Mayfield West Recycling Facility

Groundwater Monitoring Program

Prepared for Benedict Recycling Pty Ltd

April 2025

Mayfield West Recycling Facility

Groundwater Monitoring Program

Benedict Recycling Pty Ltd

J14152 27E

April 2025

Version	Date	Prepared by	Approved by	Comments
v2	2 March 2020	T. Wilkinson	J. Tait	Final
v3	13 September 2023	P. Towler	P. Towler	Update following MOD2 approval
V4	30 April 2025	Z Ahmed	P Towler	Update following MOD3 approval

Approved by

Dr Philip Towler
Associate Director
30 April 2025
Level 10 201 Pacific Highway
St Leonards NSW 2065
ABN: 28 141 736 558

TABLE OF CONTENTS

Appendices

Tables

Figures

1 Introduction

Benedict Recycling Pty Ltd (Benedict) is the operator of the Mayfield West Recycling Facility (MWRF) located at 1A McIntosh Drive, Mayfield West.

Development Consent (SSD 7698) granted on 13 March 2018 permits the operation of the resource recovery facility, with a capacity to accept and process up to 315,000 tonnes per year of general solid waste (non-putrescible). Subsequently, the following modifications have been approved:

- Modification 1: to amend the works boundary and relocate the public hand unloading area – approved 27 October 2021.
- Modification 2: to receive, treat and export up to 30,000 tonnes per annum of actual acid sulfate soils and potential acid sulfate soils – approved 13 June 2023.
- Modification 3: to relocate the approved actual and potential acid sulfate soils receival and processing from the main processing building to an existing vacant building (Mag Shed) on the site – approved 18 February 2024.

The 'Development Consent (as modified)' is the consent as modified by Modification 1, 2 and 3.

Condition B40 of the Development Consent (as modified) requires the preparation of a Groundwater Monitoring Program (GWMP).

1.1 Report purpose and structure

This report is a GWMP that addresses Condition B40. It includes:

- a summary of relevant studies and plans (remainder of Chapter 1)
- a description of the local groundwater systems (Chapter 2)
- a comparison of groundwater and surface water quality (Chapter 3)
- management measures (Chapter 4).

1.2 Relevant studies and plan

1.2.1 Previous groundwater studies

A Phase 2 detailed site investigation was completed by AECOM in 2006–2008. Relevant information from this study is summarised in Chapter 2.

1.2.2 Groundwater Monitoring Program

An initial Groundwater Monitoring Program (EMM 2020) was prepared to address Condition B40. It was prepared in consultation with the EPA (associated correspondence is provided in Appendix A) by Tim Wilkinson, who is a suitably qualified and experienced person. This plan has been updated by Dr Philip Towler, who holds a PhD in environmental chemistry.

1.2.3 Surface Water Characterisation and Mitigation Plan

The surface water system is described in the *Mayfield West Recycling Facility Surface Water Characterisation and Mitigation Plan* (SWCMP) (EMM 2023) which addresses B33.

1.3 Consent conditions

The following SSD consent conditions (as modified) are relevant to the development of this GMP.

i Condition B40

Condition B40 states:

> Within 12 months of the commencement of operations the Applicant must conduct a Groundwater Monitoring Program to the satisfaction of the Planning Secretary. The program must:
>
> a) be carried out by a suitably qualified and experienced expert in consultation with the EPA;
>
> b) ascertain the potential for leakage of the sediment basin and perimeter drain to groundwater;
>
> c) detail baseline data, groundwater levels and groundwater quality against the relevant criteria;
>
> d) provide mitigation and contingency measures to prevent the sediment basins from leaking; and
>
> e) identify a program for ongoing groundwater monitoring and reporting.

ii Condition B41

Condition B41 states:

> Within three months of the completion of the Groundwater Monitoring Program, the Applicant must submit a copy of the Groundwater Monitoring Program as identified in Condition B40 to the Planning Secretary and the EPA.

Table 1.1 outlines where each consent condition is addressed in the report.

