Groundwater monitoring program

Mayfield West Recycling Facility

Prepared for Benedict Recycling Pty Ltd
March 2020

EMM
creating opportunities

EMM
creating opportunities

Servicing projects throughout Australia and internationally

SYDNEY
Ground Floor, 20 Chandos Street
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

ADELAIDE
Level 1, 70 Pirie Street
Adelaide SA 5000
T 08 8232 2253

MELBOURNE
Ground Floor, 188 Normanby Road
Southbank VIC 3006
T 03 9993 1905

PERTH
Level 6, 191 St Georges Terrace
Perth WA 6000

CANBERRA
Level 8, 121 Marcus Street
Canberra ACT 2600

Groundwater monitoring program

Mayfield West Recycling Facility

Report Number

J14152 20

Client

Benedict Recycling Pty Ltd

Date

2 March 2020

Version

V2.1 Final

Prepared by

Tim Wilkinson
Associate Hydrogeologist
2 March 2020

Approved by

Jonathon Tait
Associate Hydrogeologist
2 March 2020

Table of Contents

Appendices

Tables

Figures

1 Introduction

Benedict Recycling Pty Ltd is the operator of the Mayfield West Recycling Facility (MWRF) located at 1A McIntosh Drive, Mayfield West. The MWRF has been developed to provide a range of services to the demolition and construction industries including:

- receival of waste;
- sorting of waste;
- processing of waste;
- recovery of recyclables;
- export of recovered recyclables; and
- transfer and disposal of residuals.

Resource recovery activities, limited to 90,000 tonnes per year of general solid waste (non-putrescible), are approved under consent DA2015/0291. State significant development (SSD) project approval 7698 (SDD 7698) allows increased processing capacity to 315,000 tonnes per year of general solid waste (non-putrescible) including construction, demolition, commercial and industrial waste. The site currently operates under the Environment Protection Licence (EPL) 20771.

The site does not currently interact with or use groundwater. There is currently no groundwater monitoring network. However, historic site land uses have resulted in groundwater contamination. Phase 2 detailed site investigations by AECOM (2006–2008) found elevated concentrations are primarily manganese, associated with the former EMD operations, and organics (total petroleum hydrocarbons (TPH) and polycyclic aromatic hydrocarbons), associated with reclaimed steel works materials. Baseline groundwater quality is further discussed in Section 3.2.2.

The site covered by the SSD approval (the western side of Lot 1 DP 874109, with a total area of 8.9 hectares (ha)) is divided into two catchment areas: Area 1 and Area 2 (see Figure 2.2). Area 1 handles general waste that is considered higher risk of contamination and Area 2 handles the remainder. The on-site management of surface water has the potential to impact the local groundwater system if not managed by appropriate controls. Infiltration of surface water contaminants is limited by the site's roadways; concrete stockpile areas; and a sealed perimeter drain that surrounds the site and drains to a final lined sediment basin in the north-west corner of the site. Surface water management is further discussed in Section 2. The site is asphalt or concrete sealed entirely save for the minor areas of landscaping and as such generally has limited potential for rainwater infiltration.

This groundwater monitoring program (GMP) has been prepared to guide the management of groundwater resources during the operation of the site. The GMP details baseline surface and groundwater data collected during the site investigations, site validation (AECOM 2008) and the environmental approvals (EMM 2018) (Tooker & Associates 2018). Baseline water quality has been used to develop the surface and groundwater monitoring plans and the trigger action response plan (TARP). This groundwater report has been carried out in consultation with the EPA by Tim Wilkinson, who is a suitably qualified and experienced expert consultant and in consultation with the EPA.

1.1 Consent conditions

The following SSD consent conditions are relevant to the development of a 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 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 B40 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 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 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 5
c) detail baseline data, groundwater levels and groundwater quality against the relevant criteria	Section 3.2.2 and 4
d) provide mitigation and contingency measures to prevent the sediment basins from leaking	Section 5
e) identify a program for ongoing groundwater monitoring and reporting	Section 7

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 Secretary. The program must:	
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 Secretary and the EPA	Section 7

2 Surface water management

2.1 Area 1 surface water management system

General solid waste that is considered to have a higher risk of contaminating stormwater is stockpiled and processed in a designated area that is referred to as Area 1. These wastes include:

- soils that meet the CT1 thresholds for General Solid Waste in Table 1 of the Waste Classification Guidelines as in force from time to time with the exception of the maximum threshold values for contaminants specified in the "Other Limits" column of Condition L3.1 of the current EPL;
- soils that meet the SCC1 and TCLP thresholds for General Solid Waste in Table 2 of the Waste Classification Guidelines;
- basic oxygen slag;
- electric arc furnace slag;
- electric arc ladle slag;
- granulated blast furnace slag; and
- rail ballast.

