



Department initiated Amendment

Part V Division 3 of the *Environmental Protection Act 1986*

Licence Number	L8974/2016/2
Licence Holder	Eclipse Soils Pty Ltd
ACN	131 802 661
File Number	DER2016/000832-1
Premises	Abercrombie Road Resource Recovery Centre Abercrombie Road POSTANS WA 6167 Legal description – Lot 115 on Plan 48295 (Volume 2602, Folio 976) and Lot 2 on Plan 29392 (Volume 2219, Folio 775)
Date of Report	21 December 2020
Proposed Decision	Revised licence granted

**MANAGER WASTE INDUSTRIES
REGULATORY SERVICES**

an officer delegated under section 20 of the
Environmental Protection Act 1986 (WA)

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1. Decision summary

Licence L8974/2016/2 is held by Eclipse Soils Pty Ltd (Licence Holder) for the Abercrombie Road Resource Recovery Centre (the Premises), located at Lot 115 on Plan 48295 and Lot 2 on Plan 29392, Postans.

This Amendment Report documents the assessment of potential risks to the environment and public health from potential emissions and discharges during the operation of the Premises. As a result of this assessment, Revised Licence L8974/2016/2 has been granted.

2. Scope of assessment

2.1 Regulatory framework

In completing the assessment documented in this Amendment Report, the department has considered and given due regard to its Regulatory Framework and relevant policy documents which are available at <https://dwer.wa.gov.au/regulatory-documents>.

2.2 Amendment summary

On 2 November 2020, the department initiated an amendment to Licence L8974/2016/2 to incorporate the following changes:

- Remove improvement program conditions IC1 and IC2 relating to the green waste and acid sulfate soils (ASS)/potential acid sulfate soils (PASS) areas on the Premises.
- Add new improvement conditions to the licence relating to the installation of two new groundwater monitoring bores.
- Amend the groundwater monitoring program to include the two new monitoring bores, change the sampling frequency from quarterly to six-monthly and change the parameters required for analysis.

This amendment was initiated following a request from the Licence Holder on 24 August 2020 asking DWER to consider removing IC1 and IC2 from the conditions in the licence and to change the groundwater monitoring frequency from quarterly to annually. The amendment was assessed as a DWER initiated amendment on the basis that the proposed amendments related to the outcome of a previous appeal determination as discussed in the following section.

During the amendment assessment process, DWER identified some additional minor changes to include in the scope of the licence amendment. The Delegated Officer considers that these changes do not affect the risk profile of the premises and therefore they were not included within the scope of the risk assessment. These amendments include:

- Expanding the ASS/PASS area specified in the Premises map in Schedule 1 of the Licence to include an area already being used for this purpose and which meets the required specifications for this infrastructure.
- Refining the asbestos monitoring method outlined in condition 19 of the Licence to better reflect the recommended sampling approach.
- Reinstating the approved waste acceptance rates which were specified in condition 1 of the Licence before a previous amendment dated 10 June 2020.

2.2.1 Background

The Premises was previously operated by Eclipse Resources Pty Ltd under licence

L7766/2001/5 for categories 61A, 63 and 67A. That licence expired on 27 April 2015.

Licence L8974/2016/2 was issued to the current Licence Holder on 28 March 2017. The Licence Holder lodged an appeal against the original licence conditions on 13 April 2017. The Licence Holder raised a number of objections to individual conditions relating to management and monitoring of emissions to groundwater, such as the location of storage and processing areas and infrastructure requirements.

The appeal was determined by the Minister for Environment on 21 May 2018 (Office of the Appeals Convenor, Appeal 13 of 2017). The Minister allowed the appeal in part. The aspects of the appeal which relate to this amendment are summarised in the following sections.

Green waste and ASS/PASS storage infrastructure

One of the matters addressed in the appeal was the inclusion of an improvement program in the licence relating to the green waste and ASS/PASS storage areas. The due date for the improvement was originally 28 May 2017. The improvement conditions were as follows:

- IC1: The Licence Holder shall submit to the CEO a report that assesses the permeability of the green waste area limestone pad and green waste stormwater basin. If the green waste area limestone pad or green waste stormwater basin does not achieve a hydraulic conductivity of 1×10^{-8} m/s or less, representative across the respective infrastructure, the Licence Holder is required to submit to the CEO a report outlining the steps and timeframes involved in meeting that specification.
- IC2: The Licence Holder shall submit to the CEO a report that assesses the permeability of the ASS/PASS Area limestone pad. If the ASS/PASS Area pad does not achieve a hydraulic conductivity of 1×10^{-8} m/s or less, representative across the respective infrastructure, the Licence Holder is required to submit to the CEO a report outlining the steps and timeframes involved in meeting that specification.

DWER's basis for the inclusion of the improvement program in the 2017 licence was that potential leachate emissions from the green waste and ASS/PASS areas presented a high risk to the receiving environment. This was informed by the following considerations:

- An assessment of the available groundwater dataset could not determine if previous on-site activities had impacted groundwater quality.
- The Licence Holder's main control for containing leachate emissions from green waste and ASS/PASS storage and processing was to undertake these activities on pads constructed of crushed and compacted limestone. The permeability of these pads was not known.

In their grounds for appeal, the Licence Holder submitted that:

- The department's ASS Guidelines (*Treatment and management of soil and water in acid sulfate soil landscapes*, 2015) do not specify a specific hydraulic conductivity but only that the treatment pad is 'appropriately low'.
- A requirement for the limestone pads (green waste and ASS/PASS) to meet a standard of 1×10^{-8} m/s is unnecessary and unachievable in practical terms with compacted limestone. It submitted that the environmental risks from receiving, storing, grinding and composting green waste do not justify the new requirements, and to achieve these requirements would require the installation of either a compacted clay hardstand (which in winter would be difficult to

traffic), or concrete/asphalt pads which would be prohibitively expensive.

In its response to the appeal, DWER stated that given the inconclusive nature of available groundwater monitoring results, it is reasonable to allow a period of 12 months increased (quarterly) groundwater monitoring to verify whether the high risk rating for leachate emissions is accurate, in advance of requiring any improvements in the infrastructure to be undertaken. In these circumstances, DWER recommended that the requirements to give effect to improvements to containment infrastructure could be deferred pending the results of the monitoring.

The Minister accepted DWER's advice that if additional groundwater monitoring demonstrates that the existing limestone pads used for green waste and ASS/PASS are of a sufficient permeability to mitigate impacts to groundwater, improvement requirements IC1 and IC2 may no longer be required to be met within the stipulated timeframes. The Minister therefore allowed the appeal to the extent that this outcome should be reflected in revised wording to IC1 and IC2.

Groundwater monitoring

In their appeal, the Licence Holder objected to the requirement to undertake groundwater monitoring at a quarterly frequency instead of the annual frequency which was specified on the previous premises licence L7766/2001/5. The Licence Holder submitted that water quality monitoring results over time had not demonstrated conclusively that activities on site resulted in unacceptable impacts on water quality and all controls for managing risks to acceptable levels applied to Eclipse Resources Pty Ltd since 2002 had been complied with.

In its response to the appeal, DWER stated that while water quality monitoring had not conclusively demonstrated that elevated concentrations and fluctuations in groundwater quality were attributable to site activities, the department considered that quarterly groundwater monitoring data remained necessary. This was to provide an accurate and reliable data set to verify the risk assessment in relation to emissions to groundwater and to assist in determining if the site activities are resulting in unacceptable impacts on groundwater. Quarterly monitoring results were considered necessary to understand any seasonal fluctuations in groundwater level and chemistry which may be attributable to natural processes and also to determine whether there are any seasonal 'flushes' of contaminants from the premises. These conclusions cannot be determined from an annual monitoring program.

DWER also stated that amendments to reduce the groundwater monitoring frequency and the range of parameters monitored may occur pending the results of the groundwater monitoring required under the Existing Licence.

In relation to groundwater monitoring, the Minister considered it appropriate for quarterly monitoring to be required for at least the first 12 months following this decision, for the reasons stated by DWER. Should those results confirm the original risk assessment, it is open to DWER to remove improvement requirements IC1 and IC2 and review the requirement to maintain quarterly monitoring.

