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WATER DISCHARGE MANAGEMENT PLAN

Concrush Resource Recovery Facility

FINAL

July 2020

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Concrush Resource Recovery Facility

FINAL

Prepared by
Umwelt (Australia) Pty Limited
on behalf of
Concrush Pty Ltd

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Rev No.	Reviewer		Approved for Issue	
	Name	Date	Name	Date
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Table of Contents

Figures

Tables

Appendices

1.0 Introduction

1.1 Background

Concrush Pty Ltd (Concrush) received development consent (the Project Approval) to increase the processing and storage capacity of the existing resource recovery facility (State Significant Development (SSD) 8753) located on part of Lot 2 DP 220347 at 21 Racecourse Road, Teralba, New South Wales (NSW) on 27 March 2020 under Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act), for which the Minister for Planning is the consent authority.

Concrush was established in 2002 after recognising the need for a construction and demolition recycling facility in the Lake Macquarie region. Concrush is a locally owned and operated business based at Teralba.

The Concrush facility provides cost effective options for recycling of concrete, asphalt, bricks, pavers, roof tiles, wall and floor tiles, rock, sand, plasterboard and green waste for domestic households and commercial industry. These materials are then recycled into specification and non-specification quality products such as: roadbase, drainage aggregates, pipe bedding and haunch, packing fines, decorative aggregates and mulches. These products are used within the civil and construction industries or for commercial, domestic and household applications.

The Project Approval allows Concrush to increase the process up to 250,000 tonnes per annum (tpa) and store up to 150,000 tonnes onsite. The Project will be constructed over two stages to allow for the proposed Project elements to come online as required in line with increasing production.

A description of the individual elements of the proposed Project including additional plant and equipment are summarised in **Table 1.1**.

Table 1.1 Proposed Project Components

Component	Description
Hardstand areas	Hardstands will be constructed in material processing areas and stockpile areas (will require some site levelling). Hardstands will consist of 200 mm thick recycled roadbase). Internal access roads will have a two coat seal.
Material Processing Areas	Processing areas for the crushers and screens.
Waste and Product Stockpile Areas	Waste and product stockpiles will be established with a stockpile height of up to 10 metres (m). It is anticipated that up to 150,000 t of material will be stored onsite.
Upgrade of existing facilities	The existing weighbridge and office will be upgraded, and the existing lunch room and maintenance shed will be relocated to facilitate the new site layout.
Waste Tracking System	The existing Wasteman software will be used to track the details of all inbound and outbound loads
Production Compound	The relocated lunch room, toilet and maintenance shed will be grouped together to form a compound for production staff.
Retail Area	This area will be restricted to light vehicles and small trucks and will include an area for tipping and an area containing concrete bays of products for sale.
Storage Bays	Concrete storage bays will be constructed using 1 m^3 concrete blocks.
Concrete Walls	A 2 m high concrete wall will be constructed close to the southern Project site boundary using 1 m^3 concrete blocks. The wall will prevent stockpiled material encroaching on swale drains and moving offsite. Concrete walls may also be used to delineate other areas of the site.

Component	Description
Green Waste Pasteurisation	An aeration system using four electronically driven and computer controlled fans to push air through movable perforated pipes underneath the pasteurisation piles will be implemented in the green waste area. This system allows more control of oxygen levels in the pasteurisation process compared to the tradition turnover process.
Wheel Wash	A vehicle wheel wash bay will be constructed immediately after the exit weighbridge to reduce tracking of material onto public roads.
Concrete Washout Bay	A wet concrete washout bay will be constructed consisting of a bunded, impermeable area with an isolated catchment. Wet concrete and agitator washout will be captured in the concrete washout bay.
Water Management System	The existing Water Management System (WMS) will be upgraded involving resizing of existing sediment basins, new sediment basins, swale drains and a leachate dam and artificial wetland to treat nutrient runoff. Water tanks and associated poly pipe and pumps will be installed to allow collection and re-use of stormwater for dust suppression.
Trommel Screening Machine	Addition of a Trommel screening machine for sorting of green waste.
Primary Jaw Crusher	The primary jaw crusher will be replaced on a like for like basis as part of future operations.
Perimeter Landscaping - Mounds, Fencing and Lighting	Landscape mounds will be established on the perimeter to limit visibility. 1.8 m high security fencing and security lighting are also to be installed.
Utilities	The existing Ausgrid connection is via a power pole in the north east corner of the site. The power supply will be extended to the south west corner of the site via an underground connection.
Pug mill	A pug mill may be installed in the future to allow fast mixing of materials to produce products such as road base.
Ballast wash facility	A processing area may be dedicated to a ballast wash facility to allow for processing of rail ballast.

1.2 Project Staging

The volume of materials recycled and products sold will increase over a period of time up to the maximum approved production level of 250,000 tpa. To most efficiently meet the increase in demand for recycling of materials and Concrush products, the Project will be staged by undertaking some elements of the site upgrade early and implementing other elements of the Project as required when a certain production level is reached. Two Project stages and the associated approximate production level will be implemented as follows:

Stage 1

The key elements of Stage 1 are:

- Construction of all hardstand areas (processing areas and waste and product stockpiles)
- Creation of the retail area
- Widen site access and install sliding gate
- Re-configuration of existing exit only weighbridge to allow for vehicle exit and entry to facilitate entry to the site
- Construct production compound by relocating maintenance shed and lunch room and toilet

- Augment the existing water management system to incorporate the leachate dam, constructed wetland, additional sediment basins, drainage swales, flood mitigation bund, water storage tanks and sprinkler systems
- Establish wheel wash, landscaping mounds, fencing, power line extension and lighting
- Two coat seal of internal access roads
- Replace primary jaw crusher.

Stage 2

Stage 2 will be implemented when production reaches approximately 200,000 tpa up to the Project limit of 250,000 tpa. The key elements of Stage 2 are:

- Relocation of the existing exit weighbridge, construction of a new entry weighbridge and establishment of the new weighbridge office
- The existing entry weighbridge becomes the retail area weighbridge and the existing weighbridge office becomes the retail area weighbridge office
- Construction of a new exit onto Racecourse Road from retail area for light vehicles (less than 2 t) only
- Establish pug mill
- Establish ballast wash facility
- Establish trommel screening machine for green waste
- Establish aeration system for green waste pasteurisation.

1.3 Purpose and Scope

The purpose of this Water Discharge Management Plan (WDMP) is to describe the soil and water quality management strategies, procedures, controls and monitoring programs to be implemented at Concrush to manage potential water quality impacts associated with discharges from the expanded operation Water Management System (WMS).

This WDMP addresses the relevant requirements of the Project Approval and Environment Protection Licence (EPL) 13351. The Project Approval conditions and related Environmental Impact Statement management commitments relevant to this plan are provided in **Table 1.3**.

1.4 Plan Implementation

1.4.1 Responsibilities

Environmental management at Concrush is the responsibility of all employees with the Concrush Director having overall responsibility for environmental management of the operations. Roles and responsibilities for implementation of this WDMP for key personnel at Concrush are outlined in **Table 1.2**.

Table 1.2 Roles and Responsibilities

Role	Responsibilities
Concrush Director (Kevin Thompson)	• Provide sufficient resources for the implementation of this plan. • Be aware of the environmental legislative requirements associated with the site operation and take measures to ensure compliance. • Initiate investigations of complaints as received from the public or government agency. • Coordinate water related incident investigations and reporting as required by legislation. • Prepare a report to government agencies or neighbours following incidents/ non-compliances. • Coordinate the review of this plan in accordance with the requirements of the Project Approval. • Evaluate and report monitoring results as required by the Project Approval and Environment Protection Licence (EPL).
Business Manager (Helen Milne)	• Oversee the implementation of this plan. • Have working knowledge of this plan. • Coordinate the implementation of water management measures and strategies in accordance with this plan. • Ensure that monitoring is undertaken in accordance with this plan. • Ensure employees are competent through training and awareness programs. • Provide primary contact for complaints and supply follow-up information to any complainant.
All employees and contractors	• Comply with all requirements in this plan. • Report all potential environmental incidents to the Business Manager immediately. • Operate in a manner that minimises risks of incidents to themselves, fellow workers or the surrounding environment. • Follow any instructions provided by the Business Manager or Yard Manager.

1.4.2 Further Studies

Concrush has a requirement as detailed within the Project Approval (condition B19) to prepare a Discharge Verification and Mitigation Report (DVMR) within 12 months of commencement of Stage 1 operations.

1.4.3 Hold Points

Concrush has three hold point requirements relating to water discharges as detailed in the Project Approval:

- Concrush must not commence Stage 1 construction until this WDMP required by condition B12 of the Project Approval (refer to **Table 1.3**) is approved by the Planning Secretary.
- Concrush must not commence Stage 1 operations until the DVMP required by condition B14 of the Project Approval is approved by the Planning Secretary.
- Concrush must not commence Stage 1 operations until the approved management and mitigation measures required by condition B14 of the Project Approval have been installed and implemented.

Table 1.3 presents the Project Approval conditions specific to this WDMP and where they are addressed in this document.

Table 1.3 Project Approval Conditions relevant to water management at Concrush

Condition	Requirement	Section/s Addressed
Part B – Specific Environmental Conditions		
Water Discharge Management Plan		
B12	Prior to the commencement of Stage 1 construction, the Applicant must prepare a Water Discharge Management Plan (WDMP) to the satisfaction of the Planning Secretary. The WDMP must form part of the CEMP required by condition C2 and be prepared in accordance with condition C1. The WDMP must:	
	(a) be prepared by a suitably qualified and experienced person(s), whose appointment has been endorsed by the Planning Secretary;	**Appendix A**
	(b) be prepared in consultation with the EPA;	**Section 1.6**
	(c) detail the expected volume and frequency of discharges from each proposed discharge point;	**Section 4.0**
	(d) characterise the quality of discharges from each proposed discharge point including the concentrations and loads of all pollutants present at non-trivial levels that pose a risk of harm to human health or the environment;	**Section 5.0**
	(e) detail the potential impact of discharges on the environmental values of the receiving waterways with reference to the relevant Australian and New Zealand Guidelines for Fresh and Marine Water Quality Guideline values;	**Section 6.0**
	(f) detail the control measures to be implemented to protect receiving waters during the development, including measures to address any identified impacts to receiving waters and contingency measures for any unexpected pollutants with reference to the relevant Australian and New Zealand Guidelines for Fresh and Marine Water Quality Guideline values; and	**Sections 3.0 and 7.0**
	(g) propose any changes to the wastewater management system to address potential impacts.	**Section 7.2**
B13	The Applicant must:	
	(a) not commence Stage 1 construction until the WDMP required by condition B12 is approved by the Planning Secretary; and	**Section 1.6**
	(b) implement the most recent version of the WDMP approved by the Planning Secretary for the duration of the development.	**Section 1.4**

1.4.4 Environment Protection Licence

The Concrush Resource Recovery Facility operates under EPL 13351, issued under the *NSW Protection of the Environment Operations Act 1997* (POEO Act). EPL 13351 contains the following condition in relation to potential water resource impacts:

> **L1 Pollution of waters**
>
> L1.1 Except as may be expressly provided in any other condition of this licence, the licensee must comply with section 120 of the Protection of the *Environment Operations Act 1997*.

1.5 Guidelines and Policies

Water quality data has been compared to guideline values presented in *The Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZG) (Australian and New Zealand Governments and Australian state and territory governments, 2018).

1.6 Consultation and Plan Approval

On 27 April 2020 Chris Bonomini (Senior Engineer – Water, Process and Risk of Umwelt contacted Steven James (Unit Head Waste Compliance) of the NSW Environment Protection Authority (EPA) by telephone to discuss the approach to preparation of this WDMP and water discharge characterisation. A copy of this WDMP was submitted to the EPA on 19 May 2020 for review and comment. Comments were received from the EPA on 16 July 2020 and a copy of these is provided on **Appendix B**.

Construction of Stage 1 of the Project will not commence until this WDMP has been approved by the Planning Secretary.