Table 1.1 Consent conditions

Condition	Section
Condition B40 - Within 12 months of the commencement of operations the Applicant must conduct a Groundwater Monitoring Program to the satisfaction of the Planning Secretary. The program must:	
a) be carried out by a suitably qualified and experienced expert in consultation with the EPA	Section 1 and Appendix A
b) ascertain the potential for leakage of the sediment basin and perimeter drain to groundwater	Section 4
c) detail baseline data, groundwater levels and groundwater quality against the relevant criteria	Sections 2.2 and 3
d) provide mitigation and contingency measures to prevent the sediment basins from leaking	Section 4
e) identify a program for ongoing groundwater monitoring and reporting	Section 5
Condition B41	
Within three months of the completion of the Groundwater Monitoring Program, the Applicant must submit a copy of the Groundwater Monitoring Program as identified in Condition B40 to the Planning Secretary and the EPA	Section 5

2 Groundwater systems

2.1 Geology

There are fill materials associated with historical emplacement of steelworks wastes across the site. Fill thicknesses ranges from 8.5 m to 10.1 m (AECOM 2009).

Estuarine sediments are present beneath the fill, encountered as a dark brown and grey clay with low plasticity, generally from depths greater than 8.5 m. The sediments are predominantly a silty clay with interbedded lenses of sand and silty sandy clay (AECOM 2009). Some lenses can contain shell fragments which are typical of shallow estuarine environments.

2.2 Hydrogeology

The hydrogeological regime at the site consists of two shallow groundwater systems. A shallow aquifer within the fill materials (the Fill aquifer) and a deeper aquifer in the estuarine sediments (the Estuarine aquifer).

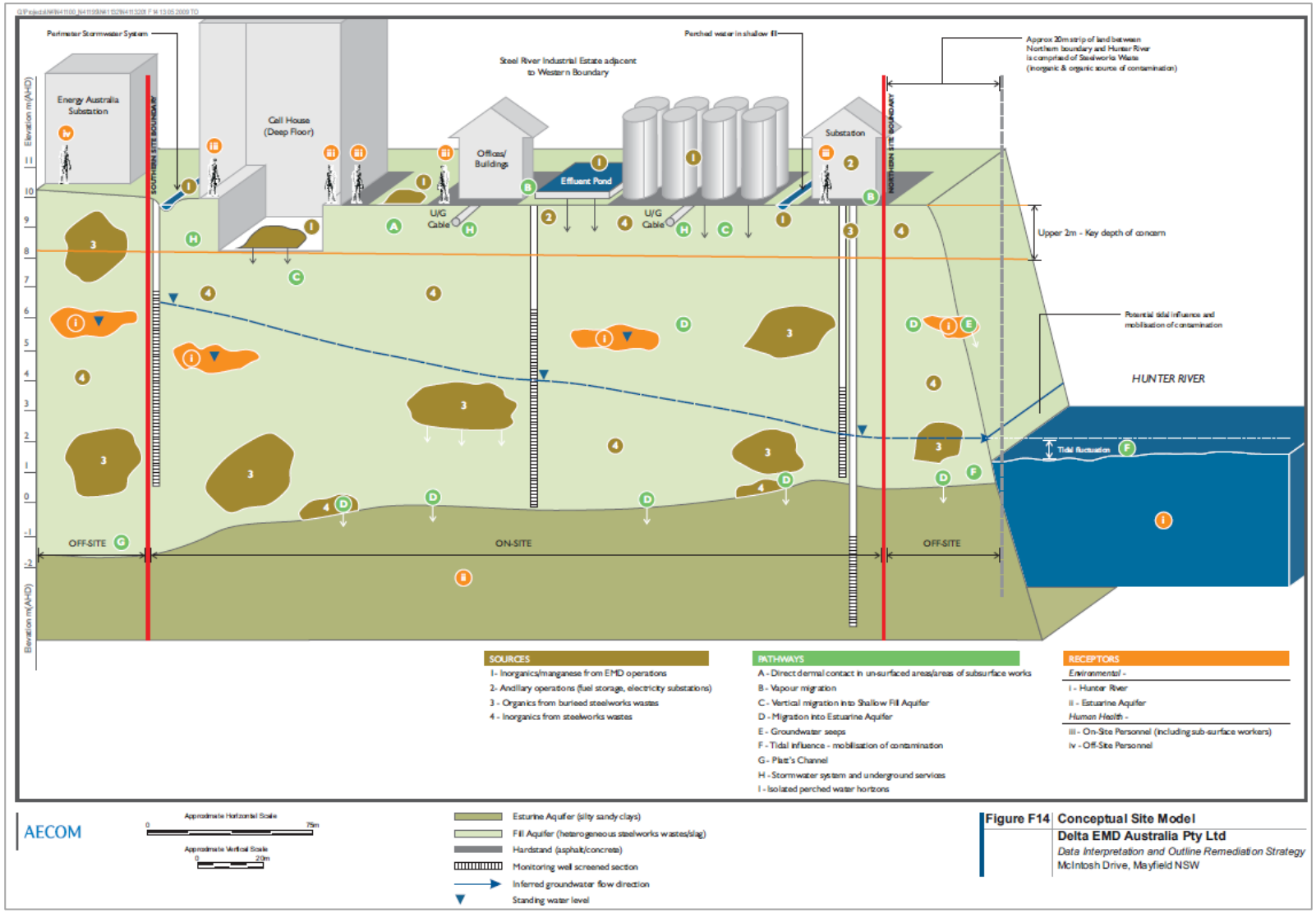
Groundwater has been contaminated from historical land uses including the former EMD operations and imported materials associated the former steel works used to fill the site. In relation to potential contaminants in groundwater, a preliminary qualitative risk assessment and consideration of the conceptual site model indicated a relatively low risk to environmental and human health receptors (AECOM 2009). A conceptual groundwater model previously prepared by AECOM is reproduced as Figure 2.1.

