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Regional Renewable Organics Network Project

Environmental Risk Assessment

Barwon Water

12 August 2024

→ The Power of Commitment



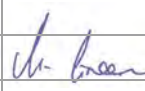

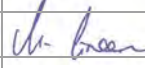
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1. Introduction

1.1 Background

Barwon Water (BW) has engaged GHD Pty Ltd to prepare a Development Licence Application (DLA) for its proposed Regional Renewable Organics Network (RRON). This Environmental Risk Assessment (ERA) has been prepared to support the DLA.

The RRON will be located at BW's Black Rock Water Reclamation Plant (WRP) (the site), located at 405 Blackrock Road, Connewarre, approximately 18 km south of Geelong. The Black Rock WRP is an already established organic waste recycling facility that treats wastewater and recycles ~60,000 t/y of biosolids.

The RRON facility is proposed to process approximately 40,000 t/y of comingled food organics and garden organic (FOGO) waste predominately from local Municipalities. This FOGO stream will be pre-processed and separated into a food organics (FO) rich stream and a garden organics (GO) rich stream. The facility will also process other feedstocks including bulk green waste (~9,000 t/y), commercial and industrial (C&I) organic waste (~2,000 t/y), and biosolids (from BW's WRPs). The main processes proposed for the RRON include:

- Thermal processing via carbonisation of the GO-rich stream (separated from FOGO), bulk green waste and biosolids
- Plug flow anaerobic digestion (PFAD) of the FO-rich stream (separated from FOGO) and FO-rich C&I organic waste

The RRON will produce the following product streams:

- Biochar (from carbonisation), a high-value product for agriculture and production of advanced sustainable materials
- Syngas (from carbonisation), which will be used within the RRON facility to dry the carbonisation feedstocks down to a suitable moisture content for carbonisation
- Digestate (from the PFAD), a product containing high levels of nutrients, which is beneficial in agricultural applications
- Biogas (from the PFAD), which will be transferred to the neighbouring biosolids drying facility and converted into heat via a biogas boiler, reducing the demand for natural gas

Further information on the environmental setting of the RRON facility and a detailed process description are provided in the DLA report. This report should be read in conjunction with the DLA report.

1.2 Purpose

The purpose of this report is to identify potential environmental hazards associated with the operation of the RRON facility and assess the risks of the hazards on the surrounding environment. This report is intended to be used to support the DLA.

1.3 Scope of works

An Environmental Risk Assessment (ERA) has been prepared in general accordance with EPA Publication 1695.1 *Assessing and controlling risk: A guide for business* and AS/NZS ISO 13000:2009 (Risk Management). The scope of work included hazard identification, documenting the proposed environmental controls for the RRON facility, performing a risk assessment of the identified hazards and documenting the findings in a risk register.

The risk assessment has been undertaken based on the findings of separate detailed technical assessments as follows:

- Air Quality Assessment (refer Appendix H of the main application)
- Noise assessment (refer Appendix J of the main application)
- Waste management assessment (refer Appendix K of the main application)
- Greenhouse gas assessment (refer Appendix M of the main application)
- Fire safety study (refer Appendix L of the main application)

Risks associated with impacts to human health have been assessed as part of the Human Health Risk Assessment (HHRA) provided as Appendix I of the main application.

1.4 Limitations

This report has been prepared by GHD for Barwon Water and may only be used and relied on by Barwon Water for the purpose agreed between GHD and Barwon Water as set out in Section 1.1 of this report.

GHD otherwise disclaims responsibility to any person other than Barwon Water arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report. GHD disclaims liability arising from any of the assumptions being incorrect.

GHD has prepared this report based on information provided by BW and others who provided information to GHD (including Government authorities), which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

2. Site overview

This section provides an overview of the area surrounding the RRON facility, which plays a critical role in the potential for environmental impacts from the facility:

- The land use within the area surrounding the facility will have an influence on the magnitude of the potential impacts and the potential exposure mechanisms
- The environment of the area surrounding the facility, including the climate, terrain and hydrology will have an influence on how pollutants disperse within an environment
- The profile of the population of the area surrounding the facility will influence the vulnerability of the potentially impacted communities

2.1 Site location

The site is located at 405 Blackrock Road, Connewarre, approximately 18 km south of Geelong CBD. An aerial image of the site location is shown in Figure 1. The proposed RRON facility will be sited within the boundary of the existing WRP. The RRON facility site layout is displayed in Figure 2.

2.2 Surrounding land uses

The site is zoned as a mix of Public Use Zone – Service and Utility (PUZ1). The areas surrounding the Site ranges from farming land to public conservation areas within the Connewarre township. A summary of the surrounding areas and relevant zoning levels for identified activities are listed in Figure 1.

Table 1 Zoning levels of surrounding areas

Direction	Activity	Zoning
North	Bicycle path then farming land	FZ
East	Thirteenth Beach	PCRZ
South	Zeally Bay and Breamlea Beach	PCRZ
West	Breamlea Flora and Fauna Reserve	PCRZ
	Farming land	FZ



Legend

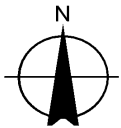
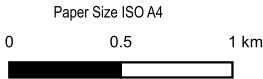
Site Layer

- Site Boundary

Maps

Planning Zone

- COMPREHENSIVE DEVELOPMENT ZONE - SCHEDULE 1
- COMPREHENSIVE DEVELOPMENT ZONE - SCHEDULE 2
- FARMING ZONE
- LOW DENSITY RESIDENTIAL ZONE
- LOW DENSITY RESIDENTIAL ZONE - SCHEDULE 1
- PUBLIC CONSERVATION AND RESOURCE ZONE
- PUBLIC PARK AND RECREATION ZONE
- PUBLIC USE ZONE - SERVICE AND UTILITY
- RURAL CONSERVATION ZONE
- RURAL CONSERVATION ZONE - SCHEDULE 10
- RURAL CONSERVATION ZONE - SCHEDULE 4
- SPECIAL USE ZONE - SCHEDULE 3
- TOWNSHIP ZONE
- TRANSPORT ZONE 2 - PRINCIPAL ROAD NETWORK
- TRANSPORT ZONE 3 - SIGNIFICANT MUNICIPAL ROAD
- URBAN GROWTH ZONE - SCHEDULE 2



Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 55

Barwon Water
Barwon Water RRON Functional Design

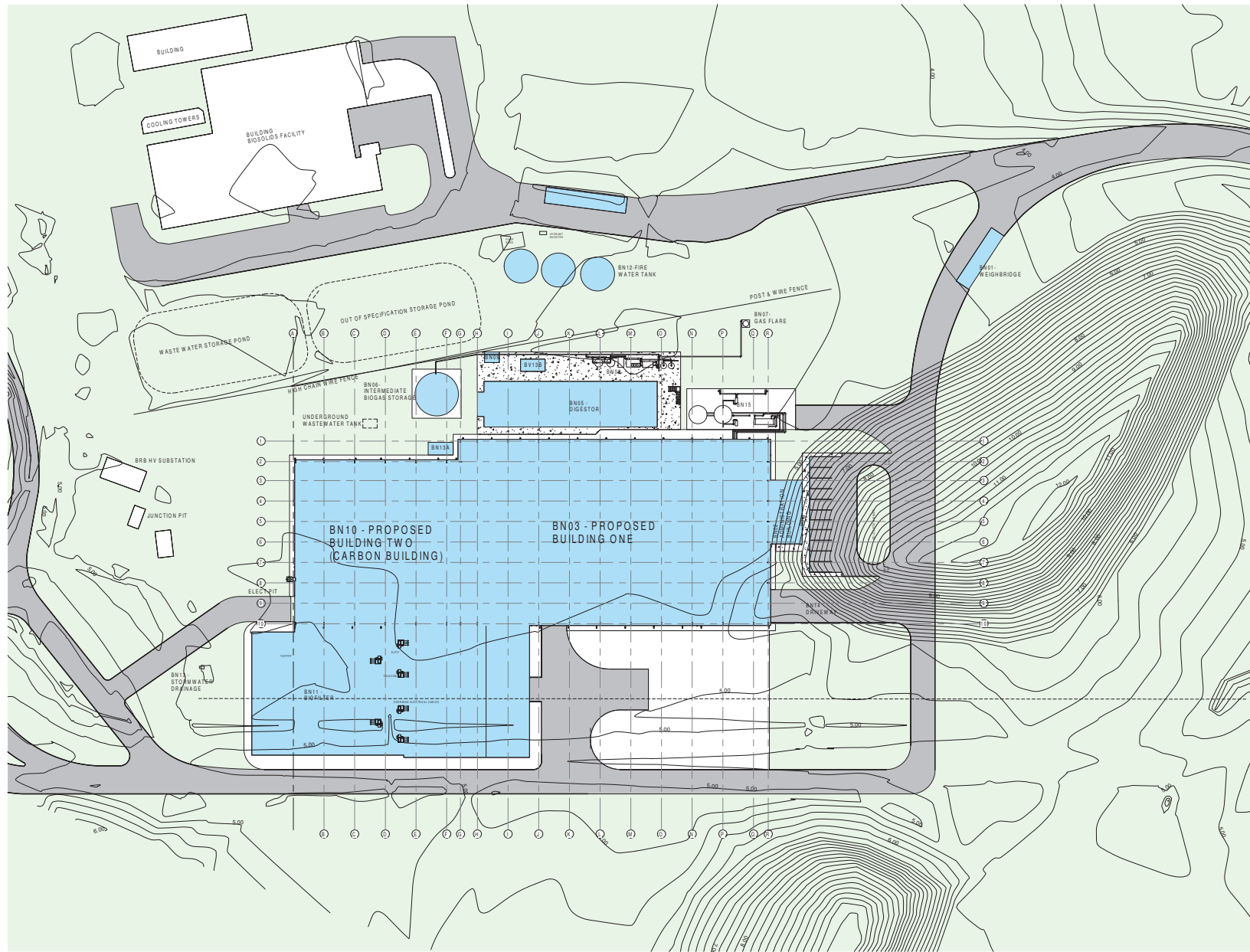
Site Location

Project No. **12585384**
Revision No. -
Date. **21/11/2023**

FIGURE 1

Bill N of Bill	Element	unit	BN 00
A	ROADS & PAVING		
A1	Roadworks	m2	
A2	Geotextile/vapour barrier	m2	
A3	Curbstones	m1	
A4	Road gullies and channel gutters	m1	
A5	Pavements for personnel car parking and pedestrian walks	m2	
A5	Street lighting	nos	
A7	Exterior Fire Fighting Main Ring and Hydrants	m1	
B	SOFT LANDSCAPING		
B1	Landscaping	m3	
B2	Green areas planting and seeding	m2	
C	FENCING & GATES		
C1	Fence	m1	
C2	Gates and barriers	nos	

- Notes:**
- Applies for layout A
 - The detailing and constructing provisions (concrete slab thickness, sand bedding thickness, gravel bed thickness...) must be adapted according to the conditions (soil, climate) and as per Australian standards and regulations.
 - This design should be viewed along with the structural engineer specifications prior to construction.
 - Water for cleaning hose reel provided by recycle water / rain water tank. - Water for fire fighting hose reel with in the building and fire hydrant provided by the fire water tank network.
 - Location of processing equipment is subject to adjustment during detail engineering.



① SITE PLAN
1:500

LEGEND	
	Proposed Building Works
	Landscaped Areas - Turf
	Hard Stand Area - Paving
	Hard Stand Area - Asphalt
	Gravel

FIGURE 2

Project-No BN722100	ProjectName BARWON WATER RRON	SITE PLAN	
As indicated		Scale 1/1	Revision BN00
Basic Design		Author	Checked
1/1		Drawn	Approved
NALG		Mitsubishi Inova	

2.3 Surrounding environment

2.3.1 Terrain

Surface elevation varies on site from approximately 1 to 18 mAHD. In general, the elevation of the site increases towards the south and east: elevation increases from approximately 6 to 10 mAHD north to south and 3 to 10 mAHD from west to east.

One slightly elevated area (20 mAHD) was identified in the southwest corner of the site.

2.3.2 Climate and meteorology

Based on the Breakwater (Geelong Racecourse) Bureau of Meteorology monitoring site (087184), the region generally has warm summers (mean maximum temperature in January of 26.1 °C) and cool winters (mean maximum temperature in July of 14.4 °C). The annual median rainfall is 516 mm.

Detailed wind data is described in the Air Quality Assessment report. GHD has been provided meteorological data (one and a half years at one-hour intervals) from the site for the years of 1998 to 1999.

The average wind rose for the entire data period is shown in Figure 3. The wind distributions show the following features:

- The predominant annual average wind directions are from the west segment comprising 16% of all incident winds
- The incidence of westerly winds is significantly higher than easterlies occurring >2% of the time
- The average wind speed measured was 3.7 m/s
- Light winds (<2 m/s) comprised 25% of the monitoring period
- The observed wind speed distribution indicates that the largest proportion of high wind speeds (> 5 m/s) are from the south and west sectors
- The largest proportion of light winds (<2 m/s) are from the west (~6%)

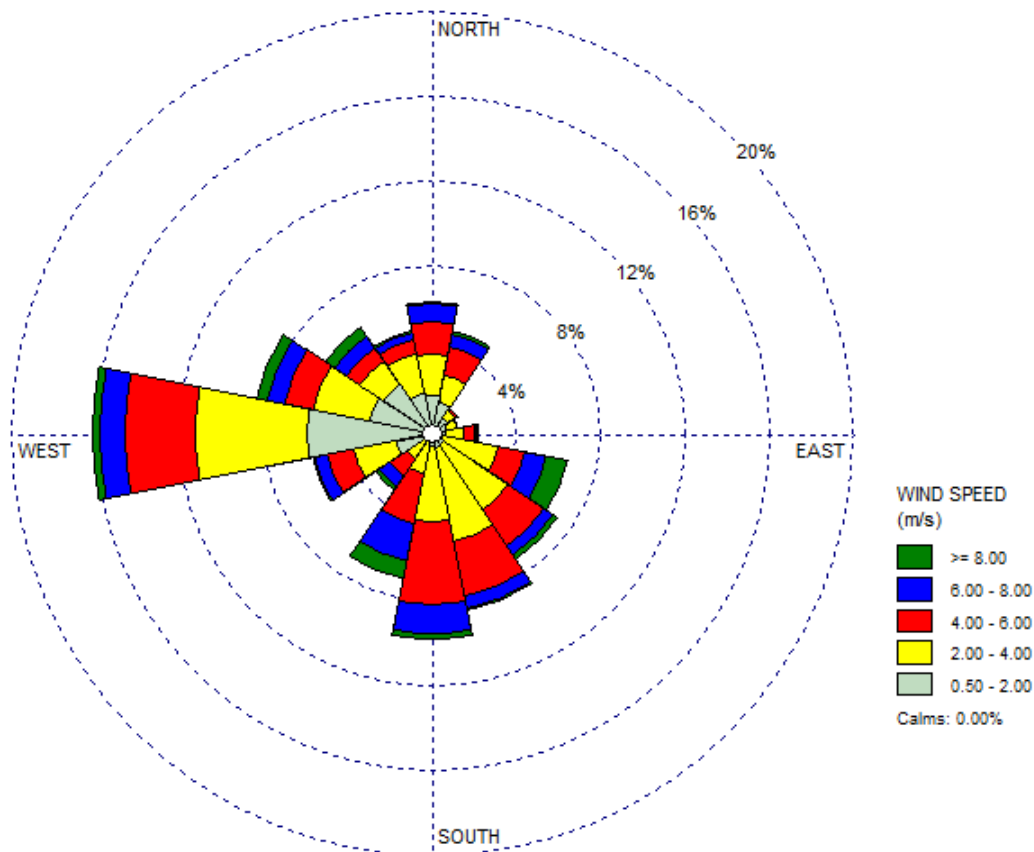


Figure 3 Wind rose (1998 – 1999)

2.3.3 Regional geology

The 1:50,000 scale regional geology for the RRON facility indicates that it is primarily underlain by the Late Tertiary age (Miocene to Holocene) Newer Volcanic Group (Neo), with more recent Quaternary age (Pleistocene to Holocene) swamp and lake deposits (Qm1) located to the north-east.

The Newer Volcanic Group typically comprises basalt rock (resulting from historic basalt flows from eruptive sources) with this material often weathered to high plasticity clay near the surface. The depth to rock head is highly variable, as is the weathering and strength of the rock material and basaltic boulders and cobbles (“floaters”) are commonly encountered within the residual clay profile.

The overlying alluvial swamp and lake deposits can also vary significantly depending on the geological origin and age of the materials and geomorphological factors. The associated ground profile can include sands, gravels, silts, clay, and organic materials and these may be variably deposited and of variable consistency (strength).

2.3.4 Hydrogeology

A review of the Visualising Victoria’s Groundwater (VVG) website GIS database indicates that groundwater at the RRON facility is expected to be between 5 to 10 m below ground level (BGL). The Victorian State Government Groundwater Resource Report for the site lists the underlying aquifers and aquitards as follows:

- 0 to 13 m BGL – Upper Tertiary / Quaternary Basalt (fractured rock) (UTB)
- 13 to 14 m BGL - Upper Tertiary Aquifer (marine) (UTAM)
- 14 to 134 m BGL - Upper Mid-Tertiary Aquitard (UMTD)
- 134 to 296 m BGL – Lower Mid-Tertiary Aquitard (LMTD)
- 296 to 496 m BGL – Mesozoic and Palaeozoic Bedrock (BSE)

Groundwater bore search

A groundwater search using the VVG database showed four (4) registered groundwater bores located within the Black Rock WRP site boundary and two (2) registered groundwater bores within 2 km to the south-west of the site. The bore details are shown in Table 2.