2.0 Surface Water Context

The Project site is situated in the suburb of Teralba, within the Lake Macquarie Local Government Area with the existing Concrush operation covering an area of approximately 2.4 hectares (ha) and the expanded Project to cover a total area of approximately 4.8 ha. The Project site is bound to the west by the Main Northern Rail Line and to the east by Racecourse Road and Cockle Creek. The land uses surrounding the Project site include a wrecker's yard, a scrap metal recycling yard to the south and Teralba Colliery and Macquarie Coal Preparation Plant to the west. The proposed Bunderra residential estate is located approximately 200 m to the east of the Project site. Access to the Project site is via a driveway on Racecourse Road.

The northern portion of the Project site is predominantly devoid of vegetation while the southern portion is dominated by exotic vegetation that has invaded previously disturbed areas. There are trees planted along parts of the existing site boundaries which act as a wind break and visual screen for adjacent properties.

2.1 Surface Hydrology

The Project site is located in the Cockle Creek Estuary catchment that forms part of the broader Lake Macquarie catchment and is classified as having a high flood risk based Lake Macquarie City Council (LMCC) flood risk mapping. The Project site is flat with the majority of stormwater runoff draining to the west by overland flow or via the Central Drainage Pit (refer to **Figure 3.1**). The Central Drainage Pit flows to a vegetated surface drain running along the northern site boundary to discharge into a drainage depression at the north eastern corner of the Project site which in turn drains to the north prior to discharging into Cockle Creek approximately 250 m downstream. A relatively smaller section at the eastern end of the site catchment currently drains to the local stormwater system along Racecourse Road.

Following implementation of Stage 1, all surface runoff (excluding the Green Waste catchment) will drain to sediment basins at the north western and south western corners of the site. Any spills from the sediment basin in the north western corner of the site, (Sediment Dam 1) will drain to the north prior to discharging into Cockle Creek approximately 250 m downstream (refer to **Figure 2.1**). Any spills from the from the sediment basin in the south western corner of the site (Sediment Basin 2) will drain to the south prior to discharging into Cockle Creek approximately 1.5 km downstream (refer to **Figure 2.1**). Further detail regarding the Project WMS is presented **Section 3.0**.

The Project site is situated in the Lower Cockle Creek Floodplain (the Floodplain) with lower portions of the Project site within the 1% Average Exceedance Probability (AEP) flood extent as determined by the Winding Creek and Lower Cockle Creek Floodplain Risk Management Study and Plan (BMT WBM, 2016).

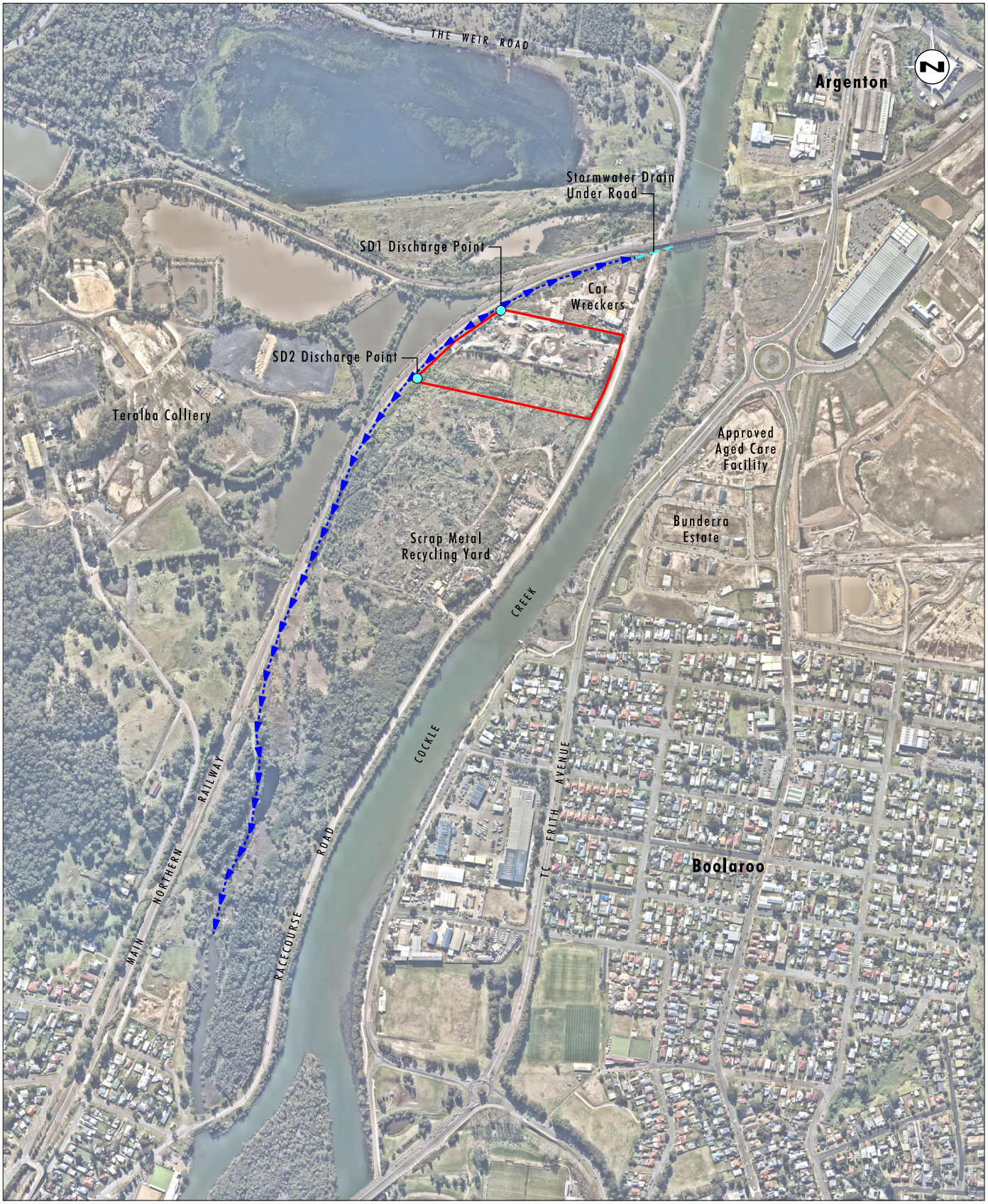


Image Source: Nearmap (Jun 2018)
Data Source: RCA Acoustics (2018)

0 100 250 500m
1:10 000

Legend

- Project Site
- Drainage Depression
- Stormwater Drain Under Road
- Proposed Discharge Points (sediment dam spillways)

FIGURE 2.1

Local Off-site Drainage

2.2 Climate

Lake Macquarie has a humid subtropical climate typical of the eastern Australia coastline. Summers are typically warm and humid with occasional periods of very hot and dry weather resulting from hot westerly and north westerly winds. Rainfall is highest in late autumn to early winter with the second half of the year typically drier. Winters are cool and on average drier than Summer. The region can also experience east coast lows with extremely high rainfall and winds in excess of 100 km/h.

The Bureau of Meteorology (BoM) station nearest to the Project is located approximately 1.5 km to the north at the Edgeworth Wastewater Treatment Works (WWTW) (station 061393). **Table 2.1** presents the monthly rainfall statistics for the Edgeworth WWTW BoM station (station 061393).

Table 2.1 Edgeworth WWTW Monthly Rainfall (mm), 1990 – 2020

Statistic	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean	93.0	146.3	126.3	124.5	92.2	120.5	54.2	52.0	68.5	73.3	96.5	86.9
10th Percentile	17.5	40.0	39.4	25.6	15.9	28.3	11.3	6.5	11.1	18.8	44.1	34.2
Median	69.8	115.6	114.2	107.0	88.2	104.7	40.8	35.0	50.6	55.5	83.5	70.1
90th Percentile	198.9	258.1	206.0	229.1	169.0	191.6	119.6	107.8	145.4	167.7	168.0	165.8

2.3 Water Quality

Baseline water quality monitoring has been undertaken for receiving waters potentially impacted by spills from the Project WMS and site water quality at the locations presented in **Figure 2.2**. **Sections 2.3.2**, **2.3.1** and **2.3.3** provide a summary of the baseline water quality results for pollutants detected at non-trivial levels for the expanded water quality monitoring program undertaken during the approvals stage of the Project.

Image Source: Nearmap (May 2017)
Data Source: Concrush (2018)

0 25 50 100m
1:2 000

Legend

- Project Site
- Proposed Extension Area
- Existing Wetland Area with Buffer
- Water Quality Monitoring Location

FIGURE 2.2

Water Quality Monitoring Locations

File Name (A4): R01/4987_002.dgn
20200505 11.34

2.3.1 Drainage Depression

The drainage depression is the immediate receiving environment for any spills from the Concrush WMS. Seven rounds of water quality monitoring were undertaken at RW1 (refer to **Figure 2.2**) which for the existing operation is not influenced by stormwater runoff flowing from the Concrush site. **Table 2.2** presents the water quality monitoring results for RW1.

Comments from the EPA on this WDMP (refer to **Appendix B**) advised referencing the default guideline values for electrical conductivity (EC) and Total Nitrogen (TN) for east flowing rivers from ANZG 2018, i.e. 300 µS/cm and 0.35 mg/L respectively. However, based on the recorded water quality results for the drainage depression immediately upstream of the existing Concrush facility (refer to **Table 2.2**) the guideline values for EC and TN presented in **Table 2.2**, **Table 2.3** and **Table 2.4** are considered appropriate.

Table 2.2 RW1 Water Quality Results

Parameter	LOD	Units	Guideline Value/Range	Number of Results >LOD	Minimum	Maximum
pH	0.1	-	6.5 – 8.5[1]	7	6.9	8.0
Electrical Conductivity (EC)	1	µS/cm	125 – 2,200[1]	7	140	920
Total Suspended Solids (TSS)	1	mg/L	50[2]	7	8	75
Total Recoverable Hydrocarbons (TRH)	0.1	mg/L	10[2]	0	<0.1	<0.1
Nitrate (as N)	0.02	mg/L	2.4[3]	6	<0.2	13.8
NOx (as N)	0.05	mg/L	0.04[1]	7	0.09	1.20
Total Nitrogen (TN)	0.2	mg/L	0.5[1]	5	<0.02	9.40
Total Phosphorus (TP)[4]	0.01	mg/L	0.05[1]	4	<0.05	9.60
Ammonia (as N)	0.01	mg/L	0.90[3] (0.02[1])	5	<0.01	0.50
Aluminium[6]	0.05	mg/L	0.055[5]	1	<0.05	1.300
Arsenic[6]	0.001	mg/L	0.024[5]	6	<0.001	0.006
Boron[6]	0.05	mg/L	0.37[5]	5	<0.05	0.140
Cadmium[6]	0.0002	mg/L	0.0002[5]	1	<0.0002	0.0003
Chromium III[6]	0.005[7]/0.001[8]	mg/L	0.0033[9]	1	0.002	0.002
Chromium VI[6]	0.005[7]/0.0005[8]	mg/L	0.001[5]	3	<0.0005	0.0020
Cobalt[6]	0.001	mg/L	-[10]	2	<0.001	0.001
Copper[6]	0.001	mg/L	0.0014[5]	7	0.003	0.036
Lead[6]	0.001	mg/L	0.0034[5]	5	<0.001	0.004
Nickel[6]	0.001	mg/L	0.011[5]	6	<0.001	0.009
Selenium[6]	0.001	mg/L	0.011[5]	1	<0.001	0.001
Zinc[6]	0.005	mg/L	0.008[5]	7	0.009	0.260

Notes:

1. NSW WQO selected from ANZG 2018 default guideline value for physical and chemical stressors in south-east Australia for slight to moderately disturbed freshwater lowland river aquatic ecosystems
2. Guideline value based on concentration limits found in typical NSW Environment Protection Licences
3. Grading (for average long term exposure) nitrate concentration for 95% species protection sourced from *Updating nitrate toxicity effects on freshwater aquatic species*, National Institute of Water & Atmospheric Research Ltd, 2013

4. Analysis for Total Phosphate was undertaken inadvertently by the laboratory rather than Total Phosphorus (TP) as requested. However, results have been included with historical TP results in the analysis and compared with ANZG 2018 guideline values for TP.
5. ANZG 2018 default guideline value for metal and metalloid toxicants in freshwater systems for 95% species protection
6. Results are for dissolved concentrations
7. Limit of Detection applied for analysis of the first round of the expanded water quality monitoring program
8. Limit of Detection applied for analysis of the additional rounds of the expanded water quality monitoring program
9. Percentage species protection level unknown
10. No default guideline value for freshwater systems

2.3.2 Cockle Creek Estuary

Two rounds of water quality monitoring were undertaken in Cockle Creek upstream and downstream of Concrush (refer to **Figure 2.2**)for the expanded water quality monitoring program and the results are presented in **Table 2.3**. It should be noted that the downstream water quality monitoring location is only downstream of the stormwater discharge point from the relatively small section of catchment draining to the front of the Concrush site.

