**Table 14: Summary of licence changes**

| Existing Licence Condition | Condition Summary | Proposed licence condition | Conversion notes |
|---|---|---|---|
| 1.1.1 | Interpretation and definitions | N/A | Redundant condition. Revised to current licensing format. |
| 1.1.2 | Interpretation and definitions | N/A | Redundant condition. Revised to current licensing format. |
| 1.1.3 | Australian or other standard | N/A | Redundant condition. Revised to current licensing format. |
| 1.1.4 | Reference to code of practice | N/A | Redundant condition. Revised to current licensing format. |
| 1.2.1 | Works | 1 | Direct transfer |
| 1.2.2 and Table 1.2.1 | Works | 2 and Table 1 | Direct transfer, addition of cell 2/3 infrastructure |
| 1.2.3 | Works | 3 | Direct transfer |
| 1.2.4 | Works | 4 | Direct transfer, addition of new infrastructure |
| 1.2.5 | Works | 5 | Revised reporting requirements to account for new infrastructure. |
| 1.2.6 | Installation of gas perimeter wells | 6 | Direct transfer, with the removal of the requirement to install Phase 1 by the 30 November 2018 as this has been completed (DWER Reference A1680365) |
| 1.2.7 | Installation of gas perimeter wells | 7 | Direct transfer |
| 1.2.8 | Aspiration well completion time | 8 | Direct transfer |

| Existing Licence Condition | Condition Summary | Proposed licence condition | Conversion notes |
|---|---|---|---|
| 1.2.9 | Connection of aspiration well to landfill gas system | 9 | Direct transfer |
| 1.2.10 and Table 1.2.2 | Capping works | 10 and Table 2 | Direct transfer, with the removal of the requirement to install Phases 1 and 2 by 20 July 2019 as this date has passed. |
| 1.2.11 and Table 1.2.3 | Quality Assurance | 11 and Table 3 | Direct transfer |
| 1.2.12 | NATA Accreditation | 12 | Direct transfer |
| 1.2.13 | Submission of CQA report | 13 | Direct transfer |
| 1.2.14 | CQA report requirements | 14 | Direct transfer |
| 1.3.1 and Table 1.3.1 | Waste acceptance | 15 and Table 4 | Direct transfer |
| 1.3.2 | Removal of non-conforming waste | 16 | Direct transfer |
| 1.3.3 and Table 1.3.2 | Waste Processing | 17 and Table 5 | Direct Transfer with removal of references to Phases 1, 2 and 3 and inclusion of new cell 2/3 |
| 1.3.4 | Management of landfilling activities | 18 | Direct transfer |
| 1.3.5 | Cover requirements | 19 | Direct transfer with correction of Inert Waste Type 2 cover depth requirements (previously absent) |
| 1.3.6 | Security measures | 20 | Direct transfer |
| 1.3.7 | Signage | 21 | Direct transfer |
| 1.3.8 | Control of pests and vermin | 22 | Direct transfer |
| 1.3.9 | Windblown waste | 23 | Direct transfer |
| 1.3.10 | No burning of waste | 24 | Direct transfer |
| 1.3.11 | Topographic contours | 25 | Direct transfer |
| 1.3.12 | Identification of ACM | 26 | Direct transfer |
| 1.3.13 | Identification of biomedical waste | 27 | Direct transfer |

| Existing Licence Condition | Condition Summary | Proposed licence condition | Conversion notes |
|---|---|---|---|
| 1.4.1 | Clearing | 28 | Direct transfer |
| N/A | Clearing | 29 | A new condition to specify that no additional clearing is authorised by the licence. The Licence Holder will be required to obtain a valid clearing permit to clear any additional areas of the Premises including the area required for the landfill cell. |
| 1.4.2 | Clearing | 30 | Direct transfer, with sub-list numbering adjusted for consistency |
| 1.4.3 | Clearing | 31 | Condition updated with the new details of the offset and the submission date extended from 30 June 2018 to 30 June 2020. |
| 2.1.1 | Monitoring requirements | 32 | Direct transfer |
| 2.1.2 | Monitoring frequency | 33 | Direct transfer |
| 2.1.3 | Monitoring calibration | 34 | Direct transfer |
| 2.1.4 | Monitoring calibration | 35 | Direct transfer |
| 2.2.1 and Table 2.2.1 | Monitoring of inputs and outputs | 36 and Table 6 | Direct transfer |
| 2.3.1 and Tables 2.3.1, 2.3.2 and 2.3.3 | Ambient environmental quality monitoring | 37 and Table 7, 8 and 9 | Direct transfer |
| 3.1.1, 3.1.2, 3.1.3, 3.1.4, 3.2.1, 3.2.2, and 3.3.1 | Records, reporting and notification conditions | 38, 39, 40, 41 and 42. | Updated to current licence format, Annual Environmental Reporting requirements transferred from previous condition 4.2.1 |
| 3.2.3 | Submission of a Closure and Post-Closure Management Plan | 43 | The original requirements of the condition were met, however the condition has been included again to require a new updated plan to include the additional cell 2/3 |