2018 Licence amendment

On 20 November 2018, DWER amended the licence in accordance with the appeal determination. This amendment included an extension to the due date of IC1 and IC2 to 20 November 2020 to provide additional time for the Licence Holder to undertake further groundwater monitoring under the revised regime, review the results and provide them to DWER for review.

The quarterly groundwater sampling frequency was retained on the licence on an ongoing basis (without a specified end date). The Delegated Officer considered that this monitoring frequency was required to provide a more conclusive data set for

monitoring the potential impact of emissions on ambient groundwater quality given the potential high risk to the receiving environment.

Current situation

The Licence Holder conducted quarterly groundwater monitoring at the premises from July 2018 to April 2020 and provided the results of this monitoring to DWER in the form of two annual groundwater monitoring reports (Aurora Environmental 2020; Aurora Environmental 2019). The Licence Holder considers that the groundwater monitoring results demonstrate that the current limestone pads are adequate to mitigate emissions. The Licence Holder also requested that the groundwater monitoring frequency change from quarterly back to annually.

3. Risk assessment

The department assesses the risks of emissions from prescribed premises and identifies the potential source, pathway and impact to receptors in accordance with the *Guidance Statement: Risk Assessments* (DER 2017).

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.

3.1 Source-pathways and receptors

3.1.1 Emissions and controls

The key emissions and associated actual or likely pathway which have been considered in this Amendment Report are detailed in Table 1 below. Table 1 also details the proposed control measures the Licence Holder has proposed to assist in controlling these emissions, where necessary. The premises layout is shown in Figure 1.

Table 1: Proposed controls

Emission	Sources	Potential pathways	Proposed controls
Leachate and contaminated stormwater	<p>Storage and processing of green waste</p> <p>Storage and treatment of ASS/PASS</p> <p>The green waste area and the ASS/PASS area are both used for the storage and processing/treatment of both green waste and ASS/PASS.</p>	Seepage to soil and groundwater	<p>Annual groundwater monitoring of four groundwater monitoring bores.</p> <p>ASS/PASS and green waste processing conducted on 300 mm thick compacted crushed limestone pads which are bunded on all sides and graded towards clay lined sumps to collect any surface water.</p> <p>ASS is neutralised immediately upon receipt.</p>

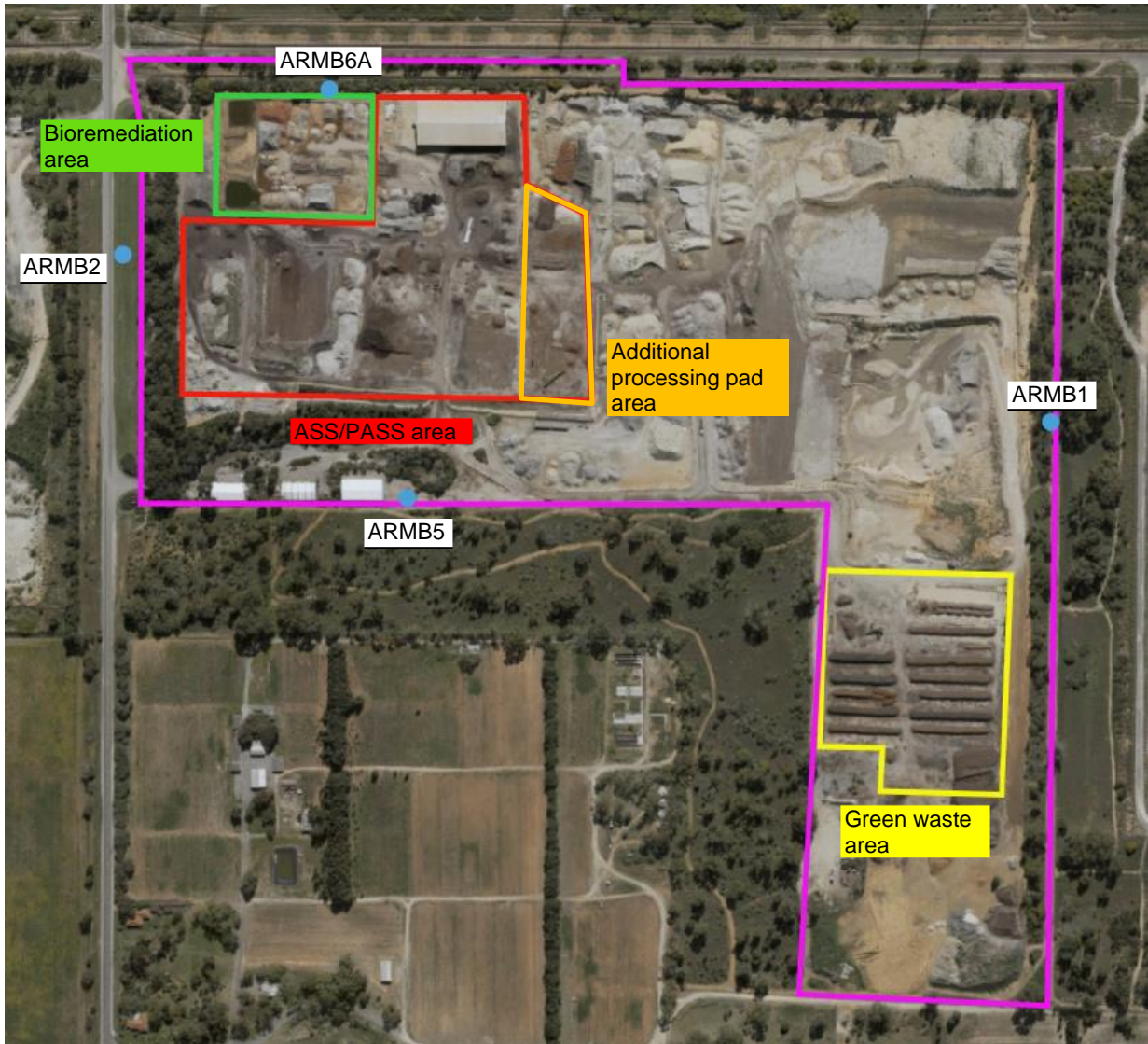


Figure 1: Premises layout and current groundwater monitoring bore locations

3.1.2 Receptors

In accordance with the *Guidance Statement: Risk Assessment* (DER 2017), the Delegated Officer has excluded employees, visitors and contractors of the applicant from its assessment. Protection of these parties often involves different exposure risks and prevention strategies and is provided for under other state legislation.

Table 2 and Figure 2 below provides a summary of potential human and environmental receptors that may be impacted as a result of activities upon or emission and discharges from the prescribed premises (*Guidance Statement: Environmental Siting* (DER 2016)).

Table 2: Sensitive human and environmental receptors and distance from premises

Human receptors	Distance from premises boundary
Agricultural research station owned and operated by the Department of Primary Industries and Regional Development at 60 Abercrombie Road.	Caretaker residence located approximately 360 m from southern boundary of Lot 115 and 595 m from the western boundary of Lot 2. The station has been closed and the caretaker's residence unoccupied for over 5 years according to information provided by the Licence Holder.
Residential receptors	No residential receptors were identified down hydraulic gradient of the premises.
Recreational receptors	There is an area zoned for parks, recreation and drainage located down hydraulic gradient of the premises, about 780 m to the west.
Commercial and industrial receptors	There are a number of commercial/industrial receptors located down hydraulic gradient of the premises in Postans, Kwinana Beach, Naval Base and the Hope Valley-Wattleup Redevelopment Area. The closest of these is WA Limestone, located on the opposite side of Abercrombie Road, immediately west of the premises.
Environmental receptors	Distance from prescribed activity
Groundwater	Based on monitoring undertaken at the premises, the depth to the water table of the superficial aquifer ranges from about 13 m below ground level (BGL) on the western and southern premises boundaries to 18-19 m BGL on the eastern and northern premises boundaries. The surface geology and superficial aquifer at the premises are within the Tamala Limestone formation. This formation contains solution channels and cavities, particularly in the zone where the water table fluctuates, and in some areas has karst structures (Davidson and Yu 2008). The hydraulic conductivity of the Tamala Limestone is highly variable. Areas with solution channels and cavities record the highest values but on a regional scale the hydraulic conductivity is mostly influenced by low conductivity beds or sandy facies (Davidson and Yu, 2008). Areas with tightly cemented siliceous materials may be almost impermeable. Based on the Perth Groundwater Map, the regional groundwater flow direction is west north-west, towards Cockburn Sound. Aurora Environmental (2020) report that relative groundwater levels measured during quarterly monitoring indicate that local groundwater flow on the premises is to the west south-west. Two of the monitoring bores used to determine groundwater flow direction on the premises are sited within 100 m of abstraction bores