Table 2 Groundwater bores located on site and within 2 km of the site

Bore ID	Status	Year constructed	Depth	Bore type
56391	Not monitored	1985	10.2	Unknown
56392	Not monitored	1985	10.2	Unknown
56393	Not monitored	1985	6.15	Groundwater Investigation
56394	Not monitored	1985	6.1	Groundwater Investigation
WRK057247	Not monitored	2010	360	Observation
WRK989245	Not monitored	Unknown	25	Unknown

Groundwater segment

Groundwater beneath the RRON facility will be within the Upper Tertiary / Quaternary Basalt aquifer, which is expected to have a salinity of 1001 – 3,500 mg/L Total Dissolved Solids. Based on the VVG database, groundwater at the site is likely to be classified as “Segment B”, which applies to groundwater with TDS concentrations of between 1001 and 3,500 mg/L. This categorisation is in accordance with the Environmental Reference Standard (ERS), under which Victoria’s groundwater is assessed.

A Groundwater Bore Review for Barwon Water was completed by RMCG in March 2016 for the Black Rock WRP. In this report, six (6) bores were identified within the Black Rock WRP, of which 2 were decommissioned. The purpose of these onsite bores was listed as determining groundwater flow gradient and groundwater quality.

The RMCG Bore Review also summarised site-specific groundwater data. Groundwater at the site was found to be relatively shallow, occurring between 0.4 and 7.2 m below top of casing (surveyed heights of casing were not provided). The lowest measured salinity, 4,900 mg/L, was greater than that indicated by regional groundwater salinity. Based on the groundwater salinity measured at the site the groundwater is classified as “Segment C”.

Under Segment C, the environmental values of groundwater requiring protection beneath the site and surrounding region include:

- Maintenance of ecosystems
- Stock watering
- Industrial water use
- Primary contact recreation
- Buildings and structures

Groundwater flow direction

The RCMG 2016 report indicates that groundwater flow is inferred to be to the north-east, i.e., away from Bass Strait as would be expected from the regional topography. RMCG state that this inferred direction of groundwater flow is ‘not unexpected given the proximity of the site to the coast and the influence of tidal action of groundwater movement/depth’.

2.3.5 Surface water bodies

Lake Connewarre is located to the north of the Black Rock WRP site approximately 2 km away. Lake Connewarre is a large, shallow, estuarine lagoon linked to the sea by the mangrove-fringed channel of the Lower Barwon River. It contains a diverse range of wetlands and vegetation including mangrove and saltmarsh communities.

Thompson Creek Estuary is located to the east of the Black Rock WRP site approximately 1 km away. The Thompson Creek Estuary has a catchment area of 2795 Ha, and is approximately 5.5km in length. It is part of the important Karaaf Wetlands.

The ocean is located to the immediate south of the Black Rock WRP. The proposed RRON facility will be located approximately 300m from the water’s edge.

2.4 Sensitive receptors

The definition of a sensitive receptor or sensitive land use is defined by EPA¹ (2022, p. 46) as:

‘Any land use that requires a focus on protecting human health and wellbeing, local amenity and aesthetic enjoyment.’ Examples of such sensitive land uses include but not limited to, *‘dwellings, hospitals, aged care facilities, education centres, childcare centres, places of worship, corrective institutions’*.

A sensitive land use is further defined in Publication 1961 (EPA Victoria 2021, p. 8) as:²

“A land use where it is plausible for humans to be exposed over durations greater than 24 hours, such as residential premises, education and childcare facilities, nursing homes, retirement villages, hospitals.”

The closest residential areas from each direction of the site have been identified and summarised in Table 3. The closest sensitive receptor is located approximately 370 m to the West of the site. The closest identified sensitive receptors have been identified displayed in Figure 4.

¹ EPA Publication 1949, Separation distance guideline (2022)

² The definition provided in the Consultation Draft version of EPA Publication 1961 may change in the final revision of the guideline, however, any changes are not expected to affect the outcomes of this assessment.

Table 3 Closest sensitive receptors

Receptor ID	X	Y	Address	Distance to RRON facility	Direction from site
1	272625.409	5758539.292	1A Horwood Dr, Breamlea VIC 3227	1715 m	SW
2	272769.442	5759572.895	291 Breamlea Rd, Connewarre VIC 3227	1265 m	W
3	272832.503	5760162.086	211- 229 Breamlea Rd, Connewarre VIC 3227	1345 m	NW
4	273741.476	5761095.686	262- 290 Bluestone School Rd, Connewarre 3227	1510 m	N
5	274571.063	5760722.451	342 - 400 Bluestone School Rd, Connewarre 3227	1076 m	NNE
6	274995.3252	5760630.285	550 Thirteenth Beach Rd, Connewarre 3227	922 m	NNE

2.5 Population profile

EPA Publication 1961 states that in addition to the identification of sensitive land uses, it is useful to consider additional descriptive data to characterise the potentially exposed population, such as the size and vulnerability of the exposed population.

The population density of an area is reported by the Australian Bureau of Statistics (ABS) by Mesh Blocks. The relevant Mesh Block for the site is 20632001270, with an area of 1.469 m² and 0 persons living in the block. The relevant sensitive receptors surrounding the site (Greater Geelong) have a population density of 191.2 persons per km² as reported in the 2016 census. This is more than the surrounding areas of Surf Coast, Golden Plains and Moorabool which have a population density of 19.6, 8.1 and 15.5 persons per km² respectively. However, the population density in Wyndham is much larger than these areas with a population density of 420.8 persons per km² respectively. Overall, the population density surrounding the site is considered low.

The vulnerability of a community is classified through the Socio-Economic Indexes for Areas (SEIFA) by the ABS, which ranks areas according to their relative socio-economic advantages and disadvantages. Of particular interest is the index of relative socio-economic disadvantage (IRSD) for the statistical area level 1 (SA1). EPA Publication 1961 states that if the IRSD score is in quintile one (most disadvantaged), then the population is likely to be particularly vulnerable to pollution. The SEIFA index for the area surrounding the site has a quintile rating of five (i.e., least disadvantaged) and therefore the population surrounding the site is not expected to be particularly vulnerable to pollution.



Legend

- Site Boundary
- Sensitive receptors

<p>Paper Size ISO A4</p> <p>0 0.25 0.5 km</p> <p>Map Projection: Transverse Mercator Horizontal Datum: GDA2020 Grid: GDA2020 MGA Zone 55</p>			<p>Barwon Water</p> <p>Barwon Water RRON Functional Design</p> <p>Closest Sensitive Receptors</p>	<p>Project No. 12585384 Revision No. - Date. 21/11/2023</p>
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FIGURE 4

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Print Date: 21/11/2023
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Data Source: Google Earth Imagery 2023. Created By: ylm

Figure 4 *Sensitive receptors*

3. Risk identification and management

3.1 General

A risk management framework has been developed for the proposed RRON facility based on the process described in EPA Publication 1695.1 *Assessing and controlling risk: A guide for business*.

3.2 Environmental hazard identification

To identify potential environmental hazards associated with operation of the proposed RRON facility, an assessment of the potential sources and impact pathways has been undertaken in Table 4 to identify the key potential hazards. The RRON facility environmental controls to prevent or mitigate the hazards are also shown in Table 4.

The potential environmental hazards were identified based on technical assessment reports for air, noise, greenhouse gas (GHG) and waste emissions, which were prepared to assess the environmental impact of the proposed RRON facility. Potential environmental hazards to land and groundwater and surface water have also been identified.

The hazard identification has considered operations of the RRON facility in a steady state and also under abnormal operation scenarios. For abnormal operation scenarios the following atmospheric emission sources may exist:

- Biogas flare: the flare is used to manage the overproduction of biogas from the digester to prevent an overpressure and emission to the atmosphere. The flare will only be engaged in case of emergencies (i.e., power failure which prevents biogas supply downstream), during shutdowns associated with the biogas utilisation equipment, or to manage unexpected peak production of biogas. The peak biogas production is expected to be 625 Nm³/hr of biogas (assuming 50% CH₄, 15% safety factor).
- Biogas overpressure valve: operates only if users are not consuming biogas and if the flare is in fault. It is connected directly to the digester and is used for the over-and-under pressure protection of the digester. The safety valve is set at an opening pressure of 55 mbar. This is only expected to operate in emergency.
- Digester bursting disc: utilised as a safeguarded by a bursting disc to a pressure of 100 ± 20 mbar. When all other safety measures fail to perform, this membrane ruptures, and the biogas escapes into the open air in a controlled way.
- Gasification emergency stack: the emergency stack release scenario only occurs in abnormal plant operation under emergency conditions (i.e., there is total power cut-off, main fan failure, or higher-than-critical biofilter inlet air temperature)

Table 4 Potential environmental hazards, pathways, impacts on receptors and controls to prevent/mitigate hazard