Table 2.3 Cockle Creek Water Quality Results

Parameter	LOD	Units	Guideline Value/Range	Cockle Creek Upstream		Cockle Creek Downstream	
				16/3/19	1/4/19	16/3/19	1/4/19
pH	0.1	-	6.5 – 8.5[1]	7.1	7.5	6.9	7.5
EC	1	µS/cm	125 – 2,200[1]	16,000	12,000	16,000	13,000
TSS	1	mg/L	50[2]	240	18	190	32
TRH	0.1	mg/L	10[2]	<0.1	<0.1	<0.1	<0.1
Nitrate (as N)	0.02	mg/L	2.4[3]	0.56	0.25	0.56	0.49
NOx (as N)	0.05	mg/L	0.04[1]	0.57	0.26	0.58	0.51
TN	0.2	mg/L	0.5[1]	0.9	0.7	1.4	1.1
TP[4]	0.01	mg/L	0.05[1]	0.15	0.05	0.15	0.05
Ammonia (as N)	0.01	mg/L	0.90[3] (0.02[1])	0.16	0.05	0.18	0.06
Aluminium[6]	0.05	mg/L	0.055[5]	<0.05	<0.05	<0.05	<0.05
Arsenic[6]	0.001	mg/L	0.024[5]	0.003	0.002	0.003	0.003
Boron[6]	0.05	mg/L	0.37[5]	1.30	1.00	1.30	1.10
Cadmium[6]	0.0002	mg/L	0.0002[5]	<0.0002	<0.0002	<0.0002	<0.0002
Chromium III[6]	0.005[10]/0.001[11]	mg/L	0.0033[9]	<0.005	<0.001	<0.005	<0.001
Chromium VI[6]	0.005[10]/0.0005[11]	mg/L	0.001[5]	<0.005	0.0006	<0.005	<0.0005
Cobalt[6]	0.001	mg/L	-[10]	<0.001	<0.001	<0.001	<0.001
Copper[6]	0.001	mg/L	0.0014[5]	0.002	<0.001	0.003	0.001
Lead[6]	0.001	mg/L	0.0034[5]	<0.001	<0.001	<0.001	0.001
Nickel[6]	0.001	mg/L	0.011[5]	<0.001	0.001	<0.001	0.001
Selenium[6]	0.001	mg/L	0.011[5]	<0.001	<0.001	<0.001	<0.001
Zinc[6]	0.005	mg/L	0.008[5]	0.024	0.028	0.024	0.037

Notes:

1. NSW WQO selected from ANZG 2018 default guideline value for physical and chemical stressors in south-east Australia for slight to moderately disturbed freshwater lowland river aquatic ecosystems
2. Guideline value based on concentration limits found in typical NSW Environment Protection Licences
3. Grading (for average long term exposure) nitrate concentration for 95% species protection sourced from *Updating nitrate toxicity effects on freshwater aquatic species*, National Institute of Water & Atmospheric Research Ltd, 2013
4. Analysis for Total Phosphate was undertaken inadvertently by the laboratory rather than Total Phosphorus (TP) as requested. However, results have been included with historical TP results in the analysis and compared with ANZG 2018 guideline values for TP.

5. ANZG 2018 default guideline value for metal and metalloid toxicants in freshwater systems for 95% species protection
6. Results are for dissolved concentrations
7. Limit of Detection applied for analysis of the first round of the expanded water quality monitoring program
8. Limit of Detection applied for analysis of the additional rounds of the expanded water quality monitoring program
9. Percentage species protection level unknown
10. No default guideline value for freshwater systems

2.3.3 Site Water Quality

Site stormwater monitoring has been undertaken since November 2017 with water quality samples being analysed for a range of nutrients, pH, electrical conductivity (EC), total suspended solids (TSS) and turbidity and for a range of other pollutants as part of the expanded water quality monitoring program initiated during the approvals stage of the Project. **Table 2.4** presents the monitoring result statistics for pollutants detected at non-trivial levels throughout the original water quality monitoring program and the expanded water quality monitoring program for stormwater flowing off-site. Where concentrations were tested below the limit of detection (LOD), the results were recorded at a value equal to half the LOD.

Table 2.4 Concrush Site Water Quality, November 2017 to February 2020

Parameter	LOD	Units	Guideline Value/ Range	Number of Results	Minimum	Average	80th Percentile	Maximum
pH	0.1	-	6.5 – 8.5[1]	13	7.0	8.1	8.4	8.5
EC	1	µS/cm	125 – 2,200[1]	13	188	847	1035	1500
TSS	1	mg/L	50[2]	13	3	90	116	608
TRH	0.1	mg/L	10[2]	5	0.05	0.06	0.06	0.10
Nitrate (as N)	0.02	mg/L	2.4[3]	13	1.0	8.8	12.8	20.0
NOx (as N)	0.05	mg/L	0.04[1]	13	0.07	0.23	0.32	0.56
TN	0.2	mg/L	0.5[1]	12	0.06	5.97	8.98	16.00
TP[4]	0.01	mg/L	0.05[1]	12	0.06	6.67	10.51	18.00
Ammonia (as N)	0.01	mg/L	0.90[3] (0.02[1])	13	0.01	0.36	0.13	3.00
Aluminium[6]	0.05	mg/L	0.055[5]	10	0.025	0.056	0.092	0.100
Arsenic[6]	0.001	mg/L	0.024[5]	10	0.001	0.007	0.008	0.021
Boron[6]	0.05	mg/L	0.37[5]	10	0.025	0.089	0.112	0.210
Cadmium[6]	0.0002	mg/L	0.0002[5]	10	0.0001	0.0001	0.0001	0.0001
Chromium III[6]	0.005[10]/0.001[11]	mg/L	0.0033[9]	10	0.001	0.005	0.004	0.022
Chromium VI[6]	0.005[10]/0.0005[11]	mg/L	0.001[5]	10	0.0025	0.0479	0.0924	0.1600
Cobalt[6]	0.001	mg/L	-[10]	10	0.001	0.003	0.003	0.015
Copper[6]	0.001	mg/L	0.0014[5]	10	0.005	0.018	0.027	0.043
Lead[6]	0.001	mg/L	0.0034[5]	10	0.001	0.002	0.002	0.004
Nickel[6]	0.001	mg/L	0.011[5]	10	0.001	0.008	0.007	0.052
Selenium[6]	0.001	mg/L	0.011[5]	9	0.001	0.002	0.003	0.004
Zinc[6]	0.005	mg/L	0.008[5]	10	0.003	0.030	0.060	0.096

Notes:

1. NSW WQO selected from ANZG 2018 default guideline value for physical and chemical stressors in south-east Australia for slight to moderately disturbed freshwater lowland river aquatic ecosystems
2. Guideline value based on concentration limits found in typical NSW Environment Protection Licences

[3] Grading (for average long term exposure) nitrate concentration for 95% species protection sourced from *Updating nitrate toxicity effects on freshwater aquatic species*, National Institute of Water & Atmospheric Research Ltd, 2013
[4] Analysis for Total Phosphate was undertaken inadvertently by the laboratory rather than Total Phosphorus (TP) as requested. However, results have been included with historical TP results in the analysis and compared with ANZG 2018 guideline values for TP.
[5] ANZG 2018 default guideline value for metal and metalloid toxicants in freshwater systems for 95% species protection
[6] Results are for dissolved concentrations
[7] Limit of Detection applied for analysis of the first round of the expanded water quality monitoring program
[8] Limit of Detection applied for analysis of the additional rounds of the expanded water quality monitoring program
[9] Percentage species protection level unknown
[10] No default guideline value for freshwater systems

Stormwater discharges from the existing Concrush site contain a number of pollutants (including TSS, nutrients from green waste processing and dissolved metals from waste and product materials containing concrete) at elevated concentrations. Some of the pollutants in stormwater leaving the site were detected at concentrations above the listed guideline values, however, the proposed controls (Leachate Dam, Constructed Wetland, SD1 and SD2) to be implemented as part of the Project will reduce the concentrations and loads discharged off-site (refer to **Section 5.0**).

3.0 Water Management System

The WMS for both Stage 1 and Stage 2 will essentially be the same and comprise of three main catchments as presented in **Figure 3.1**. **Table 3.1** provides the catchment areas, potential pollutants contained in runoff from the catchment, associated pollution controls and where off-site discharges will report to. **Figure 3.2** presents a schematic of the WMS.

The overall water management strategy is to retain as much runoff from catchments with a higher likelihood of elevated contaminants in runoff for on-site reuse in material processing and dust suppression. Primary controls on site will comprise sediment dams, a Leachate Dam and a Constructed Wetland. Site water storage tank capacity will be increased by at least 200 kL to 310 kL.

In addition to the three primary catchments, the Project will have two isolated catchments; the Concrete Agitator Washout Bay and the Wheel Wash (refer to **Figure 3.2**). Concrete agitator washout is received as a relatively dry solid product but has a high proportion of fine solids and an elevated pH. The isolated Concrete Agitator Washout Bay catchment will be located within the raw materials stockpile area. Wheel Wash water will have a high concentration of sediment. Any runoff in the Concrete Agitator Washout Bay and used Wheel Wash water will be contained on site and used as a first priority for operating demands.

Runoff and seepage from the Green Waste catchment will be contained in the Leachate Dam which will be lined with a flexible membrane liner with a permeability of less than 10^{-14} m/s and will be sized to accommodate the runoff from a 1 in 10 year, 24 hour duration storm event in accordance with the *Environmental Guidelines for Composting and Related Organics Processing Facilities* (NSW Department of Conservation, 2004). Water captured in the Leachate Dam will be transferred by pump to the a leachate treatment system that is presently in the design stage. During the approvals phase, it was anticipated that a constructed wetland would provide leachate treatment (nutrient removal), however, detailed analysis by water treatment specialist (Hunter H2O) has indicated a standalone wetland is not appropriate to treat the significantly varying inflows from the Leachate Dam, i.e. the maximum inflow rate is approximately 30 m^3/day higher than the 95^{th} percentile flow rate. As such, further design works is to be undertaken and it is anticipated that the leachate treated system will incorporate an attenuation tank, a pocket wetland for treatment of typical inflows and a bioswale/bioretention type system for treatment of higher inflows.. Leachate Dam dewatering rates to the leachate treatment system and storage tanks will target restoration of Leachate Dam design capacity (i.e. runoff from a 1 in 10 year, 24 hour duration storm event) within 5 days of a rainfall event. Treated water from the leachate treatment system will be reused in the Green Waste catchment only. However, should water quality monitoring demonstrate suitably low nutrient concentrations in treated leachate, Concrush will request approval from the EPA to utilise treated leachate across the broader site for dust suppression.