	<p>operated by the Licence Holder. Groundwater flow in close proximity to these bores may be affected by drawdown from abstraction, however the extent of their respective capture zones within the premises area is unknown.</p> <p>The Delegated Officer considers that the regional groundwater flow direction to the west north-west is the most reliable representation of potential contaminant transport pathways from the premises. However, the localized influences from groundwater abstraction also require consideration when interpreting groundwater monitoring data.</p> <p>The premises is within the Cockburn Groundwater Area which is a proclaimed area under the <i>Rights in Water Irrigation Act 1914</i>.</p> <p>Groundwater in the superficial aquifer below the premises is fresh to brackish. The main beneficial use of the superficial aquifer in the vicinity and down hydraulic gradient of the premises is non-potable use for irrigation, dust suppression and industrial purposes. There are more than ten groundwater licences located down hydraulic gradient of the premises. Shallow groundwater may also support groundwater dependent ecosystems of the Swan Coastal Plain including wetlands (see below) and groundwater dependent vegetation such as shrubland scrub heath and tuart woodlands.</p>
Geomorphic Wetlands of the Swan Coastal Plain	<p>The following wetlands were identified as potentially down hydraulic gradient of the premises:</p> <ul style="list-style-type: none"> - Unnamed resource enhancement basin dampland – 1.8 km north-west <p>The following wetlands were identified as likely to be cross hydraulic gradient of the premises:</p> <ul style="list-style-type: none"> - Unnamed resource enhancement basin dampland – 760 m north north-west - Unnamed multiple use basin dampland – 870 m north north-west - Long Swamp, conservation basin sumpland – 1.3 km north - Unnamed resource enhancement basin sumpland – 2.9 km north-west
Surface water	<p>No hydrological features were identified directly down hydraulic gradient of the premises. One hydrological feature coinciding with Long Swamp wetland was identified 1.3 km north which is considered cross hydraulic gradient of the premises.</p>
State Environment Policy Cockburn Sound Policy Boundary	<p>The premises is within this area and is located about 3.4 km from the Cockburn Sound coastline.</p>
Threatened and Priority Ecological Communities	<p>The premises is within the 500 m buffer area for the following communities:</p> <ul style="list-style-type: none"> - Tuart (<i>Eucalyptus gomphocephala</i>) woodlands and forests of the Swan Coastal Plain – mapped areas within the premises boundary and additional areas to the north, south and south-west. - <i>Melaleuca huegelii</i> – <i>Melaleuca systema</i> shrublands on limestone ridges – mapped area about 140 m north. - Banksia Dominated Woodlands of the Swan Coastal Plain IBRA Region – mapped area about 180 m north-east.

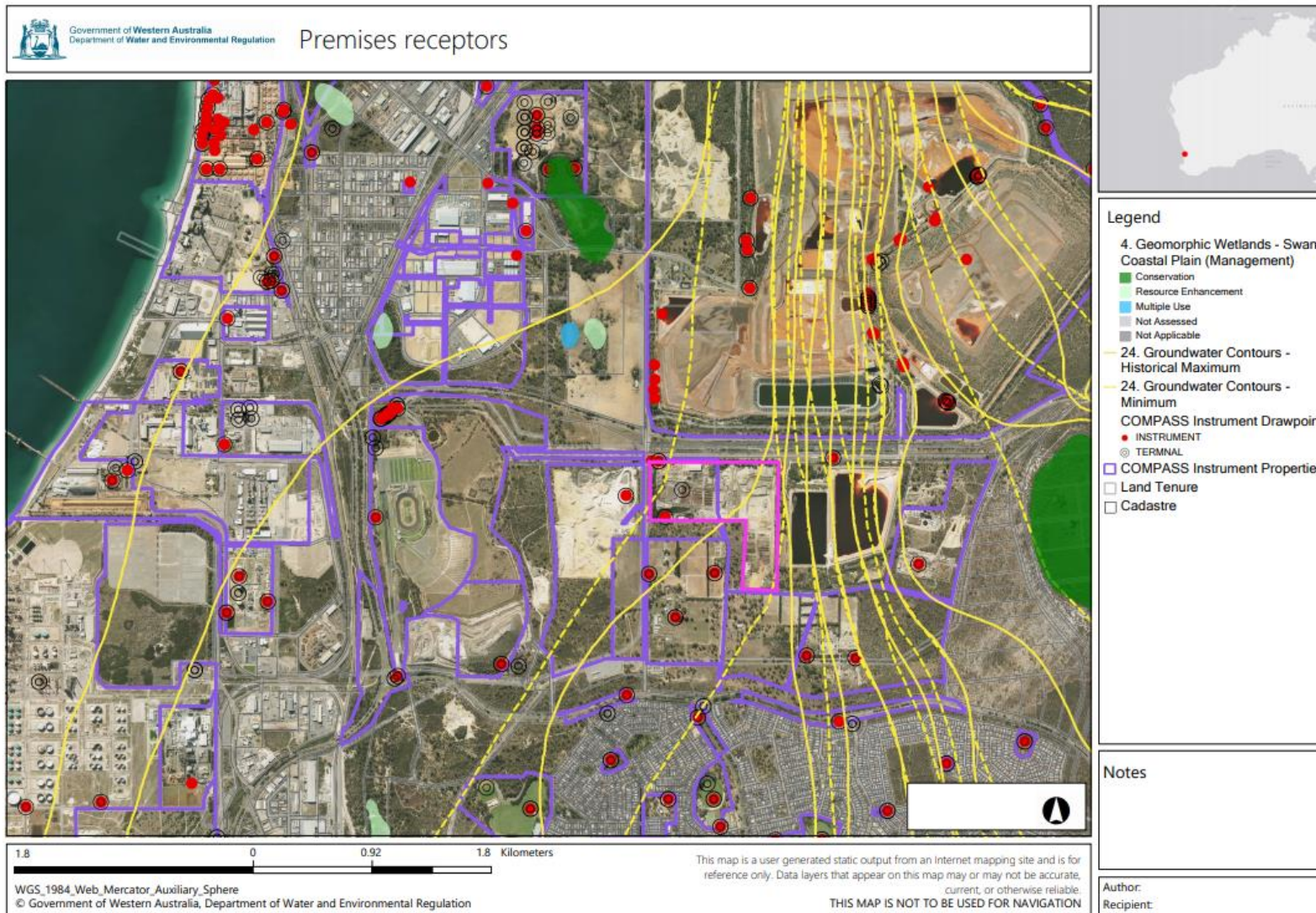


Figure 2: Distance to sensitive receptors from the Premises.

The premises boundary is shown by the pink line. Purple lines show sites with groundwater licences, red dots show groundwater licence drawpoints and yellow lines show the historical maximum (solid) and minimum (dashed) superficial aquifer groundwater contours from the Perth Groundwater Map. Threatened ecological communities are not shown.

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3.2 Risk ratings

Risk ratings have been assessed in accordance with the *Guidance Statement: Risk Assessments* (DER 2017) for existing emission sources related to the storage and processing of green waste and the storage and treatment of ASS/PASS and takes into account potential source-pathway and receptor linkages as identified in Section 3.1. Where linkages are in-complete they have not been considered further in the risk assessment.