Item	Environmental Aspect	Source description	Pathway (hazard initiating event)	Control to prevent and mitigate hazard
1	Air	<ul style="list-style-type: none"> Emissions from carbonisation of waste material (including particulates, NO_x, SO₂, SO₃, CO, VOCs, HCl, HF, dioxins and furans, PAHs (BaP), H₂S, mercury, hexavalent chromium, PFAS, copper, lead, nickel, zinc. 	<ul style="list-style-type: none"> Release of treated air from gasification plant out of the biofilter stack via air pollution control system 	<ul style="list-style-type: none"> Air dispersion modelling results indicate the emissions will be compliant with the adopted air pollution assessment criteria (APACs). Refer to the Air Quality Assessment provided as Appendix H of the main application. Thermal oxidiser (at Temperature of 850°C to 1000°C, retention time 1-2 seconds) Adiabatic cooling (air is washed in the scrubber to remove particulate matter and lower temperature) Acid scrubber (flue gas is combined with building air and the ammonia content in the air is reduced by chemical scrubbing with (sulfuric) acid on low pH level) Caustic scrubber (malodorous compounds are removed from the air by spraying caustic water in combination with an oxidative agent in a dual configuration scrubbing tower system) Deodorized air is boosted by an air treatment fan towards the biofilter for odour treatment Air from the boosted from the biofilter via a fan to be released out stack at a height of 13m Continuous emissions monitoring for particulates, NO_x and CO Monitoring of full suite of contaminants during commissioning Ongoing monitoring for contaminants of concern
2	Air	<ul style="list-style-type: none"> Combined odour emissions from pre-treatment, PFAD, digestate drying and carbonisation of feedstocks (FOGO, WRP sludge, bioprill, commercial and industrial wastes) 	<ul style="list-style-type: none"> Release of odour emissions out of the biofilter stack via air pollution control system 	<ul style="list-style-type: none"> Air Quality Assessment which included a Level 2 Odour Assessment determined an assessment score of 6 indicating the activity is low risk for odour Air dispersion modelling was also undertaken for odour which provided further evidence on the risk being low for odour Pre-treatment building and digestate processing building is maintained under constant negative pressure to control fugitive odours and dust, with the extraction system targeting three air exchanges per hour. The extracted air is directed to the carbonisation plant building where it passes through the rotary dryer and then air scrubber before final odour treatment at the biofilter. Biofilter will be designed and maintained to comply with EPA Publication 1880: Biofilter design and maintenance Pre-treatment building will have two automated rapid action roller doors at the entry and exit locations these are activated by under floor sensors Digestate outloading area will have a rapid action roller door, operated using manual controls. A non-rapid airlock roller door will separate the dewatering press area from the drying area. This door will prevent the transfer of hot, humid, and ammonia-rich air from the drying area into the pre-treatment building.

Item	Environmental Aspect	Source description	Pathway (hazard initiating event)	Control to prevent and mitigate hazard
				<ul style="list-style-type: none"> – Digestate dewatering, drying and loading of trucks is undertaken within an odour controlled building – Offsite transport of digestate will take place using heavy rigid trucks, with watertight seals and impermeable cover over the material to prevent leaks and odour emissions during transport
3	Air	<ul style="list-style-type: none"> – Emissions from CHP engine and/or combustion of biogas at the biosolids drying facility (NOx is considered the dominant emissions) 	<ul style="list-style-type: none"> – Release of NOx emissions to the atmosphere via CHP engine stack or biosolids drying facility stack 	<ul style="list-style-type: none"> – Air dispersion modelling which gives consideration of cumulative emissions from all proposed RRON operations indicates combined NOx emissions will be compliant with APACs (i.e., 67% for combined NOx emissions from the facility including background NOx levels). Refer to the Air Quality Assessment provided as Appendix H of the main application. – Discharge of emissions via a stack
4	Air	<ul style="list-style-type: none"> – Emissions from biogas emergency flare (abnormal scenario) 	<ul style="list-style-type: none"> – Release combusted biogas from flare. The biogas flare will only be engaged under emergency conditions. The main foreseeable scenario where the flare will be required is a power failure that prevents biogas supply downstream. 	<ul style="list-style-type: none"> – Flare is used to manage an overproduction of biogas produced by the digester, and is part of the digester safety equipment to prevent an overpressure in the digester and biogas emissions into the environment – Full combustion of biogas in the flare. Based on HZI flares the emissions profile will consist of CO2 (9.5%), H2O (19%) and N2 (71.4) with emissions flow of 3,292 Nm³/hr and temperature of 55 °C
5	Air	<ul style="list-style-type: none"> – Gasification emergency stack release 	<ul style="list-style-type: none"> – The emergency stack release scenario only occurs in abnormal plant operation under emergency conditions (i.e., there is total power cut-off, main fan failure, or higher-than-critical biofilter inlet air temperature) 	<ul style="list-style-type: none"> – The case of power shut down, there will be almost no flow, with some heat emitted – In the case of biofilter overheating flue gas will be combusted in the thermal oxidizer but not be treated via the wet scrubber system
6	Air	<ul style="list-style-type: none"> – Digester burster disc (biogas release) 	<ul style="list-style-type: none"> – Utilised as a safeguard by a bursting disc to a pressure of 100 ± 20 mbar. When all other safety measures fail to perform, this membrane ruptures, and the biogas dissipates into the open air in a controlled way. 	<ul style="list-style-type: none"> – Emissions flow rate of 850 Nm³/hr and Temperature of 55 °C – Safe release of biogas as an emergency measure

Item	Environmental Aspect	Source description	Pathway (hazard initiating event)	Control to prevent and mitigate hazard
7	Air	<ul style="list-style-type: none"> – Biogas overpressure valve 	<ul style="list-style-type: none"> – Operates only if users are not consuming biogas and if the flare is in fault. It is connected directly to the digester and is used for the over-and-under pressure protection of the digester. The safety valve is set at an opening pressure of 55 mbar. 	<ul style="list-style-type: none"> – Emissions flow rate of 850 Nm³/hr and Temperature of 55 °C – Safe release of biogas as an emergency measure
8	Air	<ul style="list-style-type: none"> – Atmospheric emissions from the facility may be present in the air and deposited on ground 	<ul style="list-style-type: none"> – Deposition of particulates onto soil, including: <ul style="list-style-type: none"> • Direct dermal contact with soil/dust • Inhalation of dust • Incidental ingestion of soil/dust • Uptake into homegrown fruit and vegetable crops and the subsequent consumption of this produce • Uptake into chickens and the subsequent consumption of homegrown eggs • Uptake into livestock and the subsequent consumption of homegrown meat or milk – Deposition of particulates onto a roof, runoff into a rainwater tank and the subsequent consumption and domestic use of tank water 	<ul style="list-style-type: none"> – The human health risk assessment (HHRA) concluded that human health risk of nearby sensitive receptors is low and acceptable (refer Appendix I of the main application) – Robust air emissions controls (refer item 1)

Item	Environmental Aspect	Source description	Pathway (hazard initiating event)	Control to prevent and mitigate hazard
9	Noise	<ul style="list-style-type: none"> Noise generation from routine operation 24 hours a day 	<ul style="list-style-type: none"> Noise emitted beyond the site boundary above noise levels adopted for the facility 	<ul style="list-style-type: none"> The Noise Assessment report determined the noise levels for the RRON facility per the requirements of EPA Publication 1826.4. Modelling indicates that the noise levels for the RRON facility will be below the derived noise levels. Refer to Appendix J of the main application for the Noise Assessment. The pre-treatment building and carbonisation building will be cladded with Kingspan Architectural ribbed wall panels or equivalent to reduce noise emissions from the buildings to the surrounding environment Fans located outside the digestate drying area will have enclosures Noise controls such as reducers and enclosure of noisy equipment will be adopted as part of detailed design Low noise equipment will be adopted as part of detailed design such as direct drive motors, compressors, pumps and flares
10	Noise	<ul style="list-style-type: none"> Noise generation from internal truck movements delivering waste material to the RRON 	<ul style="list-style-type: none"> Noise emitted beyond the site boundary 	<ul style="list-style-type: none"> Modelling indicates that the noise levels for the RRON facility will be below the noise levels determined in the Noise Assessment per the requirements of EPA Publication 1826.4 The speed limit on internal roads for trucks at the RRON facility will be 20 km/h
11	Surface water, land and groundwater,	<ul style="list-style-type: none"> Leaks from liquid C&I organic wastes during delivery and storage 	<ul style="list-style-type: none"> Leakage from tanker unloading in off-load bay (liquids will be pumped from tankers into holding tanks in the off-load bay) Leakage from liquid C&I holding tanks due fault in tank or overflow 	<ul style="list-style-type: none"> Liquid C&I organic waste will be received in a designated liquid C&I bunded off-load bay any spills will be contained in the bund sump and pumped to the liquid holding tank From the off-load bay it will be pumped to a holding tank before being fed directly to the anaerobic digester Holding tanks will be designed with appropriate buffer storage Bund walls and floor will be concrete and joints will be sealed Bund will comply with EPA Publication 1698: <i>Liquid storage and handling guidelines</i>
12	Surface water, land and groundwater	<ul style="list-style-type: none"> Leakage of wastewater streams outside pre-treatment building from feedstocks and washdown of floors and process equipment 	<ul style="list-style-type: none"> Release of feedstock liquid and washdown water outside the pre-treatment building via vehicle rollover or runoff out of the entry/exit doors 	<ul style="list-style-type: none"> Feedstock is received in the enclosed receival building in the FOGO drop-off bunker Pre-treatment building will have two automated rapid action roller doors at the entry and exit locations these are activated by under floor sensors Spill kits to be provided Emergency spill procedures included in the operational environmental management plan