# 11. Consultation summary

**Table 15: Consultation Summary**

| Method | Comments received | DWER response |
|---|---|---|
| Application advertised on DWER website (6/6/2019) | None received | N/A |
| Shire of Harvey contacted for comment and advice on planning on 6 September 2019 | No response | N/A |
| Licence Holder referred draft documents on 11 December 2019 | See Attachment 2 | See Attachment 2 |

# 12. Conclusion

Based on the assessment in this decision report, the Delegated Officer has determined that an amendment will be granted, subject to conditions commensurate with the determined controls and necessary for administration and reporting requirements.

**Tracey Hassell**
**A/MANAGER WASTE INDUSTRIES**
Delegated Officer under section 20 of the *Environmental Protection Act 1986*

# Appendix 1: Key documents

| | Document title | In text ref | Availability |
|---|---|---|---|
| **Supporting documentation to application** | | | |
| 1 | Supporting Information for Licence Amendment Application: Cells 2/3 – Stanley Road Class II Putrescible Landfill: L8949/2016/1, ASK 2019 | The Application | DWER Records A1772690 |
| 2 | Landfill Closure Management Plan – Cells 2/3, Bunbury Harvey Regional Council, ASK 2019 | The Application | DWER Records A1772690 |
| 3 | Construction Environmental Management Plan – Cells 2/3, Bunbury Harvey Regional Council, ASK 2019 | The Application | DWER Records A1772690 |
| 4 | Landfill Environmental Management Plan – Cells 2/3, Bunbury Harvey Regional Council, ASK 2019 | The Application | DWER Records A1772690 |
| 5 | Risk Assessment – Cells 2/3, Bunbury Harvey Regional Council, ASK 2019 | The Application | DWER Records A1772690 |
| 6 | Cells 2/3 Landfill Construction – Technical Specification, Bunbury Harvey Regional Council, GreenTec 2019 | The Application | DWER Records A1772690 |
| 7 | Engineering Assessment in Support of Development Work Application – Stanley Road Waste Management Facility, Bunbury Harvey Regional Council, GreenTec 2019 | The Application | DWER Records A1772690 |
| 8 | Construction Works Quality Assurance (CQA) Plan, Bunbury Harvey Regional Council GreenTec 2019 | The Application | DWER Records A1772690 |
| 9 | Stanley Road Landfill – Detailed Hydrogeological Investigation, Bunbury Harvey Regional Council, GHD 2018 | The Application | DWER Records A1772690 |
| 10 | Application form: Works Approval / Licence / Renewal / Amendment / Registration, ASK 2019 | The Application | DWER Records A1772690 |
| 11 | Technical Review of Cell 2/3 Works Approval Design Documents, Stanley Road Waste Management Facility, Impact Blue 2019 | The Application | DWER Records A1772690 |
| **Submissions in response to DWER requests for information** | | | |

| | Document title | In text ref | Availability |
|---|---|---|---|
| 12 | Clarification Table 1E 21 May 2019 | The Application | DWER Records A1790960 |
| 13 | Cells 2/3 Landfill Construction – Technical Specification, Bunbury Harvey Regional Council, GreenTec 2019 – Reference 6b | The Application | DWER Records A1795187 |
| 14 | Engineering Assessment in Support of Development Work Application – Stanley Road Waste Management Facility, Bunbury Harvey Regional Council, GreenTec 2019 – Reference 7b | The Application | DWER Records A1795189 |
| **Other reference documents** | | | |
| | DOH 2009, *Guidelines for Assessment, Remediation and Management of Asbestos Contaminated Sites in Western Australia*. Department of Health, Perth. | N/A | www.health.wa.gov.au |
| | EPA Victoria 2015, *Best practice environmental management, Siting, design, operation and rehabilitation of landfills (VIC BPEM)*. Environment Protection Authority Victoria, Melbourne. | EPA Victoria 2015 | www.epa.vic.gov.au |
| | DER 2015, *Guidance Statement: Regulatory principles.* Department of Environment Regulation, Perth. | N/A | www.dwer.wa.gov.au |
| | DER 2015, *Guidance Statement: Setting conditions.* Department of Environment Regulation, Perth. | N/A | www.dwer.wa.gov.au |
| | DER 2016, *Guidance Statement: Licence duration.* Department of Environment Regulation, Perth. | N/A | www.dwer.wa.gov.au |
| | DER 2016, *Guidance Statement: Environmental Siting.* Department of Environment Regulation, Perth. | N/A | www.dwer.wa.gov.au |
| | DER 2017, *Guidance Statement: Risk Assessments*. Department of Environment Regulation, Perth. | N/A | www.dwer.wa.gov.au |
| | DWER 2019, *Guideline: Decision making.* Department of Water and Environmental Regulation, Perth. | N/A | www.dwer.wa.gov.au |