Where the Licence Holder has proposed mitigation measures/controls (as detailed in Section 3.1), these have been considered when determining the final risk rating. Where the Delegated Officer considers the Licence Holder's proposed controls to be critical to maintaining an acceptable level of risk, these will be incorporated into the licence as regulatory controls.

Additional regulatory controls may be imposed where the Licence Holder's controls are not deemed sufficient. Where this is the case the need for additional controls will be documented and justified in Table 3.

The Revised Licence L8974/2016/2 that accompanies this Amendment Report authorises emissions associated with the operation of the Premises i.e. category 61A and category 67A activities.

The conditions in the Revised Licence have been determined in accordance with *Guidance Statement: Setting Conditions* (DER 2015).

Table 3. Risk assessment of potential emissions and discharges from the Premises during operation

Risk Event					Risk rating ¹ C = consequence L = likelihood	Applicant controls sufficient?	Conditions ² of licence	Justification for additional regulatory controls
Source/Activities	Potential emission	Potential pathways and impact	Receptors	Applicant controls				
Storage and processing of green waste Storage and treatment of ASS/PASS	Leachate and contaminated stormwater	Seepage to soil and groundwater and migration down hydraulic gradient Deterioration of groundwater quality	Non-potable groundwater users down hydraulic gradient	Refer to Section 3.1.1	Green waste C = Minor L = Likely Medium Risk (refer to Section 3.3) <u>ASS/PASS</u> C = Minor P = Possible Medium Risk (refer to Section 3.3)	N	Condition 1, 3, 6, <u>18, 21, 22, 28</u>	Refer to Section 3.3.9
			Groundwater dependent wetlands 1.8 km down hydraulic gradient		Incomplete source-pathway-receptor linkage due to 1.8 km distance to closest down hydraulic gradient wetland.			
			Cockburn Sound marine environment		Incomplete source-pathway-receptor linkage due to 3.4 km distance to coast and Cockburn Sound.			

Note 1: Consequence ratings, likelihood ratings and risk descriptions are detailed in the *Guidance Statement: Risk Assessments* (DER 2017).

Note 2: Proposed Licence Holder's controls are depicted by standard text. **Bold and underline text** depicts additional regulatory controls imposed by department.

3.3 Detailed risk assessment for leachate emissions

3.3.1 Description of risk event

Leachate is generated during composting of green waste and through the interaction of stormwater with green waste and ASS/PASS stored in the green waste and ASS/PASS storage areas. The Existing Licence allows these areas to be used interchangeably, both green waste and ASS/PASS may be stored and processed/treated in the green waste area or the ASS/PASS area.

Where processing infrastructure does not adequately capture leachate and stormwater, or is not constructed to achieve a sufficiently low permeability, leachate will seep into soil and migrate through the unsaturated zone to the superficial aquifer. Contaminants associated with green waste and ASS/PASS may degrade groundwater quality and have the potential to impact down gradient groundwater users.

3.3.2 Identification and general characterisation of emission

Decomposition of green waste during composting leads to the generation of leachate. This process is enhanced through the irrigation of materials undergoing composting to maintain moisture and achieve dust suppression. During and following rainfall, rain and stormwater interact with green waste and may entrain contaminants associated with the waste. Contaminants associated with green waste may include nutrients, metals, high biological oxygen demand (BOD) and organic compounds such as phenols and terpenes. The Licence Holder adds nitrogen in the form of urea and iron in the form of iron sulfate to green waste during composting, these additives may also affect leachate and stormwater generated during green waste storage and processing.

The two areas on which green waste is stored and processed (green waste area and ASS/PASS area) comprise 300 mm thick compacted limestone pads which are bunded by 300 mm high crushed limestone. The Delegated Officer considers that this type of pad surface is not likely to provide an adequate barrier to the infiltration of contaminants in leachate and stormwater emissions associated with green waste at the premises.

The Existing Licence requires that all runoff and leachate from green waste storage, mulching and composting areas are directed to a stormwater basin which is constructed of at least 300 mm thick compacted limestone and retains a 300 mm embankment freeboard. The Licence Holder's correspondence dated 24 August 2020 indicates that the green waste and ASS/PASS pads are graded towards clay lined sumps. One sump is located in the north-western corner of the green waste area (Figure 3) and two sumps are present along the southern boundary of the ASS/PASS area (Figure 4). The volume, liner specifications and permeability of these sumps are not known. The likelihood of leachate and contaminated stormwater emissions occurring via seepage from these sumps is not known.

Interaction of stockpiled ASS/PASS with water from irrigation, rain and stormwater has the potential to generate leachate with hydrochemical characteristics and contamination associated with ASS. Leachate from ASS/PASS is likely to be acidic and contain elevated concentrations of sulfate. The interaction of acidic leachate with stockpiled soils also has the potential to mobilise metals such as arsenic, aluminium and iron. Treatment of ASS/PASS is undertaken at the premises using aglime, limestone or lime sand.

The two areas on which ASS/PASS is stored and treated (green waste area and ASS/PASS area) comprise 300 mm thick compacted limestone pads which are bunded by 300 mm high crushed limestone. Although this type of pad surface may not provide an adequate physical barrier to prevent infiltration, its chemical composition will have a neutralising effect on acidic leachate and stormwater emissions.



Figure 3: Green waste area captured August 2019

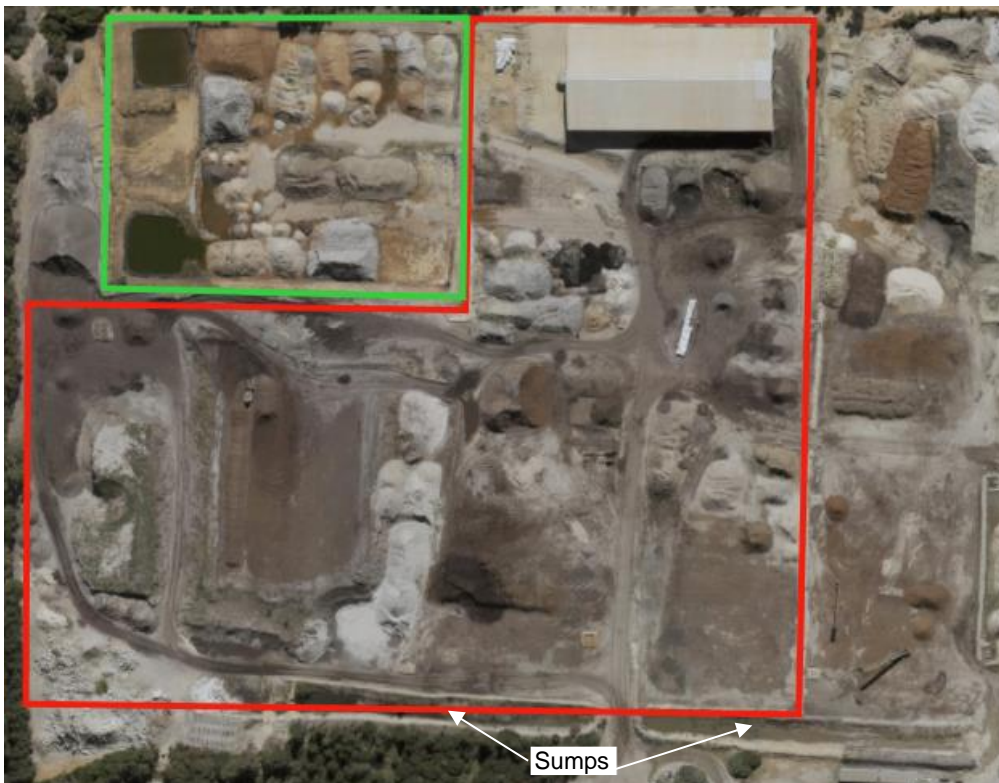


Figure 4: ASS/PASS area (red polygon) captured August 2019

3.3.3 Description of potential adverse impact from the emission

Infiltration of contaminated leachate has the potential to degrade soil and groundwater quality of the superficial aquifer. Soil beneath the premises may become impacted through the

accumulation of contaminants in the unsaturated zone. Contaminants which are transported to the superficial aquifer may impact the beneficial use of groundwater for non-potable purposes down hydraulic gradient from the premises.