Item	Environmental Aspect	Source description	Pathway (hazard initiating event)	Control to prevent and mitigate hazard
13	Surface water, land and groundwater	<ul style="list-style-type: none"> – Leakage of wastewater streams outside digestate drying area from digestate liquid 	<ul style="list-style-type: none"> – Release of digestate liquid and washdown water outside the processing area via vehicle rollover or runoff out of the entry/exit doors 	<ul style="list-style-type: none"> – Digestate aeration process takes place within concrete bunkers to prevent runoff – Digestate out loading area will have a rapid action roller door, operated using manual controls – Offsite transport of digestate will take place using heavy rigid trucks, with watertight seals and impermeable cover over the material to prevent leaks and odour emissions during transport – Spill kits to be provided – Emergency spill procedures included in the operational environmental management plan
14	Surface water, land and groundwater	<ul style="list-style-type: none"> – Pipeline leaks from wastewater system for digestate liquid and washdown water generated in the pre-treatment building 	<ul style="list-style-type: none"> – Potential for leakage in pipeline or pump failure from digestate liquid or wastewater to be pumped to Black Rock WRP connection point 	<ul style="list-style-type: none"> – Pipelines will be designed to be impervious with suitable flow and pressure capacity based on proposed duty – Preventative maintenance program – Visual inspections – Spill kits to be provided – Emergency spill procedures included in the operational environmental management plan
15	Surface water, land and groundwater	<ul style="list-style-type: none"> – Leaks from underground wastewater storage tank 	<ul style="list-style-type: none"> – Wastewater will be pumped to an underground holding tank before being pumped to the Black Rock WRP. Potential for leakage from the underground wastewater tank due to fault in the tank or the tank reaching capacity. 	<ul style="list-style-type: none"> – Tank will be designed to be impervious with appropriate buffer storage – Preventative maintenance program – Visual inspections of underground tank – Emergency spill procedures included in the operational environmental management plan
16	Surface water, land and groundwater	<ul style="list-style-type: none"> – Chemical storage for sulfuric acid and caustic solutions (sodium hydroxide and sodium hypochlorite) for scrubber system 	<ul style="list-style-type: none"> – Failure of chemical storage bund 	<ul style="list-style-type: none"> – Chemicals will be stored in a bund designed to AS 1940:2017 <i>The storage and handling of flammable and combustible liquids</i> – Bund will comply with EPA Publication 1698: <i>Liquid storage and handling guidelines</i> – Incompatible substances will have localised containment in the bund – Spill kits will be located at the bund
17	Surface water	<ul style="list-style-type: none"> – Sediment laden runoff from surface water generation outside facility buildings 	<ul style="list-style-type: none"> – Sediment laden or contaminated runoff flowing to offsite waterways 	<ul style="list-style-type: none"> – Clean surface water from roadways and hard stand areas surrounding the site will be directed to a retention basin

Item	Environmental Aspect	Source description	Pathway (hazard initiating event)	Control to prevent and mitigate hazard
18	Waste	<ul style="list-style-type: none"> Contamination of the biochar end product 	<ul style="list-style-type: none"> Biochar is to be used as a soil enhancer if the biochar is contaminated (e.g., heavy metals, PFAS) this could lead to impacts when it applied to land as a soil enhancer product. 	<ul style="list-style-type: none"> Processing of higher risk feedstocks (i.e., biosolids) classified as RPW will be done in a controlled manner to prevent heavy metal and PFAS contamination of the biochar. This will include chemical testing of the biosolids before processing Chemical testing of biochar was undertaken at the Loganholme Gasification Demonstration Plant in 2020 with results included in a technical report³. The results of the biochar testing demonstrated that concentrations of PFAS compounds (including PFOS and PFOA) in the biosolid feedstock were reduced by a minimum of 91%. The Loganholme Demonstration Plant gasifier temperature operates at 600 - 650°C and the gasifier at the RRON will typically run around 720-850°C. An A16 permit or waste designation will be sought by Barwon Water for the supply and use of biochar as a soil enhancer As part of commissioning and ongoing operations, testing of the biochar material will be undertaken to confirm that the supply and use of the biochar will not present a risk to the environment and human health
19	Waste	<ul style="list-style-type: none"> Contamination of digestate 	<ul style="list-style-type: none"> Digestate trucked off-site to a local composting facility is contaminated (i.e., chemical and/or physical contamination) and therefore does not meet the requirements of EPA's Designation⁴ for low risk digestate 	<ul style="list-style-type: none"> The RRON facility is expected to process low risk feedstocks e.g., municipal FOGO Organic wastes processed via the PFAD will meet the pasteurisation requirements of the Designation for low risk feedstocks requirements (due to thermophilic anaerobic digestion process at ≥55°C). As part of commissioning and ongoing operations, testing of the digestate will be undertaken to confirm it meets the chemical and physical contaminant limits listed in Appendix 1 of the Designation. Storage and processing of pasteurised digestate takes place in a separate building to unpasteurised feedstock receivals to prevent cross-contamination.
20	Waste	<ul style="list-style-type: none"> Contamination of incoming feedstocks with prohibited wastes (ie. wastes the facility is not licensed to accept) 	<ul style="list-style-type: none"> Biochar produced via the carbonisation of the feedstock (biosolids, bioprill and green waste) is to be used as a soil enhancer if the biochar is contaminated (e.g., by heavy metals, PFAS) this could lead to environmental impacts when it applied to land as a soil enhancer product. 	<ul style="list-style-type: none"> Wastes will only be accepted from approved suppliers Incoming wastes will be inspected at the site weighbridge, at waste receiveal bunker and during pre-treatment sorting and screening processes Robust air emissions controls (refer item 1) As part of commissioning and ongoing operations, testing of the biochar material will be undertaken to confirm that the supply and use of the biochar will not present a risk to the environment and human health

³ Loganholme Demonstration Biosolids Gasification Facility Technical Report 2020

⁴ <https://www.gazette.vic.gov.au/gazette/Gazettes2023/GG2023G051.pdf#page=13>

Item	Environmental Aspect	Source description	Pathway (hazard initiating event)	Control to prevent and mitigate hazard
21	Greenhouse gas	<ul style="list-style-type: none"> Greenhouse gases emitted from combustion of fuels, biogas and syngas 	<ul style="list-style-type: none"> Greenhouse gases emitted from combustion of fuels, biogas and syngas contributing to climate change impacts 	<ul style="list-style-type: none"> The RRON facility will be carbon positive as outlined in the Greenhouse Gas Assessment (refer Appendix M of the main application) The net result of the project is an emissions saving of ~330,000 tCO₂-e over the life of the project (25 years). The net result is achieved by the diversion of waste to avoid landfill emissions, sequestering carbon as biochar and generating renewable energy.
22	Fire	<ul style="list-style-type: none"> Loss of containment of biogas from anaerobic digester, biogas pipework or biogas storage leads to combustion of biogas in an uncontrolled manner Fire in the feedstock 	<ul style="list-style-type: none"> Combustion of biogas in an uncontrolled manner leads to fire generation at the facility and uncontrolled air emissions due to the shutdown of the facility and potential for waste feedstocks to ignite leading to further uncontrolled air emissions Feedstock ignites from prohibited item in the feedstock (e.g., lithium ion battery) 	<ul style="list-style-type: none"> The consequence assessment results for the scenario examined around the loss of containment of biogas from the anaerobic digester, biogas pipework or biogas storage found there are no impacts to personnel anticipated. Refer to Fire Safety Study provided in Appendix L of the main application. Solid waste feedstock will generally have a high moisture content (i.e., food waste and biosolids) The facility will include a gaseous fire suppression system and other fire controls

4. Risk assessment

4.1 Method

A qualitative risk assessment has been undertaken using data from the desktop assessment. The risk assessment method follows the general method outlined in EPA Publication 1695.1 *Assessing and controlling risk: A guide for business*.

A risk assessment has been performed based on the proposed control measures to be implemented at the site to identify the residual risks. If the residual risks are identified as medium, high or very high then further management actions are likely to be required to manage the risk.

4.2 Likelihood descriptors

Table 5 lists the likelihood categories devised for assessing risks to the environment for the proposed RRON facility. The descriptors adopted for this risk assessment are similar to the descriptors set out in EPA Publication 1321.2, with the revisions having the intention of providing greater clarity with regard to this assessment and reducing the potential for overlap.

The likelihood rankings are limited to “highly unlikely”; where it is considered implausible that an adverse effect would occur the situation is not considered further.

Table 5 Qualitative measure of likelihood

Rating	Descriptor	Description
5	Certain	Expected to happen regularly under normal circumstances
4	Likely	Expected to happen at some time
3	Possible	May happen at some time
2	Unlikely	Not likely to happen in normal circumstances
1	Rare	Could happen but probably never will

4.3 Consequence descriptors

The consequence descriptors in EPA Publication 1695.1 are generic. For the purposes of assessing risk for the site and the surrounding area, the descriptors have been revised to better consider the range of impacts that can occur from the RRON facility, with reference to the various most relevant segments of the environment and pathways for impact, and the various regulatory requirements, policies and guidance documents. The latter include:

- AS/NZS ISO 31000:2009 – Risk Management: Principles and Guidelines
- Environmental Reference Standard, No. S245, Gazette 26 May 2021
- Environmental Protection Regulations 2021

The revised descriptors adopted for this risk assessment are listed in Table 6.