Area 1 has a 0.52 ha surface area and is sealed and bunded. Runoff from Area 1 is initially treated in a sediment pit (referred to as the two-stage pit) prior to being pumped into a series of plastic holding tanks that we understand have a collective capacity of 250,000 L. The pump in the two-stage pit is activated when the pit is three quarters full. Water in the holding tanks is either:

- used for dust suppression;
- discharged to the sewer as trade waste; or
- released into the perimeter drain (subject to meeting water quality criteria).

Thus far in the Recycling site's operational history, on site water consumption for dust suppression has been such that no water has been required to be discharged from site, either to the sewer or offsite.

2.2 Area 2 water management system

The remainder of the SSD site is referred to as Area 2. Area 2 has a 3.2 ha surface area that includes roads, site buildings and waste stockpiles. The remainder of Lot 1 DP 874109 comprises of currently lay down areas, site buildings and leased areas. Wastes stored within the SSD approved portion of Area 2 include:

- certified virgin excavated natural material (VENM);
- certified excavated natural material (ENM) (where the waste does not contain contaminant levels exceeding the limits for General Solid Waste stated in the EPA's Waste Classification Guidelines Part 1: Classifying Waste); and
- processed wastes that have been tested for compliance against the relevant resource recovery orders.

Runoff from Area 2 drains to a perimeter drain that has been sealed using asphalt. The perimeter drain contains several rock check dams to enhance the capture of coarse sediments. The drain flows into a sedimentation basin in the north-western corner of the site. The basin has been sealed and has a volume of 2,852 m^3 (2,852,000 L) which exceeds the minimum storage capacity required by Condition B25(d). Water accumulated in the basin is managed as follows:

- water is used for dust suppression as required;
- in accordance with Condition B31, a visible marker has been installed in the final sedimentation basin showing the freeboard in the basin required to contain runoff from a 90th percentile rainfall event over any consecutive 5-day event;
- when basin levels are high and water quality is suitable, water can be discharged to the Hunter River Estuary as controlled discharge; and
- uncontrolled overflows to the Hunter River will occur when the entire basin and swale system is full.

The surface water management system functionality is shown in Figure 2.1. The locations of Areas 1 and 2 and the water management infrastructure are shown in Figure 3.2. A water balance for the whole of Lot 1 was completed as part of the SSD 7698 approval. The water balance found both the two-stage pit and sediment basin would likely overflow 1.4 times per year (Tooker & Associates 2018).