Soil and water reports included in the development applications for the recycling facility did not conduct any groundwater sampling as no groundwater use was proposed and no significant excavations were required. This remains the case.

A summary of the baseline groundwater level and quality results from the detailed site investigation completed as part of the site management plan for subsurface disturbance activities (AECOM 2009) is provided in Sections 2.2.1 and 2.2.2.

2.2.1 Groundwater levels

Groundwater levels in the Fill aquifer range from around 3.4 m below ground level (mbgl) to 7.4 mbgl across the site (AECOM 2009). Groundwater levels in the Estuarine aquifer are generally deeper, ranging from 5.2 mbgl to 8.3 mbgl (AECOM 2009). Based on the groundwater elevations in both the fill and underlying estuarine clay, groundwater is inferred to flow generally in a northerly direction towards the Southern Arm of the Hunter River.



Source: AECOM (2009).

Figure 2.1 Site conceptual groundwater model

2.2.2 Groundwater quality

Environmental studies completed at the site identified the presence of elevated concentrations of several inorganic and organic compounds within fill soil and groundwater beneath the site (AECOM 2009). Elevated concentrations are primarily manganese associated with the former EMD operations and organics (TPHs and PAHs) that are associated with steel works materials.

Historical groundwater quality for the fill and estuarine clay are summarised below. Sampling locations from the Phase 2 Environmental Site Assessment are shown on Figure 2.2 and groundwater quality for each aquifer is presented in Table 2.1 and Table 2.2.

Source: AECOM (2008).

Figure 2.2 Site sampling locations

i Fill aquifer

Groundwater quality in the Fill aquifer is characterised as follows:

- Manganese concentrations ranged between 3 µg/L (MW13) and 849 µg/L (MW102)
- Naphthalene concentrations in MW10 (128 µg/L), MW11 (181 µg/L) and MW13 (888 µg/L) exceeded the investigation level (IL) of 70 µg/L, with concentrations less than the IL ranging from less than the laboratory limit of reporting (LOR) to 55 µg/L (MW7)
- Total PAHs concentrations ranged from 2.1 µg/L to 1,072 µg/L, noting no IL exists for total PAHs in groundwater
- TPH concentrations (C_6-C_9) ranged from <LOR to 110 µg/L