Table 6 Qualitative measure of consequence / impact

Level	Descriptor	Event Description
5	Catastrophic	Significant impact to the wider community / serious side effects to persons, or long-term environmental damage / serious effects on environmental values with environmental impact within and beyond site-boundary; site shutdown and/or immense financial loss
4	Significant	Significant impact on local community / evacuation of local populace / medical treatment required, or medium to long-term environmental damage or serious effects on environmental values with environmental impact within and beyond site boundary; extensive clean-up with external assistance required and major financial loss
3	Moderate	Some impact upon staff or short term environmental damage on site or minor short term environmental damage off site; external complaints (greater than 3 per year); minimal clean-up required and large financial loss
2	Minor	Minor effect on a small number of staff; minor environmental damage; no distinguishable off-site effects; occasional external complaints (less than 3 per year); minimal financial costs
1	Insignificant	No impact expected, or minor impact contained within site and requires no action; no off-site effects

4.3.1 Risk matrix and risk ratings

Table 7 presents the risk matrix adopted for this assessment. The matrix has been based on the EPA risk matrix presented in EPA Publication 1695.1, and has been revised to result in risk rankings that reflect the level of risk expected to result from the various combinations of likelihood and consequence relevant to the RRON facility.

In reviewing and adjusting the EPA matrix, the following considerations applied:

- Where the likelihood of an event (consequence) occurring is considered to not be plausible, this will not be considered
- Where consequences are considered to be “insignificant”, the risk is ranked as “low” regardless of the likelihood
- Where consequences are considered to be “catastrophic”, the risk is ranked as “extreme” if this is judged to be “likely” or “certain”; “high” if this is judged to be “possible” or “unlikely”, and “medium” if it is judged to be “rare” (but plausible)

Table 7 Risk Matrix

Consequence		Likelihood				
		A	B	C	D	E
		Certain	Likely	Possible	Unlikely	Rare
1	Catastrophic	E	E	H	H	M
2	Significant	E	H	H	M	M
3	Moderate	H	H	M	M	L
4	Minor	H	M	M	L	L
5	Insignificant	L	L	L	L	L

The following definitions of risk ratings are applied:

- Extreme – Totally unacceptable level of risk. Stop work and/or take action immediately
- High – High risk, immediate action required by site management
- Medium – Can be acceptable if controls are in place. Attempt to reduce to low
- Low – Acceptable level or risk. Attempt to eliminate risk but higher risk levels take priority

5. Conclusions

A qualitative risk assessment has been undertaken using data from the desktop assessment. The risk assessment method follows the general method outlined in EPA Publication 1695.1 Assessing and controlling risk: A guide for business.

The risk assessment register is included in Appendix A.

The risk assessment findings following implementation of the proposed environmental controls to prevent or mitigate the hazard are as follows:

- Seven risks associated with air emissions were found to be low with one risk deemed medium
- Two risks associated with noise emissions were found to be low
- Seven risks associated with land, surface water and groundwater impacts were found to be low
- One risk associated with waste was found to be low and two risks were deemed medium
- One risk associated with greenhouse gas emissions was found to be low
- One risk associated with fire was found to be low

The medium risks identified in the risk assessment are shown in Table 8 and additional controls are recommended to be implemented as part of the design, commissioning and operation of the facility for these risks. The existing controls are outlined in Table 4 and in the risk assessment register.

Table 8 *Medium risks and controls*

Item	Aspect	Description of risk	Recommended additional controls
5	Air emissions	The emergency stack release scenario only occurs in abnormal plant operation under emergency conditions (i.e., there is total power cut-off, main fan failure, or higher than critical biofilter inlet air temperature).	<ul style="list-style-type: none"> – As part of detailed design, a bypass of the emergency stack release to the scrubber system should be considered in circumstances where the biofilter inlet air temperature is higher than critical If an emergency stack release occurs the cause of the release should be investigated and reasons for the release should be documented. Controls should then be put in place to prevent or mitigate an emergency release occurring again in the future.
18	Waste	Biochar produced via the carbonisation of the feedstock (biosolids, bioprill and green waste) is to be used as a soil enhancer if the biochar is contaminated (e.g., by heavy metals, PFAS) this could lead to environmental impacts when it is applied to land as a soil enhancer product.	<ul style="list-style-type: none"> – An A16 permit or waste designation will be sought by Barwon Water for the supply and use of biochar as a soil enhancer or for other purposes – As part of commissioning and ongoing operations, testing of the biochar material will be undertaken to confirm that the supply and use of the biochar will not present a risk to the environment and human health – A separate biochar management and monitoring plan will be prepared before operations commence to outline the testing requirements of the biochar and document processes to limit the potential chemical contamination of the biochar. The plan should also document procedures associated with any changes to the carbonisation feedstocks to monitor and control risks associated with this. It should also include chemical testing of the biosolids before processing.
19	Waste	Digestate trucked off-site to a local composting facility is contaminated (i.e., chemical and/or physical contamination) and therefore does not meet the requirements of EPA's Designation for low risk digestate	<ul style="list-style-type: none"> – As part of commissioning and ongoing operations, testing of the digestate will be undertaken to confirm it meets the chemical and physical contaminant limits listed in Appendix 1 of the Designation – A separate digestate management and monitoring plan will be prepared before operations commence to outline the testing requirements of the digestate and document processes to limit potential physical and/or chemical contamination of the digestate. The plan should also document procedures associated with any changes to the PFAD feedstocks to monitor and control risks associated with this.

Appendices

Appendix A

Risk assessment register

Client: Barwon Water
Project name: Barwon Water RRON Development Licence Application
Project number: 12585384
Date: 9/08/2024
Prepared by: DQ
Reviewed by: AG

Item #	Category	Aspect or Source	Issue Description	Potential pathways	Receptors	Impact Description	Controls to prevent or mitigate risk	Residual Risk Assessment after Existing Controls Applied			Comment
								Likelihood	Consequence	Risk Ranking	
1	Air	Emissions from carbonization of waste material (including particulates, NOx, SO2, SO3, CO, VOCs, HCl, HF, dioxins and furans, PAHs (BaP), H2S, mercury, hexavalent chromium, PFAS, copper, lead, nickel, zinc.	If emissions exceed air pollution assessment criteria (APACs) it is a licence non-compliance and potential impacts to human health and the environment beyond the site boundary.	-Release of treated air from carbonisation out of the stack via air pollution control system that exceed APACs	Local population and sensitive receptors of site boundaries (refer to Air Quality Assessment for a description of local population)	-Community complaints -Breach of licence -Adverse impacts to environment and health of sensitive receptors beyond the boundary of the site	-Thermal oxidiser (at Temperature of 850°C to 1000°C, retention time 1-2 seconds) -Adiabatic cooling (air is washed in the scrubber to remove particulate matter and lower temperature) -Acid scrubber (flue gas is combined with building air and the ammonia content in the air is reduced by chemical scrubbing with (sulfuric) acid on low pH level) -Caustic scrubber (malodorous compounds are removed from the air by spraying caustic water in combination with an oxidative agent in a dual configuration scrubbing tower system) -Deodorized air is boosted by an air treatment fan towards the biofilter for odour treatment -Air from the boosted from the biofilter via a fan to be released out stack at a height of 13m -Continuous emissions monitoring for particulates and NOx -Monitoring of full suite of contaminants during commissioning -Ongoing monitoring for contaminants of concern	Unlikely	Minor	Low	Air dispersion modelling results indicate the emissions will be compliant with the adopted air pollution assessment criteria (APACs). Refer to the Air Quality Assessment provided as Appendix H of the main application.
2	Air	Combined odour emissions from pre-treatment, PFAD and carbonisation of feedstocks (FOGO, WRP sludge, bioprill, commercial and industrial wastes)	If emissions odour exceeds 500 odour units potential impacts to human health and the environment beyond the site boundary. Licence non-compliance	Release of odour emissions out of the biofilter stack via air pollution control system that exceeds 500 odour units	Local population and sensitive receptors of site boundaries (refer to Air Quality Assessment for a description of local population)	-Community complaints -Breach of licence -Adverse impacts to environment and health of sensitive receptors beyond the boundary of the site	-Pre-treatment building and digestate processing building is maintained under constant negative pressure to control fugitive odours and dust, with the extraction system targeting three air exchanges per hour. The extracted air is directed to the carbonisation plant building where it passes through the rotary dryer and then air scrubber before final odour treatment at the biofilter. -Biofilter will be designed and maintained to comply with EPA Publication 1880: Biofilter design and maintenance -Pre-treatment building will have two automated rapid action roller doors at the entry and exit locations these are activated by under floor sensors -Digestate outloading area will have a rapid action roller door, operated using manual controls. A non-rapid airlock roller door will separate the dewatering press area from the drying area. This door will prevent the transfer of hot, humid, and ammonia-rich air from the drying area into the pre-treatment building. -Digestate dewatering, drying and loading of trucks is undertaken within an odour controlled building -Offsite transport of digestate will take place using heavy rigid trucks, with watertight seals and impermeable cover over the material to prevent leaks and odour emissions during transport.	Unlikely	Minor	Low	-Air Quality Assessment which included a Level 2 Odour Assessment determined an assessment score of 6 indicating the activity is low risk for odour -Air dispersion modelling was also undertaken for odour which provided further evidence on the risk being low for odour
3	Air	Emissions from CHP engine and/or combustion of biogas at the biosolids drying facility (NOx is considered the dominant emissions)	Potential for licence non-compliance and impacts to human health and the environment beyond the site boundary.	Release of NOx emissions to the atmosphere via CHP engine stack or biosolids drying facility stack	Local population and sensitive receptors within and outside of site boundaries	-Community complaints -Breach of licence -Adverse impacts to environment and health of sensitive receptors beyond the boundary of the site	-Discharge of emissions via stack	Unlikely	Minor	Low	-Air dispersion modelling which gives consideration of cumulative emissions from all proposed RRON operations indicates combined NOx emissions will be compliant with APACs (ie. 67% for combined NOx emissions from the facility including background NOx levels). Refer to the Air Quality Assessment provided as Appendix H of the main application
4	Air	-Emissions from biogas emergency flare (abnormal scenario)	Potential for licence non-compliance and impacts to human health and the environment beyond the site boundary.	-Release combusted biogas from flare. The biogas flare will only be engaged under emergency conditions. The main foreseeable scenario where the flare will be required is a power failure that prevents biogas supply downstream.	Local population and sensitive receptors within and outside of site boundaries	-Community complaints -Breach of licence -Adverse impacts to environment and health of sensitive receptors beyond the boundary of the site	-Flare is used to manage an overproduction of biogas produced by the digester, and is part of the digester safety equipment to prevent an overpressure in the digester and biogas emissions into the environment. -Full combustion of biogas in the flare. Based on HZI flares the emissions profile will consist of CO2 (9.5%), H2O (19%) and N2 (71.4) with emissions flow of 3,292 Nm3/hr and temperature of 55 °C.	Unlikely	Minor	Low	Abnormal scenario not likely to happen in normal circumstances
5	Air	Gasification emergency stack release	Potential for licence non-compliance and impacts to human health and the environment beyond the site boundary.	The emergency stack release scenario only occurs in abnormal plant operation under emergency conditions (i.e. there is total power cut-off, main fan failure, or higher-than-critical biofilter inlet air temperature)	Local population and sensitive receptors within and outside of site boundaries	-Community complaints -Breach of licence -Adverse impacts to environment and health of sensitive receptors beyond the boundary of the site	-The case of power shut down, there will be almost no flow, with some heat emitted -In the case of biofilter overheating flue gas will be combusted in the thermal oxidizer but not be treated via the wet scrubber system	Unlikely	Moderate	Moderate	Abnormal scenario not likely to happen in normal circumstances Emissions may exceed APACs due to bypassing the wet scrubber system and biofilter