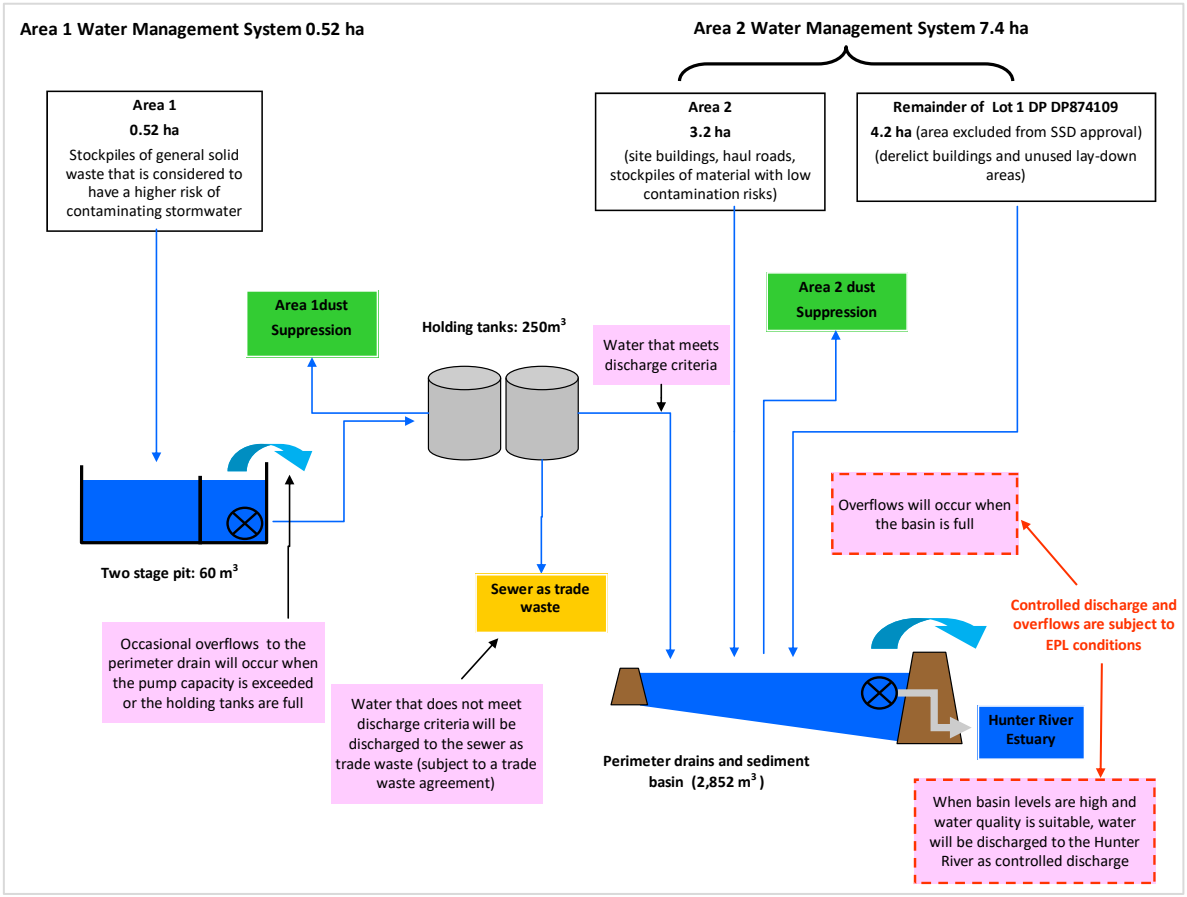


Figure 2.1 Surface water system functionality

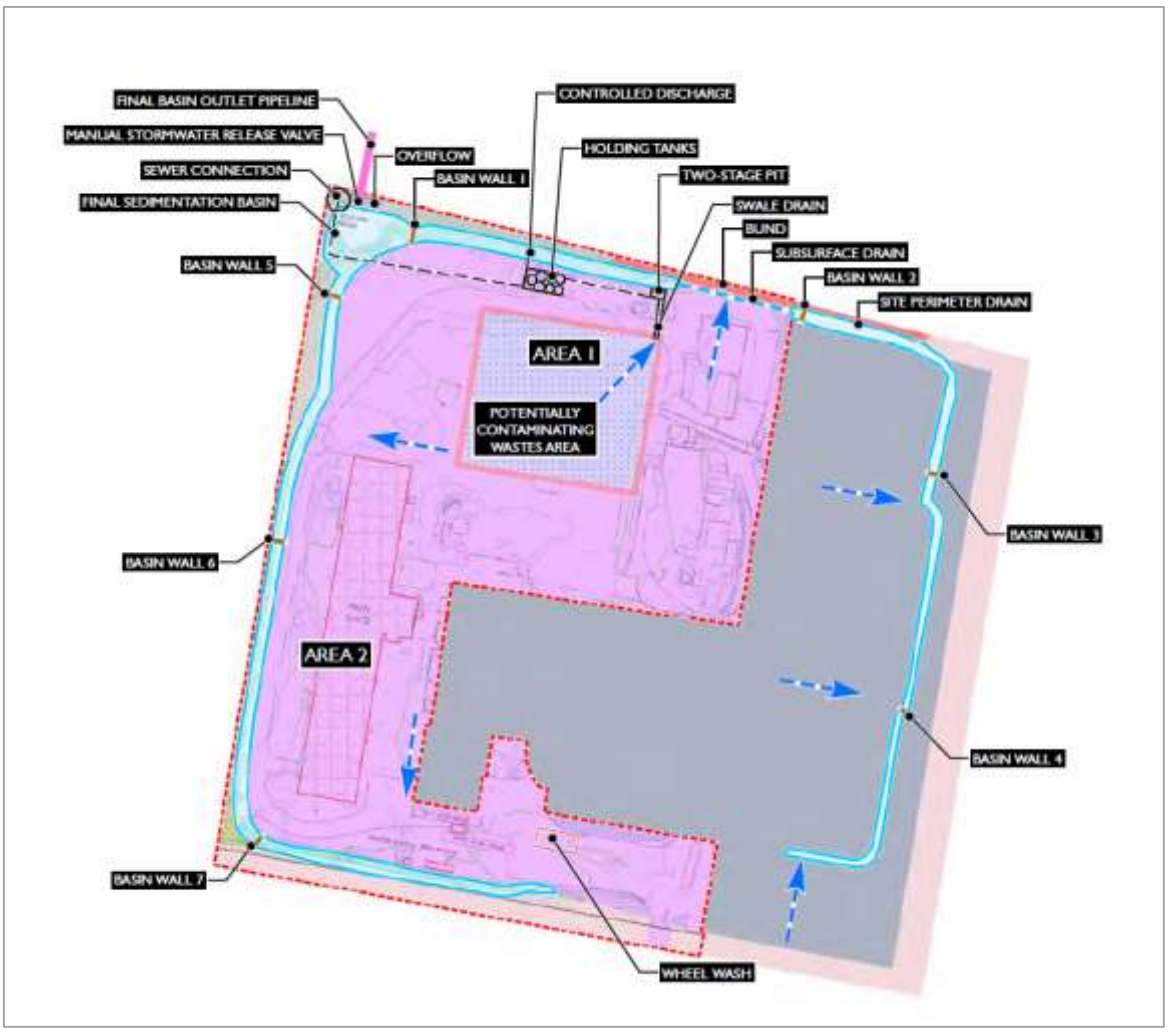


Figure 2.2 Surface water management system

2.3 Surface water characterisation

A surface water characterisation assessment (EMM 2018) was completed to address consent conditions B22(f) and B33(g). Four samples were collected from the sediment basin during the March to June 2018 period and two samples from the two-stage pit in June 2018 following construction. Details of the monitoring program, including methods, site context and results, are outlined in the *Surface Water Characterisation and Mitigation Plan* (SWCMP) (EMM 2018). The SWCMP forms part of the site's Operational Environmental Management Plan (OEMP). Surface water quality results from the characterisation are summarised below.

2.3.1 Results for Events 1 to 5

Concentrations of the following analytes were below the laboratory limit of reporting (LOR) in all sampling events. Therefore, these analytes are not considered to be of concern:

- Organics: monocyclic aromatic hydrocarbon (BTEX), Phenols, total recoverable hydrocarbons (TRH) and pesticides; and
- Dissolved metals and metalloids: beryllium (Br), bismuth (Bi), hexavalent chromium (Cr VI), selenium (Se), silver (Ag), thallium (Ti), tin (Sn) and mercury (Hg).

Poly aromatic hydrocarbons (PAH) concentrations were below the LOR in all samples except for Event 4 (collected from the two-stage pit) which identified levels of some PAHs that are similar to the low reliability trigger values that are reported in Section 8.3 of Volume 2 of ANZECC (2000). PAHs will continue to be monitored during site validation and discharge monitoring.

2.3.2 Event 6 results

The pH, total suspended solids (TSS) and oil & grease recorded during Event 6 (routine EPL monitoring) were:

- pH: 8.9;
- TSS: 100 mg/L; and
- oil & grease: <5 mg/L.