| | Document title | In text ref | Availability |
|---|---|---|---|
| | DWER 2019, *Guideline: Industry Regulation Guide to Licensing*. Department of Water and Environmental Regulation, Perth. | N/A | www.dwer.wa.gov.au |
| | DEC 2012, *Guidelines for managing asbestos at construction and demolition waste recycling facilities*. Department of Environment and Conservation, Perth. | DEC 2012 | www.dwer.wa.gov.au |
| | BoM 2019, *Climate Data Online – Station No. 009642* Bureau of Meteorology. | BoM 2019 | www.bom.gov.au |
| | BoM 2019, *Climate Data Online – Station No. 009965.* Bureau of Meteorology. | BoM 2019a | www.bom.gov.au |
| | *National Environment Protection (Ambient Air Quality) Measure* | NEPM | https://www.legislation.gov.au/Details/C2004H03935 |
| | *National Health and Medical Research Council & National Resource Management Ministerial Council Australian Drinking Water Guidelines 6, 2011 (as amended)* | ADWG | www.nhmrc.gov.au |
| | Contaminated Sites Ground and Surface Water Chemical Screening Guidelines Department of Health | DOH 2014 | www.health.wa.gov.au |
| | *Long Term Irrigation Water ANZECC & ARMCANZ (2000)* | N/A | www.waterquality.gov.au |
| | *Australian Water Quality Guidelines for Fresh and Marine Water Quality ANZECC & ARMCANZ (2000)* | N/A | |

## Appendix 2: Summary of Licence Holder's comments on risk assessment and draft conditions

| Condition | Summary of Licence Holder comment | DWER response |
|---|---|---|
| Table 1, item 6. | Query if Schedule 2 should be referenced instead of Schedule 1. | Schedule 1 shows the site plan map which is referenced in this table. |
| | Volume of 5,700 $m^2$ should be $m^3$ | Noted and changed. |
| Table 1, item 7 | Comment that the condition requiring no spillway or diverts is already shown in the drawings. | Noted, condition changed to reference drawings in Schedule 1. |
| Table 1, item 8 | Query if Schedule 2 should be referenced instead of Schedule 1. | Schedule 1 shows the site plan map which is referenced in this table. |
| Condition 4 | Comment that one month timeframe is unrealistic, and 6-8 weeks is more reasonable. | This condition was part of the original licence, however DWER considers an 8 week timeframe to be minor and fulfils the purpose of the original condition. Condition 4 has been changed. |
| Condition 5 | Query which table is referred to. | The condition references Table 2 which was incorrectly numbered. Table 2 numbering updated. |
| Table 3 | Query why this table is in the licence | This condition was part of the original licence, and previous conditions have not been reassessed. Should BHRC wish to remove this condition an amendment application with justification will be required. |
| Condition 17 | Requesting an extension on the timeframe that landfilling | The date to cease landfilling in cell 1 was a |

| Condition | Summary of Licence Holder comment | DWER response |
|---|---|---|
| | must cease in cell 1 | condition imposed as part of a previous amendment, and previous conditions have not been reassessed. Should BHRC wish to remove this condition an amendment application with justification will be required. |
| Condition 29 | Query why this condition is required as a clearing permit would supersede this condition. | Clearing may be authorised under a separate clearing permit which would not supersede this condition.<br>This condition specifies that no clearing is permitted specifically under this licence to remove any uncertainty that the licence does provide authority to clear. |
| Condition 31 | Comment that the offset is close to being concluded. | DWER notes that this matter is close to being concluded.<br>The offset is a requirement of clearing the area of Plan 7259/2 and therefore must be specified in the licence until this requirement is completed. |
| Condition 37 | Typo in table 7. | Noted and changed. |
| Definitions | AS3706 detailed provided as requested | Noted and included. |
| Schedule 1 | Updated maps provided | Noted and included. |
| Schedule 2 | A number of queries regarding the construction requirements specified in the table. | DWER notes these queries and has included reference to the Technical Specifications document in the preamble. DWER considers that specific requirements are necessary to include in the table for compliance and reporting |

| Condition | Summary of Licence Holder comment | DWER response |
|---|---|---|
| | | requirements.<br>Wording updated to refer to construction fill.<br>Comments relating to testing of water with groundwater depressurisation system will be addressed during assessment of operation.<br>A maximum specification for the HDPE membrane is provided as used in the modelling data.<br>LLDPE is not referenced in the application for construction of the liner, only the capping system and are therefore is included in the specifications.<br>DWER agrees the leachate sump specifications are considered standard however they are necessary to be included for the purposes of compliance and reporting. |
| N/A | Request to update terminology of the cells to reflect the updated diagram provided | Noted and changed. |