- TPH (C_{10}-C_{36}) concentrations ranged from 430 µg/L to 3,480 µg/L.
- Benzene concentrations were less than the laboratory LOR or IL, and with exception of minor exceedances of toluene, ethylbenzene and xylenes (total) (TEX) concentrations reported in MW7, TEX concentrations were less than the LOR.

ii Estuarine aquifer

Groundwater quality in the estuarine clay is characterised as follows:

- Manganese concentrations ranged between 0.013 mg/L (MW2) and 10.8 mg/L (MW204)
- Naphthalene concentrations were not reported at concentrations greater than the IL in any sample
- Total PAHs concentrations ranged from <LOR to 43.2 µg/L
- TPH C_6-C_9 concentrations were not reported at concentrations greater than the LOR
- TPH C_{10}-C_{36} concentrations ranged from 780 µg/L to 1,980 µg/L
- Benzene concentrations were less than the LOR and/or IL, and TEX concentrations were all less than the LOR.

Table 2.1 Baseline groundwater chemistry (inorganics)

		Fill			Estuarine clay		
Parameter	**Unit**	**Minimum**	**Maximum**	**Mean**	**Minimum**	**Maximum**	**Mean**
Aluminium	mg/L	0.02	27.3	3.9	0.02	24.5	8.19
Barium	mg/L	0.01	1.24	0.22	0.01	1.04	0.46
Cadmium	mg/L	0.0001	0.001	0.0004	0.001	0.001	0.001
Chromium	mg/L	0.002	0.04	0.010	0.002	0.03	0.01
Cobalt	mg/L	0.002	0.03	0.01	0.01	0.01	0.01
Copper	mg/L	0.001	0.09	0.02	0.02	0.02	0.01
Iron	mg/L	0.05	30.60	5.25	0.1	23.8	13.33
Lead	mg/L	0.001	0.81	0.12	0.001	0.05	0.02
Manganese	mg/L	0.002	0.85	0.11	0.01	10.8	3.5
Mercury	mg/L	0.0001	0.05	0.01	0.001	0.001	0.001
Molybdenum	mg/L	0.01	0.24	0.07	0.003	0.08	0.04
Nickel	mg/L	0.001	0.04	0.01	0.02	0.02	0.02
Sulphate	mg/L	7.00	1180	317	37	1,960	710
Sulphide	mg/L	0.30	1.40	0.73	<0.1	<0.1	<0.1
Zinc	mg/L	0.03	0.71	0.27	0.02	0.06	0.04
pH (lab)	-	7.87	12.70	10.11	7.0	10	7.94

Notes: mg/L = milligrams per litre

Table 2.2 Baseline groundwater chemistry (organics)