2.4 Surface water validation program

A surface water validation report (SWVR) is being prepared in accordance with Condition B35 in consultation with the EPA. It will include:

- collecting a minimum of four surface water samples from the sediment basin and four from the two-stage pit;
- analysing samples for all analytes identified in Table 4.2 of the SWCMP (EMM 2018) and characterising the samples with reference to ANZECC (2000)/ANZG(2018), Hunter River baseline water quality, the results of the surface water characterisation monitoring program, and EPL conditions;
- in addition to the analytes identified in Table 4.2 of the SWCMP the following analytes will also be analysed during the validation sampling at the request of the EPA:
    - methylphenyls;
    - PAHs;
    - cyanide; and
    - water treatment chemicals (dependent on selected water treatment option); and
- providing an assessment of the effectiveness of implemented mitigation measures and if necessary, provide additional measures.

This sampling commenced following the full establishment of the water management system, including commissioning of the then-proposed water treatment system. It targets rain events that generate runoff and discharge. Two rain event samples have been collected and the program is ongoing.

3 Existing environment

3.1 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.

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.

3.2 Hydrogeology

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

Groundwater has been contaminated from historical land uses including the former EMD operations and imported material associated with reclaimed steel works materials 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). The conceptual groundwater model is presented on Figure 3.1

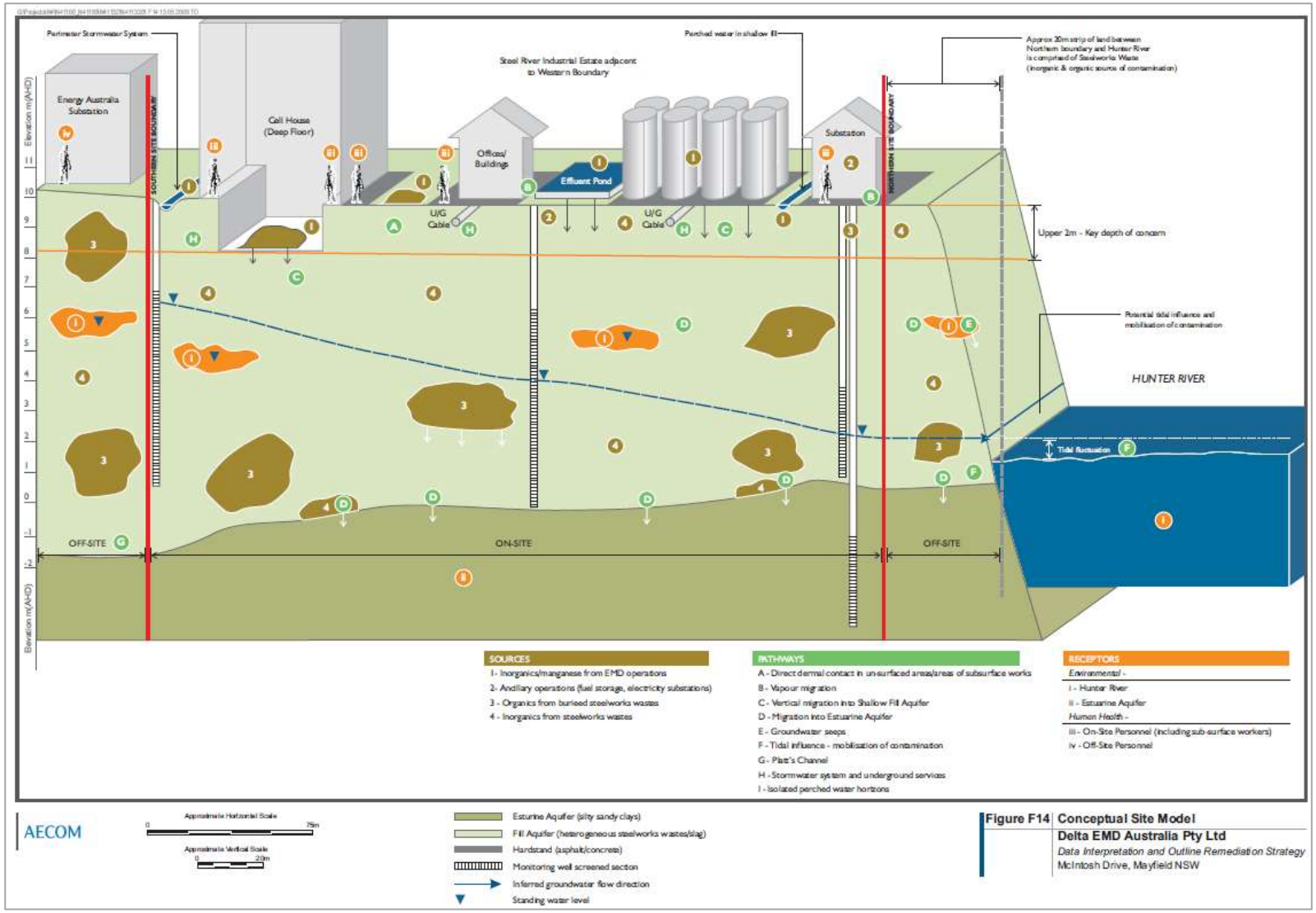
Soil and water reports included in the development applications for the recycling facility did not conduct any groundwater sampling as no groundwater use was proposed and no significant excavations were required. A summary of the baseline groundwater level and quality results from the detailed site investigation completed as part of the site management plan for subsurface disturbance activities (AECOM 2009) is provided in Sections 3.2.1 and 3.2.2.