The Green Waste storage and processing catchment will also be designed and constructed in accordance with the *Environmental Guidelines for Composting and Related Organics Processing Facilities* (NSW Department of Conservation, 2004). The green waste storage and handling area will incorporate a leachate barrier equivalent to a 600 mm clay liner with an in-situ permeability of less than 10^{-7} m/s and be bunded and graded to ensure all runoff reports to the Leachate Dam. Concrush propose to use it's "Blended Base Material" product to construct the green waste storage and handling surface which has a permeability of 1×10^{-8} m/s (refer to **Appendix C** which contains the RCA Australia permeability test results for the "Blended Base Material").

Runoff from the Northern Catchment (i.e. the existing portion of the site) will drain to the existing vegetated swale running east to west along the northern site boundary to Sediment Dam 1 (SD1). Runoff from the Southern Catchment (i.e. the southern site extension) will drain to a vegetated swale running east to west along the southern site boundary to Sediment Dam 2 (SD2). Excess water discharging from the Constructed Wetland during high rainfall events will also drain to the southern vegetated swale and into SD2 and be diluted by runoff from the Southern Catchment. As such SD2 has been sized to accommodate runoff from the Green Waste catchment.

SD1 and SD2 will be dewatered to the site water storage tanks for reuse. Each dam will be equipped with an electric pump that is level switch enabled/disabled to allow dewatering of the first flush of stormwater runoff (when there is available capacity in the site water storage tanks) which is likely to have higher concentrations of pollutants than ongoing runoff from a given rain event.

SD1 and SD2 have been sized as Type D sediment basins to accommodate runoff from the five day 90th percentile rainfall event in accordance with *Managing Urban Stormwater Volume 1* (The Blue Book) (Landcom, 2004). SD1 and SD2 will also be lined consistent with the design specifications for leachate dams recommended by *Environmental Guidelines Solid Waste Landfills* (EPA, 2016). Further, a Remediation Action Plan will be prepared for the construction phase of the Project and the construction methods to be employed (e.g. capping of all surfaces and water storage lining) will ensure negligible connectivity between any potentially contaminated underlying soils and groundwater with surface water.

Water for material processing and dust suppression will be reticulated on site via an existing pump and pipe system which will be upgraded for the larger site. A new 12 kL water cart has been purchased to assist the existing 8.5 kL water cart supply the increased processing, stockpile dust suppression and internal road dust suppression demands. During periods where the Project has a water deficit, the water carts will continue to collect water from the Hunter Water potable supply adjacent to Teralba Oval.

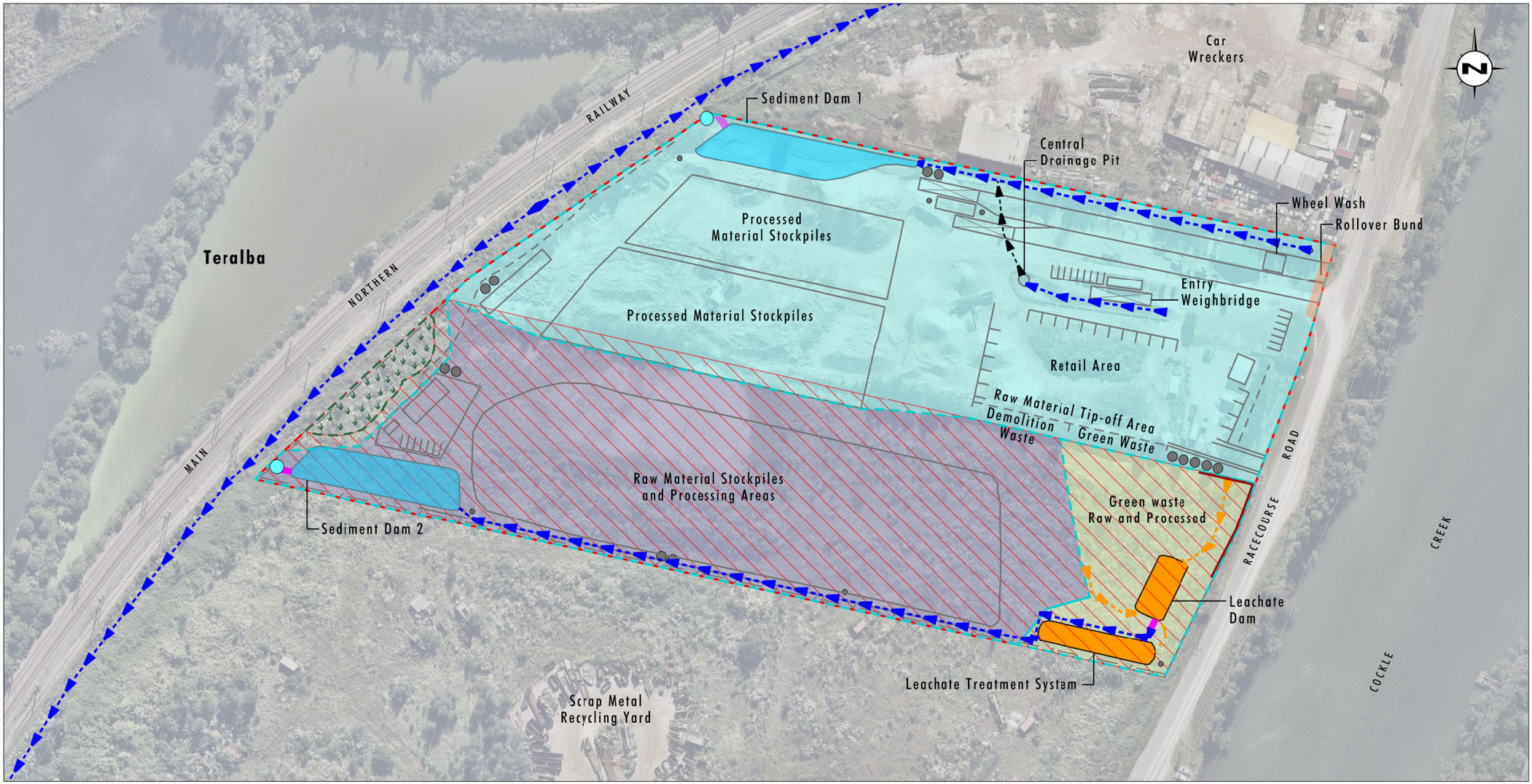


Image Source: Nearmap (May 2017)
Data Source: Concrush (2018)

0 25 50 100m
1:2 000

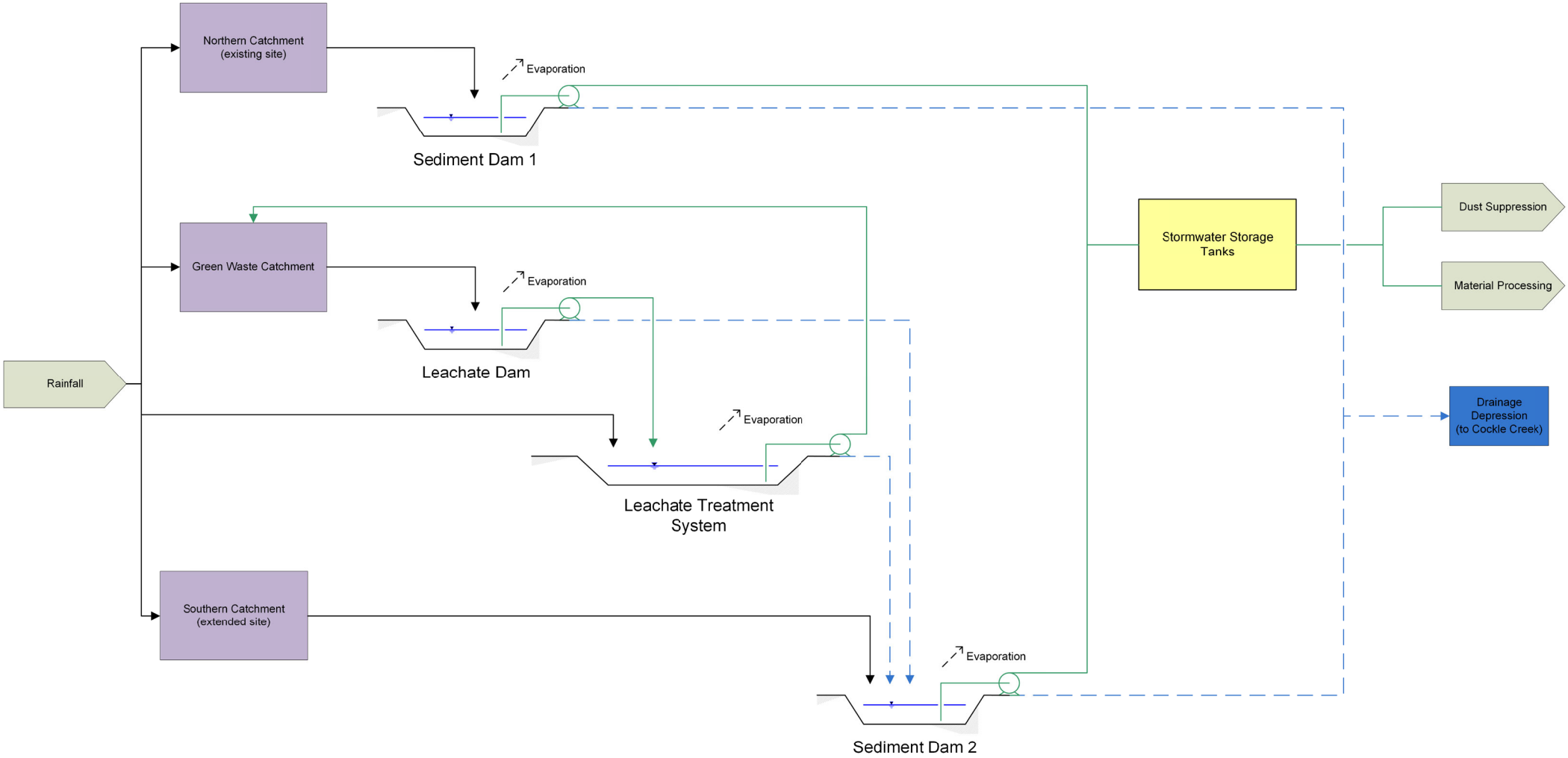
Legend

- Project Site
- Proposed Extension Area
- Existing Wetland Area with Buffer
- Northern Catchment Boundary
- Southern Catchment Boundary
- Green Waste
- Sediment Dam
- Drain Pipe
- Surface Drain
- Leachate Dam
- Leachate Pipe
- Leachate Drain
- Drainage Depression
- Proposed Discharge Points (sediment dam spillways)
- Flood Barrier
- Central Pipe

FIGURE 3.1

Project Water System Management Plan

File Name (A4): R01/4987_003.dgn
20200505 11.43



Legend

- Pumped Flow
- Overflow

FIGURE 3.2

Project Water Management System Schematic

Table 3.1 WMS Catchments

Catchment	Area (ha)	Potential Pollutants in Runoff	Controls	Discharges to
Green Waste	0.3	Nutrients Sediment	Leachate containment dam sized to contain runoff from the 24 hour 10 year average recurrence interval storm event Water from the leachate dam will be treated in a leachate treatment system to reduce nutrient concentrations Reuse within the Green Waste catchment	Sediment Dam 2
Northern Catchment (office, workshop, retail sales, weighbridge, construction material stockpiles)	2.4	Sediment Elevated pH Dissolved Metals (from waste and product materials containing concrete) Oil and Grease	Roadways and car parking areas will be sealed Workshop is covered, incorporates an oil sump to contain spills and is equipped with spill kits Product bays containing mulch will be roofed Runoff to be treated in a Type C flow through sediment basin Treated water will be retained on site in storage tanks and reused for dust suppression on the remainder of the site	Vegetated drainage depression to the west of the Project site that reports to Cockle Creek
Southern Catchment (construction material processing and stockpiles, amenities block)	1.9	Sediment Elevated pH Dissolved Metals (from waste and product materials containing concrete) Oil and Grease Nutrients (spills from Green Waste catchment)	Sealed roadways Runoff to be treated in a Type D flow through sediment basin Treated water will be retained on site in storage tanks and reused for dust suppression on the remainder of the site	Vegetated drainage depression to the west of the site that reports to Cockle Creek
Concrete Agitator Wash Out	0.01	Sediment Elevated pH Dissolved Metals (from waste and product materials containing concrete)	Minimised and isolated catchment area Sealed hardstand catchment Material is utilised for production of road base as soon after receipt as possible Material will not be received during rainfall events All water captured will be reused in road base production, i.e. no release to site stormwater system	-
Wheel Wash	0.01	Sediment Elevated pH Oil and Grease	Minimised catchment area Sealed concrete surface All water captured for operational reuse, i.e. no release to site stormwater system.	-

4.0 Water Balance

A detailed daily time step water balance model (the Model) was developed in GoldSim modelling software during the approvals stage of the Project. The Model has been updated during the preparation of this WDMP to further calibrate the Model for observed site runoff and potable water import demands. The Model was also updated for larger sediment basins (SD1 and SD2 sized to accommodate runoff from a five day 90th percentile rainfall event rather than 85th percentile event) and to limit the use of treated leachate to within the Green Waste catchment.