Parameter		Unit	Fill			Estuarine clay		
			Minimum	Maximum	Mean	Minimum	Maximum	Mean
PAH	Acenaphthene	µg/L	<1	63.3	7.6	<1	20.7	5.54
	Acenaphthylene	µg/L	<1	26.5	3.74	<1	<1	0.5
	Anthracene	µg/L	<1	14.2	2.25	<1	<1	0.5
	Benz(a)anthracene	µg/L	<1	11.9	1.85	<1	<1	0.5
	Benzo(a)pyrene	µg/L	<0.5	10.5	1.66	<0.5	0.5	0.28
	Benzo(b)fluoranthene	µg/L	<1	12.9	1.99	<1	<1	0.5
	Benzo(g,h,i)perylene	µg/L	<1	8.8	1.44	<1	<1	0.5
	Benzo(k)fluoranthene	µg/L	<1	5.8	1.14	<1	1	0.56
	Chrysene	µg/L	<1	10.5	1.68	<1	<1	0.5
	Dibenz(a,h)anthracene	µg/L	<1	<1	0.5	<1	<1	0.5
	Fluoranthene	µg/L	<1	29.9	4.98	<1	2.3	0.95
	Fluorene	µg/L	<1	30.4	5.44	<1	7	2.06
	Indeno(1,2,3-c,d)pyrene	µg/L	<1	7	1.22	<1	<1	0.5
	Naphthalene	µg/L	<1	888	85.9	<1	4.9	1.93
	Phenanthrene	µg/L	<1	82.4	11.96	<1	8.1	2.54
	Pyrene	µg/L	<1	24.6	4.11	<1	1.7	0.73
	Total PAHs	µg/L	2.1	1072	163.09	3.7	43.4	23.6
TPH	TPH C_6–C_9 fraction	µg/L	<20	110	20.63	<20	<50	11.88
	TPH C_{10}–C_{14} fraction	µg/L	110	1,580	487.5	140	1240	635
	TPH C_{15}–C_{28} fraction	µg/L	300	2,300	900	<200	600	425
	TPH C_{29}–C_{36} fraction	µg/L	70	1,220	310	<50	230	137.5
	TPH+C_{10}–C_{36} (sum of total)	µg/L	430	3,480	1,697.5	390	1980	1,181.8
BTEX	Benzene	µg/L	<1	77	9.59	<1	2	0.69
	Ethylbenzene	µg/L	<2	2	1.06	<2	<2	0.94
	Toluene	µg/L	<5	12	3.09	<5	3	2.56
	Xylene (m & p)	µg/L	<2	5	1.25	<2	4	1.38
	Xylene (o)	µg/L	<2	2	1.06	<2	2	1.13
	Xylene Total	µg/L	<4	7	2.31	<4	6	2.5

Notes: mg/L = milligrams per litre
µg/L= micrograms per litre
PAH = polycyclic aromatic hydrocarbons
TPH = total petroleum hydrocarbons
BTEX = benzene, toluene, ethylbenzene, xylene

3 Comparison of surface and groundwater quality

The groundwater systems within the facility are known to be contaminated by former land uses (Section 2.2.2). The following measures have been implemented to minimise surface water ingress into the contaminated groundwater systems:

- The site is largely covered with concrete or asphalt and drains to a large perimeter drain.
- Surface drains are bitumen lined and the stormwater basin concrete lined.

As the facility is on a remediated site and does not actively use or disturb groundwater, infiltration of surface water is the primary mechanism by which the operation of the facility could further degrade the groundwater system. To assess this risk, the groundwater quality of the Fill aquifer is compared (see Table 3.1) to the water quality of surface water in the stormwater basin that is in the north-western corner of the site and receives runoff from the entire facility (except for Area 1). The key conclusions from this comparison are:

- the groundwater in the Fill aquifer has significantly higher concentrations of metals than the surface water in the basin, and
- surface water at the facility does not have any known hydrocarbons, PAH or BTEX contamination issues.

Accordingly, surface water infiltration (should it occur) would not degrade the water quality of the Fill aquifer.

Table 3.1 Comparison of groundwater and surface water quality

Group	Analyte	Units	Fill aquifer (GW)[1]	Surface water – Basin (SW)[2]	Difference
Metals	Aluminium	mg/L	27.3	0.18	GW significantly higher
	Barium	mg/L	1.24	-	SW not measured
	Cadmium	mg/L	0.001	<0.0001	GW higher
	Chromium	mg/L	0.04	0.016	GW significantly higher
	Cobalt	mg/L	0.03	<0.001	GW significantly higher
	Copper	mg/L	0.09	0.003	GW significantly higher
	Iron	mg/L	30.6	<0.05	GW significantly higher
	Lead	mg/L	0.81	0.059	GW significantly higher
	Manganese	mg/L	0.84	-	SW not measured
	Mercury	mg/L	0.05	<0.0001	GW significantly higher
	Molybdenum	mg/L	0.24	0.005	GW significantly higher
	Nickel	mg/L	0.04	-	SW not measured
	Sulphate	mg/L	1,180	-	SW not measured
	Sulphide	mg/L	1.4	-	SW not measured
	Zinc	mg/L	0.71	0.154	GW significantly higher