Item #	Category	Aspect or Source	Issue Description	Potential pathways	Receptors	Impact Description	Controls to prevent or mitigate risk	Residual Risk Assessment after Existing Controls Applied			Comment
								Likelihood	Consequence	Risk Ranking	
6	Air	Digester burster disc (biogas release)	Potential for licence non-compliance and impacts to human health and the environment beyond the site boundary.	The emergency stack release scenario only occurs in abnormal plant operation under emergency conditions (i.e. there is total power cut-off, main fan failure, or higher-than-critical biofilter inlet air temperature)	Local population and sensitive receptors within and outside of site boundaries	<ul style="list-style-type: none"> Community complaints Breach of licence Adverse impacts to environment and health of sensitive receptors beyond the boundary of the site 	<ul style="list-style-type: none"> Emissions flow rate of 850 Nm³/hr and Temperature of 55 °C. Safe release of biogas as an emergency measure 	Unlikely	Minor	Low	Abnormal scenario not likely to happen in normal circumstances
7	Air	Biogas overpressure valve	Potential for licence non-compliance and impacts to human health and the environment beyond the site boundary.	Operates only if users are not consuming biogas and if the flare is in fault. It is connected directly to the digester and is used for the over-and-under pressure protection of the digester. The safety valve is set at an opening pressure of 55 mbar.	Local population and sensitive receptors within and outside of site boundaries	<ul style="list-style-type: none"> Community complaints Breach of licence Adverse impacts to environment and health of sensitive receptors beyond the boundary of the site 	<ul style="list-style-type: none"> Emissions flow rate of 850 Nm³/hr and Temperature of 55 °C. Safe release of biogas as an emergency measure 	Unlikely	Minor	Low	Abnormal scenario not likely to happen in normal circumstances
8	Air	Atmospheric emissions from the facility may be present in the air and deposited on ground	Potential for licence non-compliance and impacts to human health and the environment beyond the site boundary.	<ul style="list-style-type: none"> Deposition of particulates onto soil, including: <ul style="list-style-type: none"> Direct dermal contact with soil/dust Inhalation of dust Incidental ingestion of soil/dust Uptake into homegrown fruit and vegetable crops and the subsequent consumption of this produce Uptake into chickens and the subsequent consumption of homegrown eggs Uptake into livestock and the subsequent consumption of homegrown meat or milk Deposition of particulates onto a roof, runoff into a rainwater tank and the subsequent consumption and domestic use of tank water 	Local population and sensitive receptors within and outside of site boundaries	<ul style="list-style-type: none"> Community complaints Breach of licence Adverse impacts to environment and health of sensitive receptors beyond the boundary of the site 	Robust air emissions controls (refer item 1)	Unlikely	Minor	Low	– The human health risk assessment (HHRA) concluded that human health risk of nearby sensitive receptors is low and acceptable (refer Appendix I of the main application).
9	Noise	–Noise generation from routine operation 24 hours a day	Potential for noise complaint and non-compliance with legal requirements	– Noise emitted beyond the site boundary above noise levels adopted for the facility	Local population and sensitive receptors within and outside of site boundaries	<ul style="list-style-type: none"> Community complaints Breach of licence Adverse impacts to sensitive receptors beyond the boundary of the site 	<ul style="list-style-type: none"> The pre-treatment building and carbonisation building will be cladded with Kingspan Architectural ribbed wall panels or equivalent to reduce noise emissions from the buildings to the surrounding environment. Noise controls such as reducers and enclosure of noisy equipment will be adopted as part of detailed design Low noise equipment will be adopted as part of detailed design such as direct drive motors, compressors, pumps and flares. Fans located outside the digestate drying area will have enclosures 	Unlikely	Minor	Low	–The Noise Assessment report determined the noise levels for the RRON facility per EPA Publication 1826.4. Modelling indicates that the noise levels for the RRON facility will be below the derived noise levels. Refer to Appendix J of the main application for the Noise Assessment
10	Noise	–Noise generation from internal truck movements delivering waste material to the RRON	Potential for noise complaint and non-compliance with legal requirements	– Noise emitted beyond the site boundary above noise levels adopted for the facility	Local population and sensitive receptors within and outside of site boundaries	<ul style="list-style-type: none"> Community complaints Breach of licence Adverse impacts to sensitive receptors beyond the boundary of the site 	–The speed limit on internal roads for trucks at the RRON facility is 20 km/h	Unlikely	Minor	Low	–Modelling indicates that the noise levels for the RRON facility will be below the derived noise levels.
11	Surface water, land, and groundwater	Leaks from liquid C&I organic wastes during delivery and storage	Potential for licence non-compliance and impacts to the environment beyond the site boundary.	<ul style="list-style-type: none"> Leakage from tanker unloading in off-load bay (liquids will be pumped from tankers into holding tanks in the off-load bay) Leakage from liquid C&I holding tanks due fault in tank or overflow 	Offsite surface water and groundwater receptors	<ul style="list-style-type: none"> Localised contamination of land, surface water and groundwater environmental values 	<ul style="list-style-type: none"> Liquid C&I organic waste will be received in a designated liquid C&I banded off-load bay any spills will be contained in the bund sump and pumped to the liquid holding tank From the off-load bay it will be pumped to a holding tank before being fed directly to the anaerobic digester. Holding tanks will be designed with appropriate buffer storage Bund walls and floor will be concrete and joints will be sealed Bund will comply with EPA Publication 1698: Liquid storage and handling guidelines 	Unlikely	Minor	Low	
12	Surface water, land, and groundwater	–Leakage of wastewater streams outside pre-treatment building from feedstocks and washdown of floors and process equipment	Potential for licence non-compliance and impacts to the environment beyond the site boundary.	–Release of feedstock liquid and washdown water outside the pre-treatment building via vehicle rollover or runoff inside the building out of the entry/exit doors	Offsite surface water and groundwater receptors	<ul style="list-style-type: none"> Localised contamination of land, surface water and groundwater environmental values 	<ul style="list-style-type: none"> Feedstock is received in the enclosed receiver building in the FOGO drop-off bunker Pre-treatment building will have two automated rapid action roller doors at the entry and exit locations these are activated by under floor sensors Spill kits to be provided Emergency spill procedures included in the operational environmental management plan 	Unlikely	Minor	Low	