Although leachate from ASS/PASS is likely to be acidic, the immediate neutralization of soils with alkaline materials (Aglime) will ensure that any acid generated is effectively neutralised. Additionally the buffering capacity of the limestone pad and natural limestone soils underlying the premises are likely to mitigate the low pH of leachate before it enters the superficial aquifer. There is also the potential for some contaminants to undergo attenuation within the superficial aquifer. The eventual fate of shallow groundwater migrating from the premises is likely to be discharge to the Cockburn Sound marine environment about 3.4 km to the west or extraction from one of the licensed groundwater production bores between the premises and the coast (Figure 2). Shallow groundwater may also be taken up by groundwater dependent vegetation or discharged to the basin dampland 1.8 km north-west of the premises.

The Delegated Officer reviewed the 2018-2019 and 2019-2020 quarterly groundwater monitoring reports for the premises which were both prepared by Aurora Environmental. Parameters which are considered potential indicators of seepage of leachate or contaminated stormwater from green waste and ASS/PASS areas were reviewed to determine whether there is evidence that groundwater has been impacted. The findings of this review are summarised in Table 4. A map of the groundwater monitoring network is provided in Figure 5.

The Delegated Officer considers that the following parameters may provide evidence that leachate from the green waste and ASS/PASS areas has impacted groundwater below the Premises:

- Lower values of alkalinity : sulfate at ARMB5 and ARMB6A than background bore ARMB1. Potential reasons for this include an additional source of sulfate at these bores or a reduction in alkalinity caused by acidic inputs.
- Elevated concentrations of nitrogen (total nitrogen, total oxidised nitrogen and/or ammonia) at ARMB5 and ARMB6A compared to the background bore ARMB1.
- Elevated concentrations of arsenic at ARMB2, ARMB5 and ARMB6A compared to the background bore ARMB1.
- Elevated concentrations of iron at ARMB2 and ARMB6A compared to the background bore ARMB1.
- Elevated concentrations of manganese at ARMB2 and ARMB6A compared to the background bore ARMB1.

During the review, the Delegated Officer identified some remaining sources of uncertainty in the current understanding of groundwater impacts from green waste and ASS/PASS areas. These are summarised as follows:

- The impact of groundwater abstraction on local groundwater flow beneath the premises is not well understood which means there is uncertainty about which monitoring bores are down hydraulic gradient from the green waste and ASS/PASS areas. Aurora Environmental (2020) asserted that superficial groundwater flows in a west-south-westerly direction below the site which they attribute to the abstraction bore on the site pulling groundwater in a southerly direction. However, given the high hydraulic conductivity and transmissivity of groundwater, this may not be a reasonable assumption in the absence of other supporting evidence or data. To provide a conservative assessment of groundwater data, the review was conducted assuming that ARMB2, ARMB5 and ARMB6A may all be down hydraulic gradient from the green waste and ASS/PASS areas.
- The top of the screened interval in ARMB2 occurs about 13 m below the water table which means this monitoring bore does not sample the part of the superficial aquifer

which is most likely to be affected by contamination. ARMB5 and ARMB6A are both screened across the water table.

- There is no groundwater monitoring bore sited immediately down hydraulic gradient of the green waste area. It is therefore not possible to assess whether leachate emissions in this area have impacted groundwater.
- There are a number of potential contaminant sources present in close proximity to the premises. ARMB1 is considered up hydraulic gradient from the premises and has been used to determine background groundwater quality for comparison to monitoring data from ARMB2, ARMB5 and ARMB6A. However, there is the potential that on-site groundwater abstraction near the northern and southern premises boundaries in the west of the premises could draw groundwater which has been impacted by off-site sources onto the premises. The existing groundwater monitoring network is too limited to allow a definitive assessment between on-site and off-site contaminant sources.