Table 3.1 Comparison of groundwater and surface water quality

Group	Analyte	Units	Fill aquifer (GW)[1]	Surface water – Basin (SW)[2]	Difference
	TPH+C_{10}–C_{36} (sum of total)	µg/L	1,980	Below detection	GW significantly higher
PAH	Total PAH	µg/L	43.4	Below detection	GW significantly higher
BTEX	Benzene	µg/L	2	Below detection	GW higher
	Ethylbenzene	µg/L	<2	Below detection	Both below detection
	Toluene	µg/L	3	Below detection	GW higher
	Xylene (m & p)	µg/L	4	Below detection	GW higher
	Xylene (o)	µg/L	2	Below detection	GW higher
	Xylene Total	µg/L	6	Below detection	GW higher

Note: 1. Maximum concentrations from Table 2.1 and Table 2.2 (for the Fill aquifer)
2. Maximum concentrations from the Basin monitoring locations reported in Surface Water Validation Report (EMM 2020) that was prepared to address Condition B35.

4 Management measures

The sediment basin is sealed with concrete and the perimeter drains are sealed with a bitumen spray. There is potential for leaks from these systems from any cracks in the concrete. Benidict will implement management measures (Table 4.1) to minimise these risk and other risks associated with operating on a remediate site with a contaminated groundwater system.

Table 4.1 Management measures

ID	Action	Frequency	Responsibility
1	Avoid extraction of groundwater for any purpose	Ongoing	Site Supervisor or Manager
2	Avoid excavating or site disturbance the without appropriate assessment and controls	Ongoing	Site Supervisor or Manager
3	Inspect the perimeter drain and basin for any cracking and vegetation breakthrough. Any vegetation is to be removed and any identified cracks are to be repaired.	Monthly (as required by EPL condition O5.5 and consent condition B29)	Site Supervisor or Manager
4	Following rainfall, the water level in the sediment basin will be monitored for 24-hours using the water level gauge that is installed in the basin. The monitoring period is to occur during dry weather and no extraction from the basin is to occur. The following actions will be undertaken if any material change in the basin water level occurs: • the basin and perimeter drains will be inspected to identify the likely leak • repairs to the basin or drain will be made • the water level test will be redone at the next opportunity. If the above actions are not successful in resolving a leak, Bendict will engage a suitably qualified person to investigate and provide recommendations.	Annually	Site Supervisor or Manager

5 Monitoring program

5.1 Surface water monitoring

As discussed in Section 3, surface water quality is better than groundwater quality at the site.

Surface water monitoring is to continue in accordance with the *Surface Water Characterisation and Mitigation Plan.*

5.2 Groundwater monitoring

Should surface water quality on the site degrade to the point that the concentrations of analytes in Table 2.1 (as reported in the annual environmental report) are greater than baseline groundwater concentrations in Table 2.1, groundwater monitoring bores will be installed, and the following groundwater monitoring program will be implemented.

5.2.1 Monitoring bores

Four shallow monitoring bores, located in each corner of the site, that intercept the water table in will be installed. This will allow the groundwater levels, gradient, flow directions and quality to be determined.

5.2.2 Groundwater analysis

If groundwater monitoring is triggered, the parameters listed in Table 5.1 will be measured in groundwater samples from each bore.

Table 5.1 Groundwater analysis

Analysis/classification	Parameter
Field analysis	
Groundwater level	Groundwater level
Field readings	pH, dissolved oxygen (DO), temperature, electrical conductivity
Laboratory analysis	**Parameter**
Chemical and physical properties	pH, electrical conductivity (EC), total dissolved solids (TDS)
Hydrocarbons	TPH, BTEX, PAH
Dissolved metals	aluminium, arsenic, cadmium, chromium, copper, iron, lead, manganese, mercury, nickel and zinc
Major ions	alkalinity (carbonate, bicarbonate and hydroxide alkalinity as $CaCO_3$), calcium, chloride, magnesium, potassium, sodium, sulphate
Nutrients	total nitrogen, total phosphorus, nitrite, nitrate, ammonia

5.2.3 Monitoring frequency

If triggered, groundwater will be monitored (level and quality) every six-monthly (bi-annual) to allow groundwater conditions to be interpreted and water quality to be analysed and compared to historical observations.