The Model was used to predict the volume and frequency of off-site spills from the WMS.

4.1 Basis and Assumptions

The Model basis and assumptions are as follows:

- Daily rainfall data (for the period 1990 to 2020) input to the Model was sourced from the BoM Edgeworth WWTP station (station 061393) which is located approximately 1.5 km to the north of the Project and supplemented with data for the period 25 October 2019 to 6 March 2020 from the Bolton Point BoM Station (station 061133) where data from the Edgeworth WWTP station was unavailable.
- Evaporation data input to the Model was based on average monthly evaporation for the BoM Williamtown RAAF station (station 061078).
- An evaporation pan factor of 0.8 was used for evaporative loss calculations from water surfaces.
- Runoff volumes are estimated using an Australian Water Balance Model (AWBM) runoff model for hardstand catchments and stockpiles.
- A stockpile, exposed area and roadway dust suppression demand based on current application rates with a pro-rata increase for the increased area of the expanded facility.
- All water applied as dust suppression is lost from the water management system (WMS).
- A Project stormwater tank capacity of 310 kL (existing of 110 kL plus 200 kL) additional storage.

Following comment from the EPA regarding the frequency of spills from the sediment basins (refer to **Appendix B**), SD1 and SD2, the operating rules in the water balance model were adjusted such that reuse and transfers from the sediment basins is undertaken with equal preference. Prior to this adjustment, the model reused/transferred water from SD1 prior to reusing/transferring water from SD2 resulting in a higher predicted spill frequency from SD2.

4.2 Calibration

The AWBM parameters were adjusted for this round of modelling to account for the lower volume of observed runoff during a high rainfall event from 7 to 10 February 2020. During this rainfall event, more than 60 mm of rainfall fell prior to runoff flowing off-site. This is a result of the significant water holding capacity of the site stockpiles. Note that the Model calibration was undertaken conservatively such that it predicts higher rates of runoff than those expected. A much clearer understanding of the site runoff characteristics will be obtained following installation of the sediment basins when actual runoff volumes can be measured based on dam level increase.

The volume of water applied as dust suppression was calibrated to the potable water import volumes for the site for the July 2018 to March 2020.

4.3 Results

Table 4.1 and **Table 4.2** present the predicted volumes and frequencies respectively of spills from SD1 and SD2. Also included in **Table 4.2** are predicted spill frequencies from SD2 when leachate has spilled internally via the constructed wetland to SD2.

Table 4.1 Off-site Spill Volumes (ML/year)

Statistic	SD1	SD2
10th Percentile	0.0	0.0
50th Percentile	0.7	0.3
90th Percentile	5.5	5.7

Table 4.2 Off-site Spill Frequencies (events/year)

Statistic	SD1	SD2	Spills from SD2 Containing Leachate
10th Percentile	0.0	0.0	0.0
50th Percentile	1.0	1.0	0.0
90th Percentile	4.0	4.0	2.0

5.0 Discharge Characterisation

5.1 Methodology

The discharge water quality from the two discharge points (i.e. SD1 spillway and SD2 spillway)has been estimated based on the approach outlined in **Table 5.1**.

Table 5.1 Discharge Water Quality Estimation Approach

Parameter	Approach
pH	Based on the minimum to maximum measured pH range for water flowing off-site for the existing operation.
EC (µS/cm)	Based on the 80th percentile EC result for water flowing off-site for the existing operation.
TSS (mg/L)	Concentration based on the 80th percentile TSS result for water flowing off-site for the existing operation. Loads based on discharge volumes predicted by water balance modelling and the 80th percentile TSS result for water flowing off-site for the existing operation.
TRH (mg/L)	Concentration based on the maximum measured TRH result for water flowing off-site for the existing operation. Loads based on discharge volumes predicted by water balance modelling and the maximum TRH result for water flowing off-site for the existing operation.
Nutrients	A range of potential SD2 discharge concentrations for nutrients were developed based on: • The average measured nutrient concentrations measured in water flowing off-site for the existing operation; and • Dilution of the high nutrient concentration water spilling from the constructed wetland based on runoff and spill volumes predicted by water balance modelling for 14 spill events from SD2 where leachate had also spilled into SD2. Discharge nutrient loads have been estimated based on the average predicted nutrient concentration in the 14 spill events from SD2 as described above. As all existing water quality results for the existing Concrush operation are impacted by runoff from green waste storage and processing, there is limited data to predict the concentrations and loads of nutrients in discharges from SD1 (which will be unimpacted by runoff from the green waste catchment. Therefore, the concentrations and loads discharged from SD1 have been estimated at 50% of the SD2 concentrations and loads.
Metals/Metalloids	The version of this WDMP reviewed by the EPA provided the predicted concentration of metals/metalloids as the average measured result. This was considered a conservative estimate of discharge metal/metalloid concentrations given the first flush of runoff draining to the sediment basins will be pumped to water storage tanks and the significant dilution of runoff during an event that would result in sediment basin spills. The predicted discharge concentrations have been revised to reflect the median measured result for water flowing off-site for the existing operation. While less conservative than the average result, it is considered that the median result better represents the likely discharge concentrations during a high or prolonged rainfall events that exceed the sediment basin capacities. Loads based on discharge volumes predicted by water balance modelling and the median measured result for water flowing off-site for the existing operation.

5.2 Estimated Discharge Water Quality

Table 5.2 and **Table 5.3** present conservative discharge water quality estimates and loads respectively for spills from SD1 and SD2.

Table 5.2 Estimated Spill Water Quality

Parameter	Units	Discharges from SD1 Value/Range	Discharges from SD2 Value/Range
pH		7.0 – 8.50	7.0 – 8.50
EC	µS/cm	1,035	1,035
TSS	mg/L	116	116
TRH	mg/L	0.1	0.1
Ammonia	mg/L	0.0001 - 0.0132	0.0002 - 0.0264
NO_3	mg/L	0.001 - 0.220	0.003 - 0.440
NOx	mg/L	0.001 - 0.246	0.003 - 0.491
TN	mg/L	0.002 - 0.322	0.004 - 0.645
TP	mg/L	0.00005 - 0.0084	0.0001 - 0.0168
Aluminium	mg/L	0.050	0.050
Arsenic	mg/L	0.006	0.006
Boron	mg/L	0.09	0.09
Cadmium	mg/L	0.0001	0.0001
Chromium III	mg/L	0.003	0.003
Chromium VI	mg/L	0.0190	0.0190
Cobalt	mg/L	0.002	0.002
Copper	mg/L	0.012	0.012
Lead	mg/L	0.002	0.002
Nickel	mg/L	0.002	0.002
Selenium	mg/L	0.002	0.002
Zinc	mg/L	0.012	0.012

Table 5.3 Estimated Annual Discharge Loads

Parameter	Discharges from SD1			Discharges from SD2		
	10^{th} Percentile	50^{th} Percentile	90^{th} Percentile	10^{th} Percentile	50^{th} Percentile	90^{th} Percentile
TSS (kg)	0.0	81.2	638.0	0.0	34.8	661.2
TRH (kg)	0.0	0.1	0.6	0.0	0.0	0.6
Ammonia (g)	0	3	21	0	2	45
NO_3 (g)	0	46	358	0	39	743
NOx (g)	0	51	400	0	44	829
TN (g)	0	67	525	0	57	1088
TP (g)	0	2	14	0	1	28
Aluminium (g)	0	35	275	0	15	285
Arsenic (g)	0	4	30	0	2	31

Parameter	Discharges from SD1			Discharges from SD2		
	10th Percentile	50th Percentile	90th Percentile	10th Percentile	50th Percentile	90th Percentile
Boron (g)	0	60	468	0	26	485
Cadmium (g)	0	0	1	0	0	1
Chromium III (g)	0	2	14	0	1	14
Chromium VI (g)	0	13	105	0	6	108
Cobalt (g)	0	1	11	0	1	11
Copper (g)	0	8	66	0	4	68
Lead (g)	0	1	11	0	1	11
Nickel (g)	0	1	11	0	1	11
Selenium (g)	0	1	11	0	1	11
Zinc (g)	0	8	63	0	3	66

6.0 Potential Impact of Discharges

The estimated discharge pH and EC are within the acceptable range for freshwater ecosystems in a slightly to moderately disturbed condition. Discharges of TRHs are expected to be negligible given all but one analysis result was below the LOD.

TSS concentrations during spills are estimated to be above a typical EPL discharge limit, however, the predicted average annual frequency of spills from the sediment basins (0.7 spills for SD1 and 2.3 spills for SD2) is of a typical frequency for basins sized for a 5 day 90th percentile rainfall event as per Table 6.2 of *Managing Urban Stormwater Volume 2E Mines and Quarries* (DECC, 2008). Given the infrequency of spills from the Concrush WMS and the elevated sediment loads in broader catchment runoff during high rainfall events that would result in sediment basin spills, the discharge sediment loads are not expected to have an appreciable impact on the drainage depression or Cockle Creek.

A comparison of the predicted average discharge nutrient concentrations and the average nutrient concentrations at RW1 shows that the receiving drainage depression is expected to have higher baseline nutrient concentrations (refer to **Table 6.1**). As such, the impacts associated with nutrients in discharges expected to be negligible. The EPA (refer to **Appendix B**) has suggested that this assessment approach is not consistent with the principle of restoring environmental values. While discharges may exceed the default ANZG 2018 guideline values, the significantly lower predicted discharge concentrations when compared to average receiving water nutrient concentrations could reduce receiving water nutrient concentrations and, at worst, have an overall neutral effect.

Table 6.1 Average Discharge and RW1 Nutrient Concentration Comparison

Parameter	Units	Estimated Average Discharge Concentration	Average RW1 Concentration
Ammonia	mg/L	0.008	4.917
NO_3	mg/L	0.130	0.476
NOx	mg/L	0.145	2.106
TN	mg/L	0.191	2.775
TP	mg/L	0.005	0.186

Table 6.2 presents a comparison of the estimated discharge metal/metalloid concentrations with the various species protection level ANZG default guideline values. The guideline values presented in **Table 6.2** are for comparison purposes only rather than an indication of the appropriate guideline values for the immediate receiving water source (i.e the drainage depression). It is noted that the EPA advise that the 95% species protection level guideline values for slightly to moderately disturbed systems should be adopted for the drainage depression (refer to **Appendix B**). The drainage depression water quality immediately upstream of the existing Concrush facility has elevated concentrations of a range of pollutants including metals (refer to **Table 2.2**) and could be considered highly disturbed rather than slightly to moderately disturbed.

ANZG indicates that while highly disturbed systems may retain some ecological or conservation values it may not be feasible to return them to a slightly to moderately disturbed condition in the short to medium term. As such, ANZG notes that water quality management for highly disturbed ecosystems can be more flexible. While the principle of restoring environmental values is acknowledged, the adoption of the default 95% species protection level guideline values as management triggers for discharges to the drainage depression may not be practical. Note that proposed discharge management triggers will be provided in the Discharge Verification and Mitigation Plan (DVMP) which must be approved by the Planning Secretary prior to commencement of Stage 1 operations in accordance with conditions B14 and B15 of the Project Approval.