Item #	Category	Aspect or Source	Issue Description	Potential pathways	Receptors	Impact Description	Controls to prevent or mitigate risk	Residual Risk Assessment after Existing Controls Applied			Comment
								Likelihood	Consequence	Risk Ranking	
13	Surface water, land, and groundwater	– Leakage of wastewater streams outside digestate drying area from digestate liquid	Potential for licence non-compliance and impacts to the environment beyond the site boundary.	– Release of digestate liquid and washdown water outside the processing area via vehicle rollover or runoff out of the entry/exit doors	Offsite surface water and groundwater receptors	–Localised contamination of land, surface water and groundwater environmental values	–Digestate aeration process takes place within concrete bunkers to prevent runoff –Digestate out loading area will have a rapid action roller door, operated using manual controls –Offsite transport of digestate will take place using heavy rigid trucks, with watertight seals and impermeable cover over the material to prevent leaks and odour emissions during transport. –Spill kits to be provided –Emergency spill procedures included in the operational environmental management plan	Unlikely	Minor	Low	
14	Surface water, land, and groundwater	– Pipeline leaks from wastewater system for digestate liquid and washdown water generated in the pre-treatment building	Potential for licence non-compliance and impacts to the environment beyond the site boundary.	Potential for leakage in pipeline or pump failure from digestate liquid or wastewater to be pumped to Black Rock WRP connection point	Offsite surface water and groundwater receptors	–Localised contamination of land, surface water and groundwater environmental values	–Preventative maintenance program –Visual inspections –Spill kits to be provided –Emergency spill procedures included in the operational environmental management plan	Unlikely	Minor	Low	
15	Surface water, land, and groundwater	Leaks from underground wastewater storage tank	Potential for licence non-compliance and impacts to the environment beyond the site boundary.	Wastewater will be pumped to an underground holding tank before being pumped to the Black Rock WRP. Potential for leakage from the underground wastewater tank due to fault in the tank or the tank reaching capacity.	Offsite surface water and groundwater receptors	–Localised contamination of land, surface water and groundwater environmental values	–Pipelines will be designed to be impervious with suitable flow and pressure capacity based on proposed duty –Preventative maintenance program –Visual inspections –Spill kits to be provided –Emergency spill procedures included in the operational environmental management plan	Unlikely	Minor	Low	
16	Surface water, land, and groundwater	–Chemical storage for sulfuric acid and caustic solutions (sodium hydroxide and sodium hypochlorite) for scrubber system	Potential for licence non-compliance and impacts to the environment beyond the site boundary.	–Failure of chemical storage bund	Offsite surface water and groundwater receptors	–Localised contamination of land, surface water and groundwater environmental values	–Chemicals will be stored in a bund designed to AS 1940:2017 The storage and handling of flammable and combustible liquids –Bund will comply with EPA Publication 1698: Liquid storage and handling guidelines –Incompatible substances will have localised containment in the bund –Snill kits will be located at the bund	Rare	Moderate	Low	
17	Surface water	–Sediment laden runoff from surface water generation outside facility buildings	Potential for licence non-compliance and impacts to the environment beyond the site boundary.	–Sediment laden or contaminated runoff flowing to offsite waterways	Offsite surface water and groundwater receptors	–Localised contamination of surface water environmental values	–Clean surface water from roadways and hard stand areas surrounding the site will be directed to a retention basin	Unlikely	Minor	Low	
18	Waste	–Contamination of biochar end product	Potential for licence non-compliance and impacts to the environment beyond the site boundary.	Biochar is to be used as a soil enhancer if the biochar is contaminated (e.g. by heavy metals, PFAS.) this could lead to environmental impacts when it applied to land as a soil enhancer product.	Offsite environment receiving the biochar	–Contamination of land, surface water and groundwater environmental values –Adverse impact to human health	–Processing of higher risk feedstocks (ie. biosolids) classified as RPW will be done in a controlled manner to prevent heavy metal and PFAS contamination of the biochar. This will include chemical testing of the biosolids before processing –Chemical testing of biochar was undertaken at the Loganholme Gasification Demonstration Plant in 2020 with results included in a technical report . The results of the biochar testing demonstrated that concentrations of PFAS compounds (including PFOS and PFOA) in the biosolid feedstock were reduced by a minimum of 91%. The Loganholme Demonstration Plant gasifier temperature operates at 600 - 650°C and the gasifier at the RRON will typically run around 720-850°C. –An A16 permit or waste designation will be sought by Barwon Water for the supply and use of biochar as a soil enhancer –As part of commissioning and ongoing operations, testing of the biochar material will be undertaken to confirm that the supply and use of the biochar will not present a risk to the environment and human health	Unlikely	Moderate	Medium	Uncertainty around the concentrations of contaminants in the biosolids has lead to a medium risk. The concentrations of contaminants of concern will need to be assessed as part of commissioning and operation of the RRON facility.
19	Waste	–Contamination of digestate	Potential for licence non-compliance and impacts to the environment beyond the site boundary.	–Digestate trucked off-site to a local composting facility is contaminated (i.e. chemical and/or physical contamination) and therefore does not meet the requirements of EPA's Designation for low risk digestate	Offsite environment receiving the digestate	–Contamination of land, surface water and groundwater environmental values –Adverse impact to human health	–The RRON facility is expected to process low risk feedstocks e.g. municipal FOGO –Organic wastes processed via the PFAD will meet the pasteurisation requirements of the Designation for low risk feedstocks requirements (due to thermophilic anaerobic digestion process at ≥55°C). –As part of commissioning and ongoing operations, testing of the digestate will be undertaken to confirm it meets the chemical and physical contaminant limits listed in Appendix 1 of the Designation. –Storage and processing of pasteurised digestate takes place in a separate building to unpasteurised feedstock receives to prevent cross-contamination	Unlikely	Moderate	Medium	The concentrations of contaminants in the digestate will need to be assessed as part of commissioning and operation of the RRON facility as such a medium risk is allocated.

Item #	Category	Aspect or Source	Issue Description	Potential pathways	Receptors	Impact Description	Controls to prevent or mitigate risk	Residual Risk Assessment after Existing Controls Applied			Comment
								Likelihood	Consequence	Risk Ranking	
20	Waste	–Contamination of incoming feedstocks with prohibited wastes (ie. wastes the facility is not licensed to accept)	Potential for licence non-compliance and impacts to the environment beyond the site boundary.	–Biochar produced via the carbonisation of the feedstock (biosolids, bioprill and green waste) is to be used as a soil enhancer if the biochar is contaminated (e.g. by heavy metals, PFAS) this could lead to environmental impacts when it applied to land as a soil enhancer product	Local population and sensitive receptors within and outside of site boundaries	–Contamination of land, surface water and groundwater environmental values –Adverse impact to human health	–Wastes will only be accepted from approved suppliers –Incoming wastes will be inspected at the site weighbridge, at waste receival bunker and during pre-treatment sorting and screening processes –Robust air emissions controls (refer item 1) –As part of commissioning and ongoing operation testing of the biochar material will be undertaken to confirm that the supply and use of the biochar will not present a risk to the environment and human health	Unlikely	Minor	Low	The facility will have strict controls and procedures on the acceptance of waste feedstocks
21	Greenhouse gas	Greenhouse gases emitted from combustion of fuels, biogas and syngas	Contribution to climate change from GHG emissions	Greenhouse gases emitted from combustion of fuels, biogas and syngas contributing to climate change impacts	Climate change impact	GHG emissions contributing to climate change	–The net result of the project is an emissions saving of ~330,000 tCO ₂ -e over the life of the project (25 years). The net result is achieved by the diversion of waste to avoid landfill emissions, sequestering carbon as biochar and generating renewable energy.	Certain	Insignificant	Low	–The RRON facility will be carbon positive as outlined in the Greenhouse Gas Assessment (refer Appendix M of the main application).
22	Fire	–Loss of containment of biogas from anaerobic digester, biogas pipework or biogas storage leads to combustion of biogas in an uncontrolled manner –Fire in the feedstock	Combustion of biogas or a fire in the feedstock from a "hot item" leads to fire generation at the facility	–Combustion of biogas in an uncontrolled manner or feedstock igniting from prohibited item in the feedstock (e.g. lithium ion battery) leads to fire generation at the facility and uncontrolled air emissions due to the shutdown of the facility and uncontrolled air emissions from fire in the feedstock	Local population and sensitive receptors of site boundaries (refer to Air Quality Assessment for a description of local population)	–Community complaints –Breach of licence –Adverse impacts to environment and health of sensitive receptors beyond the boundary of the site	The facility will include a gaseous fire suppression system and other fire controls. Refer to Fire Safety Study provided in Appendix L of the main application	Rare	Significant	Low	– The consequence assessment results for the scenario examined around the loss of containment of biogas from the anaerobic digester, biogas pipework or biogas storage found there are no impacts to personnel anticipated. Refer to Fire Safety Study provided in Appendix L of the main application.

Consequence		Likelihood				
		A	B	C	D	E
		Certain	Likely	Possible	Unlikely	Rare
1	Catastrophic	Extreme	Extreme	High	High	Medium
2	Significant	Extreme	High	High	Medium	Medium
3	Moderate	High	High	Medium	Medium	Low
4	Minor	High	Medium	Medium	Low	Low
5	Insignificant	Low	Low	Low	Low	Low



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