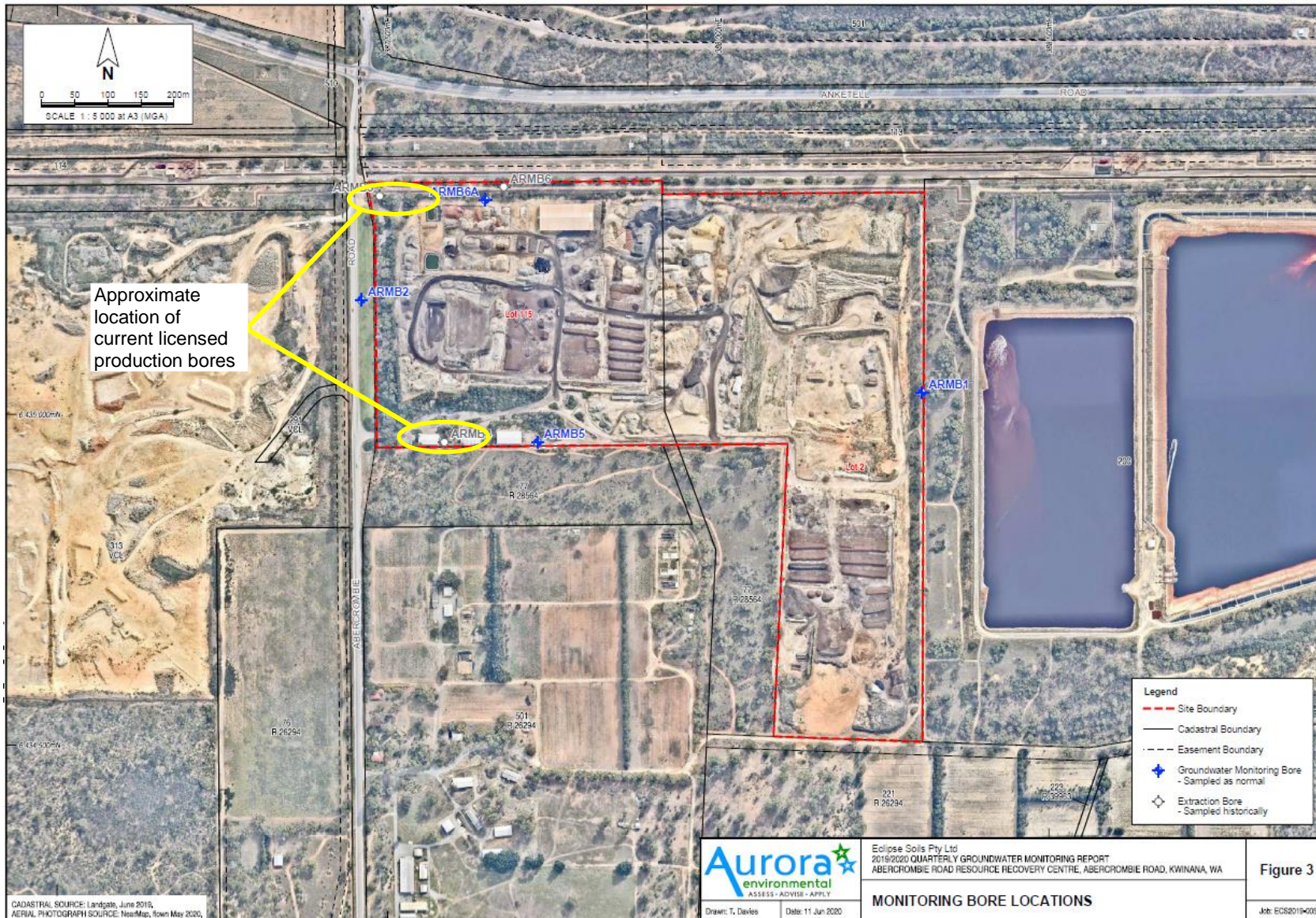


Figure 5: Groundwater bore network

Licence L8974/2016/2

Table 4: Groundwater indicator analysis

Parameter	Purpose	Summary of results	Exceedances of consequence criteria
pH	Detect seepage of acidic leachate	ARMB2, ARMB5 and ARMB6A have a consistently near neutral pH in the range of 6.5 to 8.2 based on 2018 to 2020 data. Monitoring data does not indicate that groundwater has been impacted by acidic leachate.	No applicable criteria based on the Non-Potable Use Guidelines (NPUG)
alkalinity	Detect hydrochemical changes caused by seepage of acidic leachate	Alkalinity in groundwater is consistently above 80 mg/L as CaCO ₃ . DER (2015b) indicates that this high level of alkalinity generally provides an adequate buffering capacity to maintain an acceptable pH in the future. ARMB2 and ARMB5 recorded lower alkalinity concentrations (120-250 mg/L) compared to ARMB1 and ARMB6A (320-560 mg/L).	
alkalinity : sulfate	Detect seepage of sulfate source such as oxidised ASS or iron sulfate additive to green waste	DER (2015b) indicates that an alkalinity: sulfate ratio of less than 5 may indicate that groundwater is or has been affected by the oxidation of sulfides. Background bore ARMB1 recorded ratios from 5 to 7. ARMB5 and ARMB6A generally recorded lower ratios from 2 to 5. ARMB2 recorded variable ratios, both above and below the threshold ratio of 5.	
total nitrogen	Detect seepage of nitrogen source such as urea additive or nutrients naturally present in green waste	Background bore ARMB1 recorded concentrations from 0.9 to 2.3 mg/L. ARMB2 recorded a similar range of concentrations. ARMB5 and ARMB6A recorded significantly higher concentrations, ranging from 6.9 to 11 mg/L at ARMB5 and 8 to 51 mg/L at ARMB6A. The maximum concentration of 51 mg/L at ARMB6A was recorded in January 2019 and concentrations have since reduced to 21 mg/L in April 2020. Ammonia is the main form of nitrogen detected in groundwater at ARMB6A. Concentrations at ARMB5 are relatively consistent over time. Total oxidised nitrogen is the main form of nitrogen detected in groundwater at ARMB5.	

Parameter	Purpose	Summary of results	Exceedances of consequence criteria
ammonia	Detect seepage of nitrogen source such as urea additive or nutrients naturally present in green waste	Background bore ARMB1 recorded ammonia (as N) concentrations from 0.88 to 1.9 mg/L. ARMB2 and ARMB5 generally recorded similar or lower concentrations. ARMB6A recorded significantly higher concentrations, ranging from 7.5 to 36 mg/L. The maximum concentration of 36 mg/L at ARMB6A was recorded in July 2018 and concentrations have since reduced to 21 mg/L in April 2020.	NPUG – 0.4 mg/L (as N) - ARMB1 and ARMB6A consistently exceeded this guideline - ARMB2 recorded one exceedance of this guideline in October 2017
total phosphorus	Detect seepage of phosphorus source such as green waste	Concentrations in groundwater ranged from 0.01 to 0.18 mg/L. ARMB2, ARMB5 and ARMB6A did not generally record higher concentrations than the background bore ARMB1.	No applicable criteria based on the NPUG
aluminium	Detect seepage of leachate containing metals or hydrochemical changes caused by seepage of acidic or high organic content (low BOD) leachate	Detected in the background bore ARMB1 once in January 2020. ARMB2 and ARMB6A did not generally record higher concentrations than the background bore. ARMB5 recorded two concentrations which were higher than the maximum detection in the background bore, these occurred in October 2018 and January 2020.	NPUG – 0.2 mg/L - ARMB5 recorded one exceedance of this guideline in January 2020
arsenic		Background bore ARMB1 generally recorded non-detections or very low concentrations. ARMB2, ARMB5 and ARMB6A recorded regular detections of arsenic, with ARMB6A recording significantly higher concentrations (0.007 to 0.17 mg/L) than the background and other down gradient bores. The maximum concentration of 0.17 mg/L at ARMB6A was recorded in February 2014 and concentrations have since reduced to 0.014 mg/L.	NPUG – 0.1 mg/L - ARMB6A recorded exceedances of this guideline between 2012 and 2015 but concentrations have since reduced to below the guideline
chromium		Background bore ARMB1 recorded non-detections and concentrations up to 0.002 mg/L. ARMB5 and ARMB6A generally recorded a similar range of concentrations as the background bore. ARMB2 did not record any detections.	NPUG – 0.5 mg/L (Cr VI) - No exceedances
copper		Background bore ARMB1 recorded non-detections and concentrations up to 0.009 mg/L. ARMB2, ARMB5 and ARMB6A generally recorded a similar range of concentrations as the background bore.	NPUG – 20 mg/L - No exceedances

Parameter	Purpose	Summary of results	Exceedances of consequence criteria
iron	Detect seepage of leachate containing metals or hydrochemical changes caused by seepage of acidic or high organic content (low BOD) leachate	Background bore ARMB1 recorded non-detections and concentrations up to 0.41 mg/L. ARMB5 generally recorded a similar range of concentrations as the background bore. ARMB2 and ARMB6A recorded higher concentrations, ranging from 0.1 to 2.9 mg/L at ARMB2 and 0.69 to 5.3 mg/L at ARMB6A. The maximum concentration of 2.9 mg/L was recorded at ARMB2 in October 2017 and concentrations have since reduced to 0.42 mg/L. The maximum concentration of 5.3 mg/L was recorded at ARMB6A in April 2019 and concentrations have since reduced to 2 mg/L in April 2020.	NPUG – 0.3 mg/L - ARMB2 and ARMB6A recorded regular exceedances - ARMB1 and ARMB5 recorded one exceedance in January 2020
manganese		Background bore ARMB1 recorded non-detections and concentrations up to 0.03 mg/L. ARMB5 recorded lower concentrations than the background bore. ARMB2 and ARMB6A recorded higher concentrations, ranging from 0.03 to 0.1 mg/L at ARMB2 and 0.05 to 0.37 mg/L at ARMB6A. Concentrations at ARMB2 have been relatively consistent over time. The maximum concentration of 0.37 mg/L was recorded at ARMB6A in February 2014 and concentrations have since reduced to 0.1 mg/L in April 2020.	NPUG – 5 mg/L - No exceedances
mercury		Mercury was not detected above the limit of reporting (LOR) at ARMB1 and ARMB5. Mercury was detected at a concentration equal to the LOR in October 2012 at ARMB2 and in July 2018 at ARMB6A.	NPUG – 0.01 mg/L - No exceedances
nickel		ARMB1, ARMB2 and ARMB5 generally recorded non-detections or very low concentrations (up to 0.002 mg/L). ARMB6A recorded higher concentrations ranging from 0.001 to 0.005 mg/L which were relatively consistent over time.	NPUG – 0.2 mg/L - No exceedances
zinc		Monitoring bores generally recorded non-detections with some irregular detections of zinc up to 0.017 mg/L with no clear differences between the background bore ARMB1 and other bores ARMB2, ARMB5 and ARMB6A.	NPUG – 3 mg/L - No exceedances
cadmium, lead and selenium		Monitoring bores generally recorded non-detections or very low concentrations up to 0.003 mg/L with no clear differences between the background bore ARMB1 and other bores ARMB2, ARMB5 and ARMB6A.	NPUG – (0.02, 0.1 and 0.1 mg/L respectively) - No exceedances

3.3.4 Criteria for assessment

Based on the environmental siting, relevant groundwater assessment criteria are the Non-Potable Use Guidelines (Department of Health 2014) as outlined in the guideline *Assessment and Management of Contaminated Sites* (DER 2014).