3.2.1 Groundwater levels

Groundwater within the fill was encountered at a slightly higher elevation adjacent to the eastern, south-eastern and southern site boundaries and in the centre of the site. Groundwater levels in the fill aquifer range from around 3.4 m below ground level (mbgl) to 7.44 mbgl across the site (AECOM 2009).

Standing groundwater levels measured in all deeper estuarine aquifer monitoring wells during site investigations indicated that the underlying estuarine clay is a semi-confined aquifer. Groundwater levels in the estuarine sediments are generally deeper, ranging from 5.15 mbgl to 8.29 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 3.1 Site conceptual groundwater model

3.2.2 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 2008). Elevated concentrations are primarily manganese associated with the former EMD operations and organics (TPHs and PAHs) are associated with reclaimed 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 3.2 and groundwater quality for each aquifer from the is presented in Table 3.1 and Table 3.2.

Source: AECOM (2008).

Figure 3.2 Site sampling locations

i Fill Aquifer

Groundwater quality in the shallow fill may be 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; and
- 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:

- 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; and
- benzene concentrations were less than the LOR and/or IL, and TEX concentrations were all less than the LOR.

Table 3.1 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	317.07	37	1,960.00	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 3.2 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

4 Groundwater comparison with surface water quality

Surface water runoff generated from waste stockpiles is the most likely source of potential further groundwater contamination. The shallow fill aquifer is considered the most likely receptor of any surface water infiltration. Most of the sites roadways and stockpile areas are covered by concrete which prevents direct infiltration of surface water. There are some vegetated areas within the site that are not sealed. Any further impact of the existing groundwater environment would originate from the stockpile areas and be mobilised via surface water runoff. Therefore, the surface water quality characterisation must be considered in the assessment of any potential impact to groundwater.

The historical fill groundwater and the site surface water quality (EMM 2018) has been reviewed. A summary of the maximum recorded water quality values is presented in Table 4.1. The comparison between groundwater and surface water highlights:

- dissolved metals concentrations in the surface water measured since the recycling facility operations commenced are generally significantly lower than the baseline groundwater water concentrations;
- the concentrations of dissolved cadmium, cobalt, iron, lead, mercury, sulphide and zinc in surface water are all below LORs;
- PAH concentrations are mostly below LORs in both groundwater and surface water but, when detected, surface water concentrations (sampled from the two-stage pit [event 4]) (EMM 2018) are greater than groundwater concentrations;
- TPH concentrations are all below LORs in surface water, while historical maximum groundwater concentrations were 1,980 µg/L for TPH+C_{10}–C_{36} (sum of total); and
- BTEX concentrations are all below LORs in surface water but there are low concentrations in groundwater.