6 Reporting and review

If triggered, the results of the groundwater monitoring program be presented in the annual review required by Condition C9. This would include a comparison of surface water quality sampling during the year and the baseline groundwater quality for dissolved metals, TPH, PAH and BTEX. The monitoring of the sedimentation basin for leakage will be reported, include the sediment basin water levels over time following a rainfall event. The results of the monitoring will be included in the annual environmental review and be submitted as per the consent condition.

All relevant data and information pertaining to environmental monitoring will be recorded, including but not limited to:

- sampling dates, times and name of sampler
- chain of custody records, analysis and results.

References

AECOM 2008, Phase 2 Environmental Site Assessment. Report prepared for Delta EMD Australia Pty Ltd.

AECOM 2009, Site management plan for subsurface disturbance activities for Delta EMD Australia Pty Ltd, Report prepared for Delta EMD Australia Pty Ltd.

ANZG 2018, Australian and New Zealand guidelines for fresh and marine water quality. Commonwealth of Australia

EMM 2020, Surface Water Validation Report. Report prepared by EMM Consulting Pty Limited for Benedict Recycling Pty Ltd.

EMM 2023, Mayfield West Recycling Facility Surface Water Characterisation and Mitigation Plan. Report prepared by EMM Consulting Pty Limited for Benedict Recycling Pty Ltd.

Tooker and Associates 2018, Surface water management system. Report prepared by Tooker and Associates for Benedict Recycling Pty Ltd.

Appendix A
EPA correspondence

EMM
creating opportunities

DOC19/688835-2

Mr Tim Wilkinson
Associate Hydrogeologist
EMM
Level 1, 146 Hunter Street
NEWCASTLE NSW 2300

Dear Mr Wilkinson

REQUEST FOR CONSULTATION

I refer to your emails to the Environment Protection Authority (**EPA**) dated 13 August 2019 and 8 November 2019 regarding the development of a groundwater monitoring program for the Benedict Recycling Facility at Mayfield West.

The EPA acknowledges that State Significant Development 7698 requires the EPA to be consulted in the development of the program, however the EPA does not review such plans or programs unless required. In these circumstances, the role of the EPA is to establish and regulate against environmental protection and management criteria, not to become directly involved in the development of plans, programs and strategies intended to comply with such criteria.

If you wish to discuss the matter further, please contact Karen Gallagher on 4908 6822.

Yours sincerely

11/11/2019

STEVEN JAMES
Unit Head Waste Compliance
Environment Protection Authority

Phone 131 555
Phone 02 4908 6800
Fax 02 4908 6810
TTY 133 677
ABN 43 692 285 758
PO Box 488G
Newcastle
NSW 2300 Australia
117 Bull St
Newcastle West
NSW 2302 Australia
info@epa.nsw.gov.au
www.epa.nsw.gov.au

Australia

SYDNEY
Level 10 201 Paciific Highway St
Leonards NSW 2065
T 02 9493 9500

NEWCASTLE
Level 3, 175 Scott Street
Newcastle NSW 2300
T 02 4907 4800

BRISBANE
Level 1, 87 Wickham Terrace
Spring Hill QLD 4000
T 07 3648 1200

CANBERRA
Level 2, Suite 2.04
15 London Circuit
Canberra City ACT 2601

ADELAIDE
Level 4, 74 Pirie Street
Adelaide SA 5000
T 08 8232 2253

MELBOURNE
188 Normanby Road
Southbank VIC 3006

PERTH
Level 9, Suite 9.02
109 St Georges Terrace
Perth WA 6831

Canada

TORONTO
2345 Yonge Street, Suite 300
Toronto ON M4P 2E5

VANCOUVER
60 W 6th Ave Suite 200
Vancouver BC V5Y 1K1

linkedin.com/company/emm-consulting-pty-limited

emmconsulting.com.au