3.3.5 Key findings

The Delegated Officer has reviewed the information regarding leachate emissions and has found:

1. The compacted limestone pads are unlikely to provide a long-term leachate barrier which minimises infiltration of contaminants associated with green waste leachate to soil and groundwater. The compacted limestone pads are likely to have a neutralising effect on acidic leachate which may be generated in association with ASS/PASS storage.
2. It is unknown whether the liners of the green waste and ASS/PASS area sumps provide a barrier to infiltration of leachate and contaminated stormwater.
3. Leachate and stormwater associated with green waste and ASS/PASS may contain elevated concentrations of nutrients, sulfate, metals, BOD and organic compounds.
4. The main receptors of significance to groundwater contamination which migrates down hydraulic gradient of the premises are groundwater users. Groundwater in this area is used for non-potable purposes including irrigation, dust suppression and industrial processes.
5. No wetlands of 'conservation' status are located down hydraulic gradient of the premises. There is one wetland of 'resource enhancement' status which is down hydraulic gradient and about 1.8 km from the premises. Due to its distance from the premises this wetland is not considered a receptor of significance.
6. Cockburn Sound is not considered a receptor of significance. This is based on it being 3.4 km from the premises and the potential contaminant loading resulting from leachate infiltration from green waste and ASS/PASS storage and processing areas being minor compared to other sources.
7. Groundwater in monitoring bores which may be down hydraulic gradient from the premises shows changes in quality compared to the background bore on the premises' eastern boundary. The observed impacts could be a result of leachate seeping to groundwater from the green waste and ASS/PASS areas. However, due to a number of sources of uncertainty it is not possible to determine the source of the observed impacts.
8. There are deficiencies in the current groundwater monitoring network which limit its capacity to rapidly detect impacts associated with on-site activities. This includes the lack of a groundwater monitoring bore directly down hydraulic gradient from the green waste area and ARMB2 not being screened across the water table which is the part of the aquifer which is most vulnerable to contamination.

3.3.6 Consequence

If infiltration of leachate occurs, then the Delegated Officer has determined that the Consequence Criteria (for public health) for groundwater of the Non-Potable Use Guidelines

(NPUG) are likely to be met.

Regular and ongoing exceedances of the NPUG criteria for iron and ammonia have been recorded at some bores. However, the Delegated Officer considers that these exceedances are not directly relevant to this risk assessment for the following reasons:

- The iron NPUG criterion is based on an aesthetic drinking water quality guideline set to avoid precipitation of iron. It is common for Perth groundwater to contain elevated concentrations of iron but for groundwater to be extracted and used for non-potable purposes anyway. The risk of iron precipitation (bore-related staining) does not preclude its use for non-potable purposes.
- The ammonia NPUG criterion is based on an aesthetic drinking water quality guideline set to avoid corrosion of copper pipes. Background groundwater quality at the premises (ARMB1) reports concentrations of ammonia above this criterion, although the concentrations of ammonia in ARMB6A are significantly higher than those in the background bore. The exceedance of the NPUG criterion indicates a potential aesthetic risk related to pipe damage rather than a human health risk related to non-potable groundwater use.

Exceedances of the NPUG criteria for aluminium and arsenic have also been recorded in ARMB5 and ARMB6A respectively. Only one aluminium exceedance occurred at ARMB5 in January 2020. Arsenic exceedances at ARMB6A occurred between 2012 and 2015 but have since reduced to below the guideline value.

Therefore, the Delegated Officer considers the consequence of leachate infiltration to be **Minor**.

3.3.7 Likelihood of Risk Event

The Delegated Officer has determined that contaminants associated with green waste leachate will probably infiltrate to groundwater in most circumstances. Therefore, the Delegated Officer considers the likelihood of this Risk Event to be **likely**.

The Delegated Officer has determined that contaminants associated with ASS/PASS leachate could infiltrate to groundwater at some time. Therefore, the Delegated Officer considers the likelihood of this Risk Event to be **possible**.

3.3.8 Overall risk rating

The Delegated Officer has compared the consequence and likelihood ratings described above with the risk rating matrix in the *Guidance Statement: Risk Assessments* and determined that the overall rating for the risk of this Risk Event is **medium**.

3.3.9 Justification for additional regulatory controls

The Delegated Officer has determined that improvement requirements IC1 and IC2 can be removed from the licence. Based on this outcome, changes to the groundwater monitoring program are required as an additional regulatory control to the conditions in the Existing Licence and the controls proposed by the Licence Holder. The Delegated Officer has made this determination because:

- There are remaining uncertainties and data gaps in the current understanding of groundwater impacts from the premises.
- The compacted limestone pads are considered unlikely to prevent contaminants in leachate and stormwater emissions associated with green waste storage and processing from infiltrating to groundwater. A robust groundwater monitoring program is needed for DWER to monitor potential future impacts and ensure that receptors are not exposed to unacceptable risks.

Changes to the monitoring program are summarised in the following sections.

Monitoring frequency

The groundwater sampling frequency will be reduced from quarterly to six-monthly. The Licence Holder requested that the frequency be reduced to annual. The Delegated Officer considers that six-monthly groundwater monitoring is necessary to provide a more comprehensive dataset and capture potential seasonal changes in groundwater quality.

Groundwater monitoring network

The following changes to the groundwater monitoring network are proposed:

- Removal of ARMB2 from the bore network, this is a DWER owned bore located outside of the premises boundary. While this bore is sited in an area which is considered likely to be down hydraulic gradient from the ASS/PASS area, it is not screened across the water table which is the part of the aquifer which is most vulnerable to contamination. The top of the screened interval occurs at about 13 m below the water table which means it samples a deeper part of the superficial aquifer than other monitoring bores on the premises. Based on these considerations, ARMB2 is not considered suitable to provide early detection of potential groundwater impacts from the premises or for direct comparison to groundwater quality results from other bores.
- Addition of a new monitoring bore ARMB7. The purpose of this bore is to replace ARMB2 as a down gradient bore on the western premises boundary. ARMB7 is to be screened across the water table and will be located within the premises boundary and closer to premises activities than ARMB2.
- Addition of a new monitoring bore ARMB8. The purpose of this bore is to monitor groundwater quality down gradient from the green waste area in the south of the premises. There is currently no groundwater monitoring bore at this location and the potential impacts of green waste processing in this area was identified as a data gap in DWER's review of 2018-2020 quarterly groundwater data. Installation of this new bore will also help to achieve a better understanding of groundwater flow directions below the premises which was another data gap identified by DWER.

Groundwater analytical suite

The following changes to the groundwater analytical suite will be made:

- Addition of the following monitoring parameters:
 - Redox potential and dissolved oxygen – These parameters provide an indication of general water quality and are already being analysed in the field during groundwater sampling events.
 - Sodium, calcium and magnesium – Addition of these cations means the groundwater analytical suite will include all major ions which will allow additional hydrochemical analytical tools to be used to interpret groundwater in the future.
 - Nitrate, nitrite and Total Kjeldahl Nitrogen – Concentrations of total nitrogen are elevated in some of the monitoring bores at the premises. Addition of these nitrogen species to the analytical suite will allow an improved understanding of nitrogen impacts to groundwater.
 - Biochemical oxygen demand – Leachate from green waste may have a high biochemical oxygen demand. This parameter will provide additional information about general water quality and potential groundwater impacts at the premises.
- Total petroleum hydrocarbons replaced with total recoverable hydrocarbons (TRHs) in accordance with updated terminology adopted in the *Assessment of Site Contamination*

NEPM (NEPC, 2013).

- Removal of organochlorine and organophosphate (CO/OP) pesticides, benzene, toluene, ethylbenzene and xylenes (BTEX), polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs) and TRHs from the analytical suite for ARMB1, ARMB5 and ARMB8. The soil bioremediation area where hydrocarbon and pesticide contaminated soils are stored and handled is the part of the premises at highest risk from contamination by these substances. These parameters are not considered necessary for ARMB1 because there is now a substantial dataset indicating that these parameters are not present at concentrations above the limit of reporting (LOR) at this background monitoring bore. As ARMB5 and ARMB8 are not located within the vicinity of the soil bioremediation area where hydrocarbon and pesticide contaminated soils are handled and stored, these parameters are not relevant to these bores. These parameters will be retained for ARMB6A and ARMB7 to provide ongoing assessment of groundwater quality close to the soil bioremediation area and to continue to monitor dieldrin concentrations at ARMB6A.

4. Consultation

Table 5 provides a summary of the consultation undertaken by the department.