Table 4.1 Surface water/groundwater comparison of dissolved metals (maximum concentrations)

Group	Parameter	Unit	Fill groundwater	Surface water	Difference[1] (%)
Dissolved metals	Aluminium	mg/L	27.3	0.18	99%
	Barium	mg/L	1.24	-	SW not measured
	Cadmium	mg/L	0.001	<0.0001	Below LOR (SW)
	Chromium	mg/L	0.04	0.003	92%
	Cobalt	mg/L	0.03	<0.001	Below LOR (SW)
	Copper	mg/L	0.09	0.003	97%
	Iron	mg/L	30.6	<0.05	Below LOR (SW)
	Lead	mg/L	0.81	<0.001	Below LOR (SW)
	Manganese	mg/L	0.84	0.02	98%
	Mercury	mg/L	0.05	<0.0001	Below LOR (SW)
	Molybdenum	mg/L	0.24	0.012	95%
	Nickel	mg/L	0.04	0.002	95%
	Sulphate	mg/L	1,180	178	85%
	Sulphide	mg/L	1.4	<0.5	Below LOR (SW)
	Zinc	mg/L	0.71	<0.005	Below LOR (SW)

Note: 1. Difference = (1 - Concentration in surface water groundwater/concentration in surface water) x 100

Table 4.2 Surface water/groundwater of organic compounds (maximum concentrations)

Group	Parameter	Unit	Fill groundwater	Surface water	Difference[1]
PAH	Acenaphthene	µg/L	20.7	<1	Below LOR (SW)
	Acenaphthylene	µg/L	<1	<1	Below LOR (both)
	Anthracene	µg/L	<1	<1	Below LOR (both)
	Benz(a)anthracene	µg/L	<1	2.6	Below LOR (GW)
	Benzo(a) yrene	µg/L	0.5	2	-300%
	Benzo(b)fluoranthene	µg/L	<1	2.8	Below LOR (GW)
	Benzo(g,h,i)perylene	µg/L	<1	2.6	Below LOR (GW)
	Benzo(k)fluoranthene	µg/L	1	1.3	-30%
	Chrysene	µg/L	<1	2.3	Below LOR (GW)
	Dibenz(a,h)anthracene	µg/L	<1	<1	Below LOR (both)
	Fluoranthene	µg/L	2.3	5.6	-143%
	Fluorene	µg/L	7	<1	Below LOR (SW)
	Indeno(1,2,3-c,d)pyrene	µg/L	<1	2.2	Below LOR (GW)
	Naphthalene	µg/L	4.9	<5	Below LOR (SW)
	Phenanthrene	µg/L	8.1	2.2	73%
	Pyrene	µg/L	1.7	6	-253%

Table 4.2 Surface water/groundwater of organic compounds (maximum concentrations)

Group	Parameter	Unit	Fill groundwater	Surface water	Difference[1]
	Total PAHs	µg/L	**43.4**	**29.6**	**32%**
TPH	TPH C_6–C_9 fraction	µg/L	<50	<20	Below LOR (both)
	TPH C_{10}–C_{14} fraction	µg/L	1240	<50	Below LOR (SW)
	TPH C_{15}–C_{28} fraction	µg/L	600	<100	Below LOR (SW)
	TPH C_{29}–C_{36} fraction	µg/L	230	<50	Below LOR (SW)
	TPH+C_{10}–C_{36} (sum of total)	µg/L	1,980	<50	Below LOR (SW)
BTEX	Benzene	µg/L	2	<1	Below LOR (SW)
	Ethylbenzene	µg/L	<2	<2	Below LOR (both)
	Toluene	µg/L	3	<2	Below LOR (SW)
	Xylene (m & p)	µg/L	4	<2	Below LOR (SW)
	Xylene (o)	µg/L	2	<2	Below LOR (SW)
	Xylene Total	µg/L	6	<2	Below LOR (SW)

Note: 1. Difference = (1 - Concentration in surface water groundwater/concentration in surface water) x 100

The surface water quality concentrations for the sampled analytes presented in Table 4.1 and Table 4.2, are generally significantly lower than baseline groundwater concentrations.

Surface water from Area 1 is managed by a two-stage treatment system, while Area 2 is managed by a perimeter drain and final sediment basin. Given the controlled surface water management and the baseline groundwater contamination, the current site operation is unlikely to have an impact on the existing groundwater environment.

The PAH (fluoranthene, pyrene and Benzo(a)pyrene) concentrations were below the LOR in all samples except for the Event 4 sample collected from the two-stage pit (Table 4.2), ie from Area 1. Surface water from Area 1 is managed by a two-stage treatment system as described in Section 2.1. The concentrations of these PAHs were similar than the low reliability trigger values provided in Section 8.3 of Volume 2 of ANZECC (2000)/ANZG (2018). Elevated concentrations of PAHs have not been measures in Area 2 (eg in the perimeter drain or sedimentation basin).