Table 6.2 Discharge Metal/Metalloid Concentrations - Comparison with ANZG Guideline Values

Metal/Metalloid	Comparison
Aluminium	The estimated discharge concentration of Aluminium (0.050 mg/L) is less than the 95% species protection level default ANZG guideline value (0.055 mg/L) for slightly to moderately disturbed freshwater systems.
Arsenic	The estimated discharge concentration of Arsenic (0.006 mg/L) is less than the 95% species protection level default ANZG guideline value for Arsenic III (0.013 mg/L) for slightly to moderately disturbed freshwater systems.
Boron	The estimated discharge concentration of Boron (0.09 mg/L) is less than the 95% species protection level default ANZG guideline value (0.037 mg/L) for slightly to moderately disturbed freshwater systems.
Cadmium	The estimated discharge concentration of Cadmium (0.0001 mg/L) is less than the 95% species protection level default ANZG guideline value (0.0002 mg/L) for slightly to moderately disturbed freshwater systems.
Chromium III	The estimated discharge concentration of Chromium III (0.003 mg/L) is lower than the default ANZG guideline value (0.0033 mg/L) for slightly to moderately disturbed freshwater systems. ANZG does not nominate a level of species protection for this guideline value.
Chromium VI	The estimated discharge concentration of Chromium VI (0.0190 mg/L) is less than the 80% species protection level default ANZG guideline value (0.04 mg/L) for slightly to moderately disturbed freshwater systems. Further discussion regarding potential impacts of Chromium VI in discharges is provided following this table.
Cobalt	The estimated discharge concentration of Cobalt (0.002 mg/L) is slightly above than the default ANZG guideline value (0.0014 mg/L) for slightly to moderately disturbed freshwater systems. ANZG does not nominate a level of species protection for this guideline value. While the Cobalt technical brief was not accessible on the ANZG website, a United States based study (*Toxicity of cobalt to freshwater indicator species as a function of water hardness*, Diamond et al, 1992) indicates that acute cobalt toxicity ranges from 0.288 to 0.873 mg/L for soft and hard waters respectively.
Copper	The estimated discharge concentration of Copper (0.012 mg/L) is greater than the 80% species protection level default ANZG guideline value (0.0025 mg/L) for slightly to moderately disturbed freshwater systems. Further discussion regarding potential impacts of Copper in discharges is provided following this table.
Lead	The estimated discharge concentration of Lead (0.002 mg/L) is less than the 95% species protection level default ANZG guideline value (0.0034 mg/L) for slightly to moderately disturbed freshwater systems.
Nickel (g)	The estimated discharge concentration of Nickel (0.002 mg/L) is less than the 95% species protection level default ANZG guideline value (0.011 mg/L) for slightly to moderately disturbed freshwater systems.
Selenium (g)	The estimated discharge concentration of Selenium (0.002 mg/L) is less than the 99% species protection level default ANZG guideline value (0.005 mg/L) for slightly to moderately disturbed freshwater systems.
Zinc (g)	The estimated discharge concentration of Zinc (0.012 mg/L) is less than the 90% species protection level default ANZG guideline value (0.015 mg/L) for slightly to moderately disturbed freshwater systems.

ANZG indicates that the lowest acute Chromium VI toxicity for freshwater fish has been measured at 0.220 mg/L, which is above the estimated Chromium VI discharge concentration. ANZG also indicates that acute Chromium toxicity for other freshwater animal species ranges from 0.023 mg/L to 1.87 mg/L which is also above the estimated Chromium VI discharge concentration. It is noted that the lower range for Chromium VI acute toxicity is below the 80% species protection default guideline value.

Acute Copper toxicity for freshwater species has been measured at 0.017 mg/L by the USEPA, however, a study of Australian species indicates an acute toxicity concentration of greater than 0.040 mg/L (ANZG, 2018) which is above the estimated discharge Copper concentration. Further, Copper concentrations at RW1 (i.e. in the drainage depression) have been recorded at twice the estimated discharge Copper concentration.

Based on the existing level of disturbance in the drainage depression and the dilution provided by broader catchment runoff, acute toxicity impacts associated with Chromium VI and Copper concentrations in discharges are not expected as a consequence of spills from the sediment basins. Further, chronic impacts in the drainage depression are not expected given the predicted infrequency of spills from the sediment basins.

Based on the predicted reduction in off-site flows to the drainage depression following Project implementation and assuming median measured metal/metalloid concentrations in existing off-site flows, the discharged metal/metalloid loads to the drainage depression are expected to reduce by approximately 65% in a median water balance year.

Given the extensive range of pollutants tested for during the approvals stage of the Project, impacts associated with unidentified pollutants are not expected. Further, the construction methods to be employed for the expansion will ensure negligible connectivity between any potentially contaminated underlying soils and groundwater with surface water.

7.0 Monitoring, Mitigation and Reporting

7.1 Monitoring

Surface water quantity monitoring will be undertaken as presented in **Table 7.1** following commencement of Stage 1 operations. Site and receiving surface water quality monitoring will be undertaken as presented in **Table 7.2** and **Table 7.3** following commencement of Stage 1 operations.

Table 7.1 Surface Water Quantity Monitoring

Parameter	Frequency	Methodology
SD1 volume	Following rainfall events	Manual read of staff gauge and dam level - storage relationship
SD2 volume	Following rainfall events	
Leachate Dam volume	Following rainfall events	
Treated leachate reuse volume	Monthly	Manual read flow meter; or Pump run time and rated pump flow
SD1 Discharge	Monthly during discharge	Calculation based on: • spillway design; • data logged sediment basin water level to determine flow height over the spillway; and • duration of discharge.
SD2 Discharge		
Leachate Dam Spills to SD2		

Table 7.2 Site Surface Water Quality Monitoring

Water Source	Frequency	Parameters
Leachate Treatment	Monthly	pH, EC, TSS, TN, TP, Nitrate, NOx, Ammonia
SD1	Monthly and during discharge	pH, EC, TSS, TRH, TN, TP, Nitrate, NOx, Ammonia **Dissolved Metals and Metalloids** Aluminium, Arsenic, Boron, Cadmium, Chromium III, Chromium VI. Cobalt, Copper, Lead, Nickel, Selenium, Zinc
SD2	Monthly and during discharge	
SD1 Spillway	Monthly during discharge	
SD2 Spillway	Monthly during discharge	

Table 7.3 Receiving Surface Water Quality Monitoring

Water Source	Frequency	Parameters
SW1 (Drainage Depression Downstream of SD1 spillway)	Monthly and during discharge	pH, EC, TSS, TRH, TN, TP, Nitrate, NOx, Ammonia **Dissolved Metals and Metalloids** Aluminium, Arsenic, Boron, Cadmium, Chromium III, Chromium VI. Cobalt, Copper, Lead, Nickel, Selenium, Zinc
SW2 (Drainage Depression Downstream of SD2 spillway)	Monthly and during discharge	

7.2 Mitigation

Based on the assessment of potential impacts associated with the estimated discharge concentrations, no further mitigation measures or changes to the currently proposed WMS (refer to **Section 3.0**) are proposed. Assessment of contingency mitigation measures (e.g. water treatment measures and additional water storage) will be provided in the DVMP which must be approved by the Planning Secretary prior to commencement of Stage 1 operations. These contingency measures may include:

- Increased water storage capacity to reduce the frequency of site discharges
- Water treatment measures for the removal of trace metals/metalloids such as precipitation, ion exchange or reverse osmosis

The DVMP is required to include management triggers for the range of pollutants likely to be present in site discharges. It is noted that the EPA has recommended that the management triggers for discharges adopted are not at acutely toxic levels. When proposing discharge management triggers in the DVMP, consideration will be given to the existing level of disturbance in the immediate receiving environment, published acute toxicity data and EPA recommendations.

The monitoring program detailed in **Section 7.1** will inform the Discharge Verification and Mitigation Report (DVMR) and should the agreed discharge management triggers presented in the DVMP be exceeded, the contingency mitigation measures identified in the DVMP will be implemented as required.

7.3 Reporting

The following information relating to water management will be provided in the Annual Review:

- A summary and assessment of water quality monitoring results, including the water quality of any discharges from Sediment Dam 1 and Sediment Dam 2
- The volume of any discharges from Sediment Dam 1 and Sediment Dam 2
- Details of any complaints received in relation to surface water
- An assessment of the overall effectiveness of the WMS.

A detailed assessment of any discharges from the site will also be provided in a Discharge Verification and Mitigation Report within 12 months of the commencement of Stage 1 operations

8.0 Review and Improvement

Ongoing monitoring and review on the performance and implementation of this WDMP will be undertaken in accordance with the Project Approval which requires review of the plan within 3 months of the submission of:

- The submission of an incident report under condition C10 of the Project Approval
- The submission of an Independent Environmental Audit report under Condition C16 of the Project Approval.
- The approval of any modification of the conditions of consent.
- The issue of a direction of the Planning Secretary under condition A2(b) which requires the strategies, plans and programs required under the Project Approval to be reviewed

Concrush will notify the Planning Secretary in writing of any review of this WDMP. If a review leads to any revisions to this WDMP, the revised document will be submitted to the Planning Secretary within six weeks of the review. Updated versions of this WDMP will be made publicly available on the Concrush website in accordance with Condition C9 of the Project Approval.

9.0 References

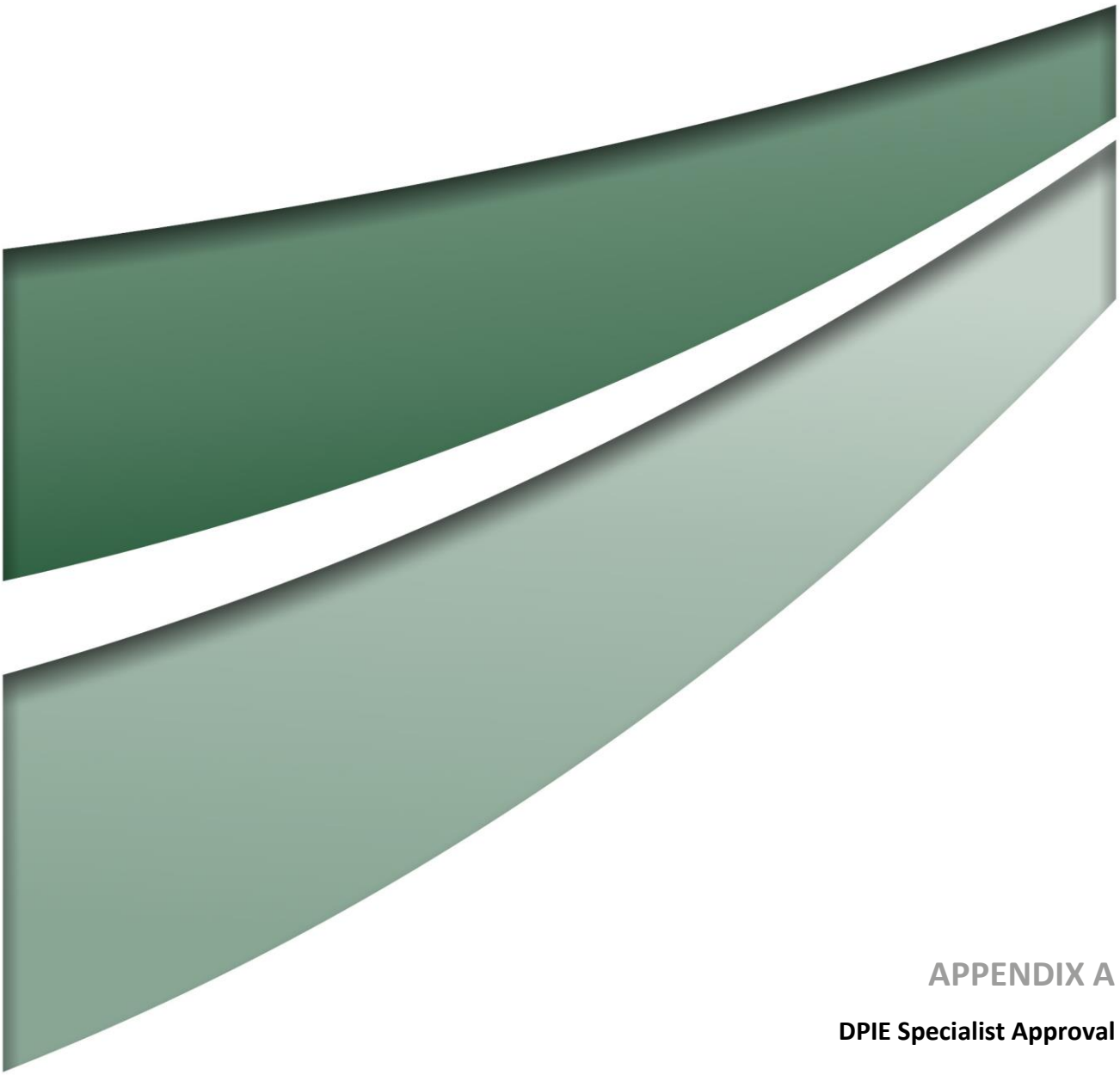
Umwelt (Australia) Pty Ltd, 2018, *Concrush Increase to Capacity Project Teralba NSW Soil and Water Impact Assessment*