Table 5: Consultation

Consultation method	Comments received	Department response
Licence Holder was provided with draft amendment on 23 November 2020	The Licence Holder responded on 2 December 2020. Refer to Appendix 1	Refer to Appendix 1

5. Conclusion

Based on the assessment in this Amendment Report, the Delegated Officer has determined that a Revised Licence will be granted, subject to conditions commensurate with the determined controls and necessary for administration and reporting requirements.

5.1 Summary of amendments

Table 6 provides a summary of the proposed amendments and will act as record of implemented changes. All proposed changes have been incorporated into the Revised Licence as part of the amendment process.

Table 6: Summary of licence amendments

Condition no.	Proposed amendments
1	Waste acceptance table formatting updated to reflect that the annual rate at which waste can be received is 200,000 tonnes for waste types accepted under category 61A (ASS/PASS, contaminated soil and clean fill) and 50,000 tonnes for waste accepted under category 67A (green waste). The Licence Holder identified that when the waste acceptance table was reformatted as part of a previous licence amendment issued on 10 June 2020, it inadvertently reduced the overall rate at which waste could be received. The change in the current licence amendment reinstates the waste acceptance rates which were previously assessed and approved in a licence amendment dated 13 May 2019.
18	Changes to the groundwater monitoring frequency, network and analytical suite as summarised in Section 3.3.9.

Condition no.	Proposed amendments
19	Minor administrative amendment to the averaging period for asbestos fibre monitoring. The averaging period was changed from 8 hours to the duration of the shift during which handling and screening of asbestos or ACM contaminated material occurs. This more accurately reflects the appropriate sampling duration based on guidance in <i>NOHSC:3003 Guidance note on the membrane filter method for estimating airborne asbestos fibres</i> . This approach is consistent with recommendations from the Department of Health and advice provided by DWER to the Licence Holder in correspondence dated 20 October 2020.
21	Removal of IC1 and IC2 improvement requirements relating to permeability testing of the ASS/PASS and green waste pads and sump. New improvement program requiring the installation of ARMB7 and ARMB8 groundwater monitoring bores by 28 February 2021 based on the reasons outlined in Section 3.3.9.
22	New condition requiring the bore construction report to be submitted within 60 calendar days of the bores being constructed.
28	<ul style="list-style-type: none"> - Condition number update. - Minor condition and table number reference corrections/updates. - Groundwater monitoring reporting requirements updated to provide more detail about what should be included in the report. - Removal of the "Format or form" column.
23-30	Condition number updates only.
Definitions	Minor corrections and additions.
Figure 1	Premises map updated to expand the size of the ASS/PASS area to include an additional area to the east of the existing pad. This change was made after DWER identified from aerial photographs that the Licence Holder was already using an area to the east of the specified ASS/PASS area for green waste composting. The draft Amendment Report asked the Licence Holder to confirm if this was the case and whether this area met the required specifications for the ASS/PASS area in condition 6, Table 3 of the Existing Licence. In their comments on the draft Revised Licence and Amendment Report, the Licence Holder confirmed that this eastern area meets the infrastructure requirements for the ASS/PASS area as specified in condition 6, Table 3 of the Existing Licence and the ASS/PASS area in the Premises map should therefore be expanded to include it.
Figure 7	Updated groundwater monitoring bore map.

References

1. Aurora Environmental, 2020, *2019/2020 Quarterly Groundwater Monitoring Report, Abercrombie Road Resource Recovery Centre, Abercrombie Road, Kwinana, WA*. DWER reference A1918819 and A1918821
2. Aurora Environmental, 2019, *2018/2019 Quarterly Groundwater Monitoring Report, Abercrombie Road Resource Recovery Centre, Abercrombie Road, Kwinana, WA*. DWER reference REPORT19/334
3. Bureau of Meteorology 2016, *Design Rainfall Data System*. Accessed: <http://www.bom.gov.au/water/designRainfalls/revise-ifd/>
4. Davidson and Yu 2008, *Perth Regional Aquifer Modelling System (PRAMS) model development: Hydrogeology and groundwater modelling*, report no. HG 20, Perth.
5. Department of Environment Regulation (DER) 2016, *Guidance Statement: Environmental Siting*, Perth, Western Australia.
6. DER 2017, *Guidance Statement: Risk Assessments*, Perth, Western Australia.
7. DER 2015a, *Guidance Statement: Setting Conditions*, Perth, Western Australia.
8. DER 2015b, *Treatment and management of soil and water in acid sulfate soil landscapes*, Perth, Western Australia.
9. DER, 2014, *Assessment and management of contaminated sites*, Perth, Western Australia.
10. DOH, 2014, *Contaminated Sites Ground and Surface Water Chemical Screening Guidelines*, Perth, Western Australia.
11. National Environmental Protection Council, 2013, *National Environmental Protection (Assessment of Site Contamination) Measure*,

Appendix 1: Summary of Licence Holder's comments on risk assessment and draft conditions

Condition	Summary of Licence Holder's comment	Department's response
1	<p>Eclipse Soils requests a formatting change be made to <i>Table 1: Types of waste authorised to be accepted on the Premises</i> in the draft Licence to reflect the following:</p> <ol style="list-style-type: none"> Green waste to be shown as a separate line item with its own annual limit of 50,000 t, and not be included in the combined annual limit of 200,000 t with other waste types, as was the case prior to DWER issuing licence amendment 10 June 2020 for L8974/2016/1. <p>Eclipse Soils believes the formatting of the waste acceptance table by DWER unintentionally changed the combined annual limit, as this change was not noted in the decision document that accompanied amendment 10 June 2020 for L8974/2016/1.</p> <p>The current formatting does not reflect the assessed production capacities of 200,000 t per annum for category 61A and 50,000 t per annum for 67A category on Eclipse Soils' licence.</p> <p>Eclipse Soils requests the formatting change outlined in item 1 above be made to <i>Table 1: Types of waste authorised to be accepted on the Premises</i> in the draft licence L8974/2016/2.</p>	<p>The Delegated Officer agrees with the Licence Holder's interpretation that this formatting change unintentionally reduced the annual rate at which waste can be received at the Premises.</p> <p>The formatting of Table 1 has been edited to reinstate the waste acceptance rates which were assessed and approved in a licence amendment dated 13 May 2019 – 200,000 tonnes per annual period for waste accepted under category 61A (ASS/PASS, contaminated soil and clean fill) and 50,000 tonnes per annual period for waste accepted under category 67A (green waste).</p>
18	<p>Eclipse Soils accepts the removal of improvement program conditions IC1 and IC2 relating to the green waste and ASS/PASS areas on the Premises.</p> <p>Removal of conditions IC1 and IC2 is an appropriate outcome given the following:</p> <ul style="list-style-type: none"> Concentrations of analytes in groundwater sampling are decreasing over time generally. Relevant guidelines for groundwater are considered unlikely to be exceeded. Composting green waste, and producing soils and mulches, does not include high nutrient/pathogen feedstocks such as animal manures or biosolids. A significant component of green waste composted on site comes from residues off State Forest. 	None required.

Condition	Summary of Licence Holder's comment	Department's response
18	Eclipse Soils accepts the change in sampling frequency from quarterly to six-monthly and the changes in the parameters required for analysis.	None required.
21	Eclipse Soils accepts the new conditions to the licence relating to the installation of two new groundwater monitoring bores as a precursor to moving back to annual groundwater monitoring (provided guidelines for analyte concentrations are being met).	The Delegated Officer considers that six-monthly groundwater monitoring is an appropriate groundwater sampling frequency for the Premises on an ongoing basis. Annual groundwater monitoring would not be a sufficient regulatory control based on the activities, infrastructure and risk profile of the Premises.
Premises map	Eclipse Soils confirms the orange rectangle area outlined in Figure 1 of the Amendment Report meets the infrastructure requirements specified in condition 6, Table 3 of the Existing Licence. The ASS/PASS area on the plan should be extended to include this area.	The area directly east of the ASS/PASS area is already used for green waste storage and based on the Licence Holder's comments, meets the ASS/PASS area specifications set out in condition 6. The Delegated Officer considers that this area is suitable for ASS/PASS processing and green waste composting and the Premises map was therefore updated to incorporate this area into the approved ASS/PASS area.