In summary, total PAHs concentrations in surface water were lower than baseline groundwater concentrations. PAHs will continue to be monitored during site validation and discharge monitoring.

Given the controlled surface water management and the baseline groundwater contamination, the current site operation is unlikely to have an impact on the existing groundwater environment.

5 Leakage of the sediment basin

The sediment basin is sealed with concrete and the perimeter drains are sealed with a bitumen spray. The potential for leakage from the sediment basin will be determined by a monitoring following a rainfall event.

The sediment basin water level will be monitored during a 24-hour period following rain. No water (for dust-suppression) will be extracted from the sediment basing during this period. If the level in the sediment basin changes by more than what expected from evaporation during the monitoring period, it will be considered that leakage is occurring. If there is no change in the level, it will be considered that leakage is unlikely.

If the sediment basin is found to be leaking mitigation measures will be implemented. Mitigation measures are outline in the Trigger Action response Plan (TARP) in Section 6.

6 Trigger action response plan

The groundwater monitoring TARP has been developed (Table 6.1) to determine when there is the potential for baseline groundwater quality to be impacted and the response, including groundwater monitoring.

Table 6.1 Groundwater TARP

Condition	Trigger	Action	Response
Surface water quality	Surface water quality concentrations for analytes in Table 3.1 and Table 3.2 reported in the annual environmental report are greater than baseline groundwater concentrations.	Investigate surface water quality trends over time to determine if the result is a one off or trend over time.	Re-evaluate surface water treatment methods
Leakage from sediment basin	Basin is measured to be leaking following a rainfall event.	Investigate location of water loss of basin and repair leakage from basin.	Re-evaluate if the basin is leaking.
Continued leakage from sediment basin and surface water quality is poorer than baseline groundwater quality	Following repair, basin is measured to be leaking following a rainfall event. Surface water quality monitoring results above groundwater quality baseline	Initiation and implement a groundwater monitoring program.	As above.

7 Monitoring program

As discussed in Section 4 and presented in Table 4.1 and Table 4.2, surface water concentrations for dissolved metals, TPH's, PAH's and BTEX (EMM 2018) are lower than baseline groundwater concentrations. The concentrations of PAHs from sampling event 4 (sampled from the two-stage pit) had slightly higher concentrations than the groundwater. However, this is prior to treatment. On the basis of these results, it is considered that any infiltration of surface water to the contaminated groundwater will not be detrimental to the existing conditions. Surface water monitoring is ongoing.

7.1 Groundwater monitoring

If the TARP in Section 6 is triggered, groundwater monitoring bores will be installed, and the following groundwater monitoring program implemented.

i 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.

ii Monitoring frequency

Groundwater monitoring frequency will be six-monthly (bi-annual). The bi-annual sampling will allow groundwater conditions to be interpreted and water quality to be analysed and compared to historical observations.

The water quality sampling frequency at the four monitoring bores and the sediment basin is outlined in Table 7.1. Recommended sample chemical parameters are outlined in Table 7.2.

Table 7.1 Groundwater quality monitoring program

	Monitoring frequency		
Monitoring phase	**Water levels**	**Groundwater quality Monitoring bores**	**Water quality Sediment Basin**
If triggered (see TARP)	Bi-annual	Bi-annual	Bi-annual

Table 7.2 Groundwater quality sampling suite

Analysis/classification	**Parameter**
Field analysis	
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

Table 7.2 Groundwater quality sampling suite

Analysis/classification	Parameter
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

Groundwater monitoring will be undertaken following the TARP being triggered, to detect deteriorating groundwater quality and implement mitigation actions (if needed). Groundwater monitoring data will be routinely compared to meteorological data such as rainfall and evaporation and sedimentation dam levels.

8 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; and
- chain of custody records, analysis and results.

9 References

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

AECOM 2009, *Site managemernt 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 2018, *Surface Water Characterisation and Mitigation Plan.* Report prepared for Benedict.

Tooker and Associates 2018, *Surface water management system.* Report prepared for Benedict.

Appendix A

EPA consultation

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