Umwelt (Australia) Pty Ltd, 2019, *Concrush Increase to Capacity Project Teralba NSW Response to Submissions*

Australian and New Zealand Governments and Australian state and territory governments, 2018, *The Australian and New Zealand Guidelines for Fresh and Marine Water Quality*

National Institute of Water & Atmospheric Research Ltd, 2013, *Updating nitrate toxicity effects on freshwater aquatic species*

Diamond et al, 1992, *Toxicity of cobalt to freshwater indicator species as a function of water hardness*



APPENDIX A

DPIE Specialist Approval

Mr Kevin Thompson
Managing Director
Concrush Resource Recovery Facility
18 Tirriki Street
Charlestown NSW 2290

Our ref: SSD-8753

14 May 2020

Dear Mr Thompson

SSD-8753 – Concrush Resource Recovery Facility
Endorsement of experts to prepare a Water Discharge Management Plan, Groundwater Management Plan and Operational Noise Management Plan

I refer to your correspondence dated 28 April 2020, 1 May 2020 and 8 May 2020, seeking approval for

- Mr Chris Bonomini from Umwelt (Australia) Pty Ltd to prepare the Water Discharge Management Plan (WDMP) as required by Condition B12, SSD-8753
- Ms Fiona Brooker from RCA Australia to prepare the Groundwater Management Plan (GMP) as required by Condition B20, SSD-8753; and
- Mr Alex Rees from RCA Australia to prepare the Operational Noise Management Plan (ONMP) as required by Condition B47, SSD-8753.

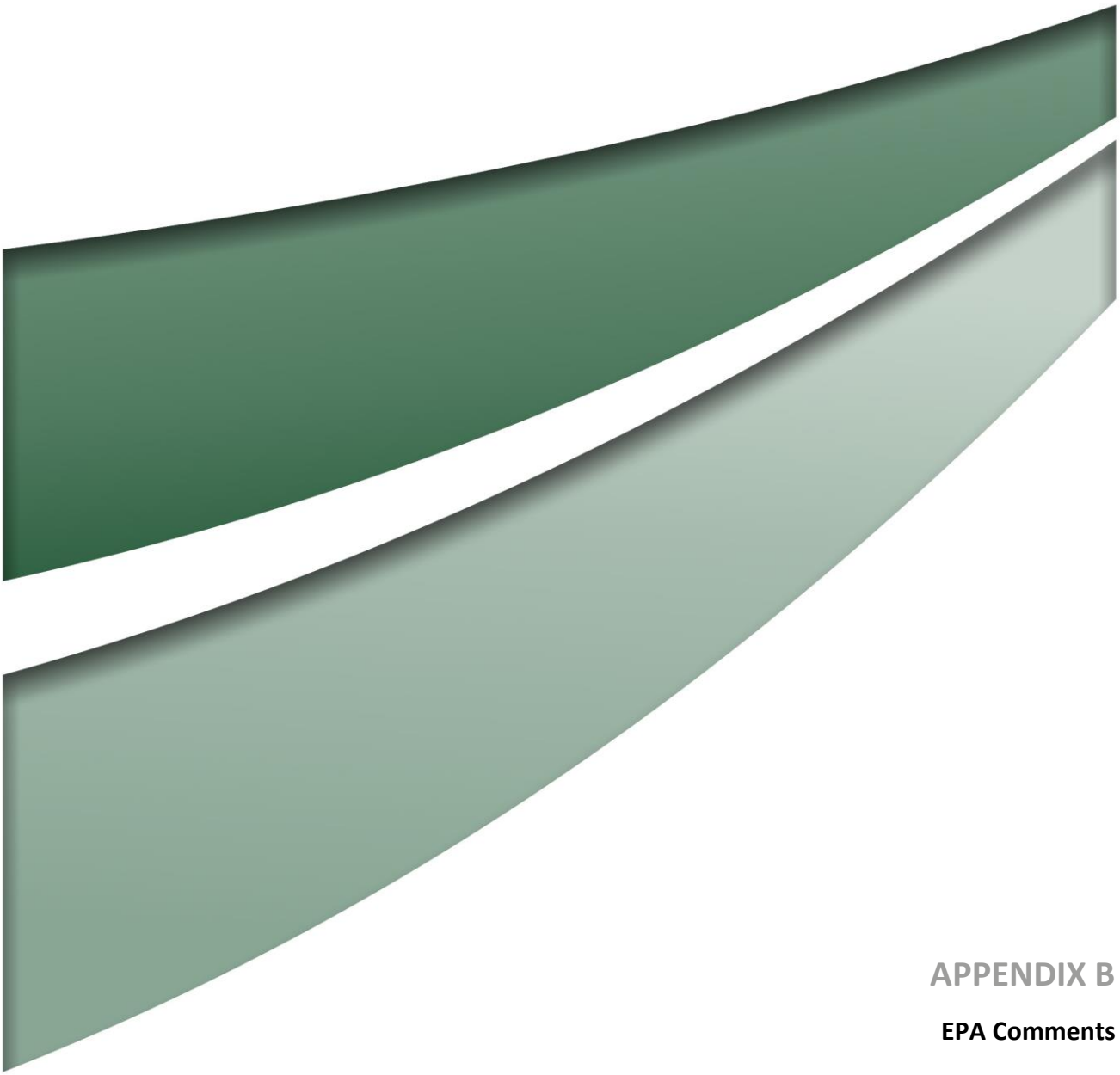
The Department has reviewed the qualifications of Mr Chris Bonomini, Ms Fiona Brooker and Mr Alex Rees and they are all considered to have the appropriate skills and experience to prepare the WDMP, the GMP and the ONMP respectively.

Should you have any queries in relation to this matter, please contact Susan Fox on 9274 6466 or via email susan.fox@planning.nsw.gov.au.

Yours sincerely,

14 May 2020

Chris Ritchie
Director
Industry Assessments
as delegate of the Planning Secretary



APPENDIX B

EPA Comments

Our ref: DOC20/576084

Mr Chris Bonomini
Senior Engineer
Umwelt (Australia) Pty Limited
cbonomini@umwelt.com.au

16 July 2020

Dear Chris,

I refer to the Water Discharge Management Plan prepared by Umwelt (Australia) Pty Limited (**Umwelt**) for the expansion of the waste facility at 21 Racecourse Road, Teralba (**the Premises**) operated by Concrush Pty Ltd (**Concrush**).

Concrush has development approval (SSD8753) to increase the processing and storage capacity of the existing resource recovery facility located at the Premises. Condition B12 of the approval requires Concrush to prepare a Water Discharge Management Plan (**WDMP**). The EPA has reviewed the WDMP prepared by Umwelt and provides the following comments.

Discharge frequency

The WDMP predicts that there will be no discharges during 10th percentile rainfall years. For SD1 and SD2 respectively 1 and 2 discharge events (totalling 1ML) during median rainfall years and 3 and 7 events (totalling 11ML) during 90th percentile rainfall years. The WDMP predicts that there will be no discharges containing green waste leachate during 10th percentile and median rainfall years and 2 such discharges during 90th percentile rainfall years.

It is unclear why the spill frequency would be so much greater for SD2 than SD1 given the design storm sizing is the same. Note that the sizing should be based on the entire basin catchment and for SD2 this includes the green waste area.

The EPA requires clarification of why the discharge frequency is greater for SD2 than SD1.

Discharge quality, potential impacts, management triggers and actions

The WDMP indicates that, currently, concentrations of nutrients and some metals are sometimes highly elevated (relative to guideline values) in site stormwater and the immediate receiving waterway (the drainage depression). This indicates that the current discharges could potentially pose a risk to aquatic ecosystem health in the drainage depression. The WDMP states, "… *the proposed controls (Leachate Dam, Constructed Wetland, SD1 and SD2) to be implemented as part of the Project will reduce the concentrations and loads discharged off-site (refer to Section 5.0).*"

The WDMP predicts the quality of discharges after these measures are implemented. Only 'typical' concentrations are predicted for hydrocarbons and metals. The predicted typical hexavalent chromium concentration (48µg/L) is greater than the default guideline value for slightly to moderately disturbed ecosystems (95% species protection level [SPL] - 1µg/L) and the guideline values for alternative levels of protection (90% SPL – 6µg/L, 80% SPL – 40µg/L).

The WDMP cites ecotoxicity data suggesting that the predicted hexavalent chromium concentrations could potentially be acutely toxic to aquatic organisms. The potential risk of acute impacts could be greater if discharge concentrations spike above the predicted typical levels. The WDMP does not identify potential hexavalent chromium sources or propose specific mitigation measures but states, "*The monitoring program detailed in Section 7.1 will inform the Discharge Verification and Mitigation Report (DVMR) and should discharge impacts exceed the predicted impacts, contingency mitigation measures identified in the DVMP will be implemented as required.*"

The WDMP reasons that discharges of nutrients will have negligible impact on the receiving waterway because predicted discharge concentrations are lower than the ambient waterway concentrations. This assessment approach is inconsistent with the national Water Quality Guidelines and the NSW Water Quality Objectives as the relevant guideline values were not adopted and the principle of restoring environmental values was not applied. However, the predicted discharge nutrient concentrations appear consistent with a reasonable level of treatment performance and given the predicted low frequency of managed overflows nutrients at the predicted concentrations are unlikely to pose a significant water quality risk.

The WDMP also reasons that, although the predicted typical hexavalent chromium concentration is potentially in the acutely toxic range, acute impacts are unlikely because of the level of disturbance of the drainage depression and the dilution provided by the broader catchment. This assessment approach is similarly inconsistent with the national Water Quality Guidelines and the NSW Water Quality Objectives. Appropriate mitigation measures are required to minimise discharges of pollutants, to ensure discharges do not contain pollutants at acutely toxic levels and to contribute to restoring the environmental values of the receiving waterways.

Appropriate maximum discharge concentration criteria are also required to trigger contingency measures and details of these measures are required to ensure water quality risks will be appropriately managed.

The EPA recommends that the WDMP be revised to:

- propose maximum discharge concentrations to be adopted as management triggers, ensuring these are not at acutely toxic levels, and revises the impact assessment with reference to these; and
- specify the contingency mitigation measures that would be triggered if these criteria are exceeded – options considered should include both source controls (e.g. roofing over pollutant hotspots) and treatment measures.

Guideline values

There are errors in the guideline values adopted in the WDMP which should be corrected in a revised plan:

- electrical conductivity – the guideline value for east-flowing rivers (300µS/cm) should be adopted;
- nitrate – the national Water Quality Guidelines no longer recommend a guideline value;
- total nitrogen – the guideline value for east-flowing rivers (350µg/L) should be adopted;
- total phosphorus – the guideline value for east-flowing rivers (25µg/L) should be adopted;
- aluminium – the default guideline value for slightly to moderately disturbed freshwater ecosystems is the 95% species protection level guideline value (55µg/L), rather than the 90% species protection level guideline value (80µg/L) indicated in Table 6.2 of the WDMP;
- arsenic – the freshwater 95% species protection level guideline value for arsenic V (13µg/L) should be adopted, as it is lower than the respective arsenic III guideline value (24µg/L);
- chromium III – the correct guideline value is adopted in Table 2.2 of the WDMP (3.3µg/L), but the incorrect value is cited in Table 6.2 (7.7µg/L);
- chromium VI – the default guideline value for slightly to moderately disturbed freshwater ecosystems is the 95% species protection level guideline value (1µg/L), rather than the 90%

and 80% species protection level guideline values (40µg/L; 85µg/L) indicated in Table 6.2 of the WDMP;

- cobalt – the freshwater interim working level (1.4µg/L) should be adopted;
- copper – the default guideline value for slightly to moderately disturbed freshwater ecosystems is the 95% species protection level guideline value (1.4µg/L), rather than the 80% species protection level guideline value (2.5µg/L) indicated in Table 6.2 of the WDMP;
- selenium – the appropriate guideline value is adopted in Table 6.2 of the WDMP (5µg/L – 99% species protection level), but not in Table 2.2 (11µg/L – 95% species protection level); and
- zinc – the default guideline value for slightly to moderately disturbed freshwater ecosystems is the 95% species protection level guideline value (8µg/L), rather than the 80% species protection level guideline value (31µg/L) indicated in Table 6.2 of the WDMP.

Monitoring

The proposed surface water monitoring program appears broadly appropriate to inform management of potential water quality risks. However, Table 7.3 indicates that receiving waterway sites would be sampled monthly. This sampling may not be sensitive to potential water quality impacts of discharges if it does not coincide with discharge events.

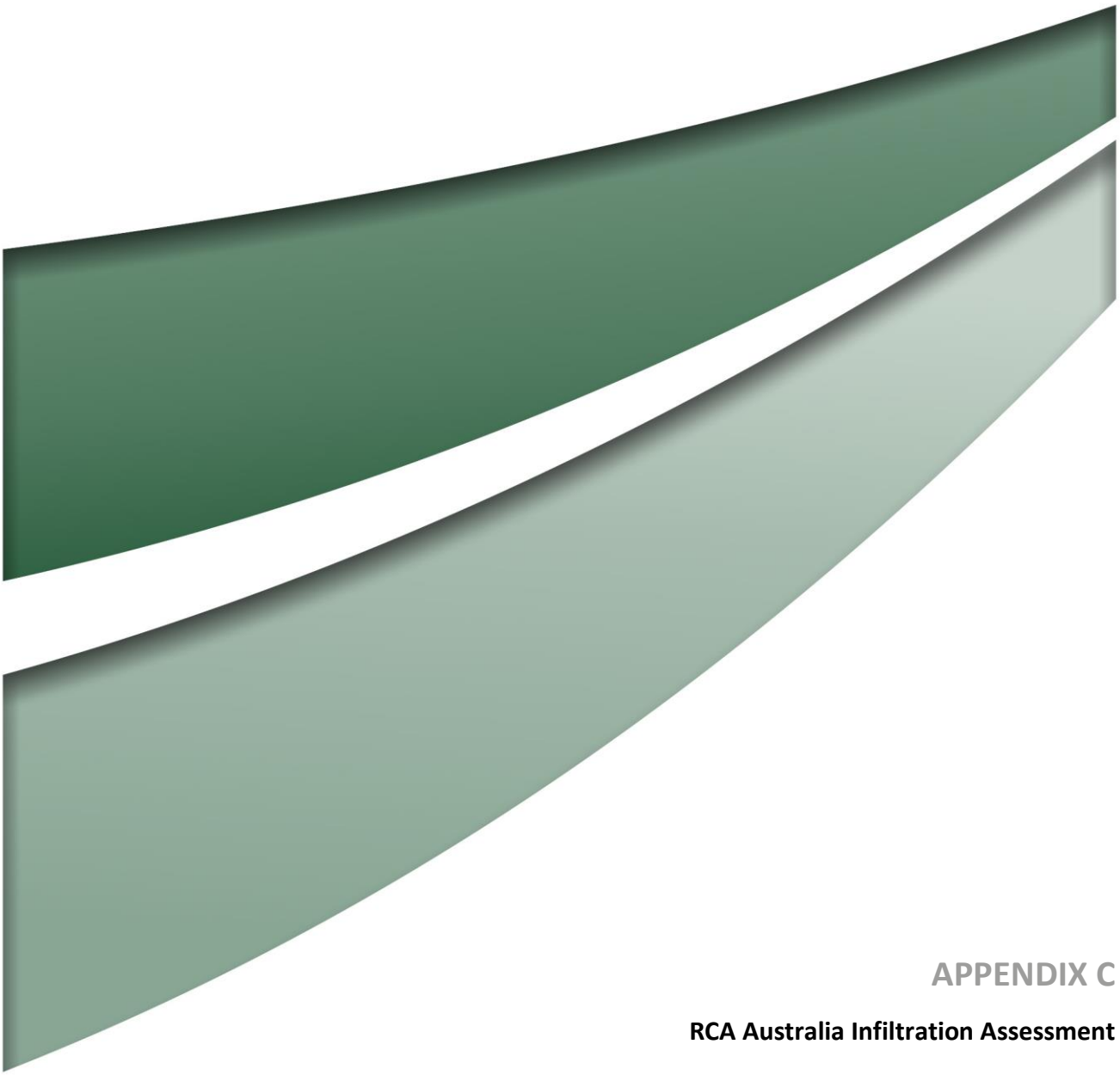
The EPA recommends that consideration is given to timing the sampling of receiving waterway sites to coincide with discharge events.

Please provide an updated WDMP to the EPA by email to waste.operations@epa.nsw.gov.au or by post to P.O. Box 488G, Newcastle NSW 2300 attention Unit Head, Metro North.

If you have any queries about this matter, please call me on 4908 6823.

Yours sincerely

STEVEN JAMES
Unit Head Waste Compliance
Environment Protection Authority



APPENDIX C

RCA Australia Infiltration Assessment

RCA ref 13001-1002/0

12 February 2018

CONCRUSH
PO Box 362
MEREWETHER NSW 2291

Attention: Helen Milne

RCA AUSTRALIA
GEOTECHNICAL • ENVIRONMENTAL

Geotechnical Engineering
Engineering Geology
Environmental Engineering
Hydrogeology
Construction Materials Testing
Environmental Monitoring
Sound & Vibration
Occupational Hygiene

INFILTRATION ASSESSMENT
CONCRUSH, TERALBA NSW

1 INTRODUCTION

RCA Australia (RCA) was engaged by Concrush Pty Ltd (Concrush) to undertake an infiltration assessment at 21 Racecourse Road, Teralba, NSW. The assessment was carried out at the request of Helen Milne of Concrush.

This infiltration assessment was required to inform an Environmental Impact Statement (EIS) currently being prepared for Concrush. The assessment comprised infiltration testing of the existing hardstand at the site and laboratory permeability testing of two (2) Concrush products (blended base and concrete base).

The objectives of the assessment were as follows:

- Assess the infiltration rate of the existing hardstand to determine if site operations (by infiltration of surface water through the hardstand) are likely to be impacting the subsoils.
- Permeability testing of two (2) Concrush products (blended base and concrete base) to assess their suitability, with regard to permeability, for use as construction materials, should additional hardstand be required at the site.

2 FIELDWORK AND LABORATORY TESTING

A geotechnical engineer attended site on 23 November 2017 to undertake infiltration testing of the hardstand with the assistance of a technician. Fieldwork comprised the following:

- Infiltration testing using a double ring infiltrometer was undertaken within the existing hardstand at three (3) locations across the site.
- Two (2) bulk samples were collected from stockpiled materials for the purpose of laboratory permeability testing, comprising the following:
    - One (1) sample was collected from the recycled/crushed ‘concrete base’ material.
    - One (1) sample was collected from the recycled/crushed ‘blended base’ material.

Bulk samples were submitted to GHD for laboratory testing comprising optimum moisture content (OMC), maximum dry density (MDD), and falling head permeability (samples were compacted to 97.5% Modified compaction).

Approximate test locations are shown below in **Figure 1**.

Figure 1. Approximate Infiltration Test Locations

3 RESULTS

A summary of the infiltration and laboratory permeability tests are provided below in **Table 1**.

Table 1. Summary of Results

Double Ring Infiltrometer Test Results	
Test Number / Name	**Infiltration Rate (m/sec)**
Test 1 – Hardstand (Silty Sandy Gravel)	6×10^{-6}
Test 2 – Hardstand (Silty Sandy Gravel)	2.8×10^{-6}
Test 3 – Hardstand (Silty Sandy Gravel, with organic matter)	6.7×10^{-7}
Laboratory Permeability Test Results	
Test Number / Name	**Permeability (m/sec)**
Silty Sandy Gravel (Blended Base Material)	1×10^{-8}
Silty Sandy Gravel (Processed Concrete Base Material)	9×10^{-9}

All double ring infiltrometer test sheets and laboratory report sheets are provided in **Appendix A**.

If conditions are such that infiltration is vertical and confined then the infiltration rate can be considered to be an approximation of the permeability.

4 DISCUSSION

The double ring infiltrometer test results reported infiltration rates ranging between 2.8×10^{-6} m/s (Test 2) to 6.7×10^{-7} m/s (Test 3). While these infer a low permeability, it is considered that water may still infiltrate the hardstand at the site. However, given the low permeability it is considered that water would likely need to pool on the surface for a prolonged period in order to infiltrate the hardstand. The variation in double ring infiltrometer test results is likely due to variation of hardstand construction materials and unknown compaction specifications.

The laboratory permeability testing on Concrush blended base product and recycled/crushed concrete base product reported permeability's of 1×10^{-8} m/s and 9×10^{-9} m/s, respectively. The laboratory permeability of either material is very low and would be considered suitable in regard to permeability should additional hardstand be constructed at the site. A limited internet literature review was undertaken which found the general permeability of good quality cured (non-cracked) concrete to be in the order of 1×10^{-12} m/s (Ref [1]).

Based on the permeability recorded for the existing hardstand (Test 1, 2, and 3), it is considered unlikely that surface water runoff is significantly infiltrating the hardstand and impacting the subsoils or groundwater at the site. It is noted that this would be dependent on maintaining adequate crossfall across the hardstand to maintain overland surface flows to the receival areas and minimise ponding of surface water.

5 LIMITATIONS

This report has been prepared for Concrush in accordance with an agreement with RCA. The services performed by RCA have been conducted in a manner consistent with that generally exercised by members of its profession and consulting practice.

The report may not contain sufficient information for purposes of other uses or for parties other than Concrush. This report shall only be presented in full and may not be used to support objectives other than those stated in the report without written permission from RCA.

The information in this report is considered accurate at the date of issue with regard to the current conditions of the site. Conditions can vary across any site that cannot be explicitly defined by investigation.

Environmental conditions including contaminant concentrations can change in a limited period of time. This should be considered if the report is used following a significant period of time after the date of issue.

Yours faithfully
RCA AUSTRALIA

Nathan Hills
Environmental Scientist

Calvin Mickan
Principal Geotechnical Engineer

REFERENCES

[1] Concrete Technology Today, Permeability of Concrete, October, 1988.

Attachment A

Permeability Test Sheets

RCA AUSTRALIA
GEOTECHNICAL • ENVIRONMENTAL

DOUBLE RING INFILTROMETER TEST

CLIENT: CONCRUSH
PROJECT: Permeability Assessment
LOCATION: Teralba,NSW

DATE: 22/11/2017
RCA REF: 13001

SOIL DESCRIPTION: Hardstand - Sandy Gravel / Gravelly Sand

TEST METHOD: Constant Head

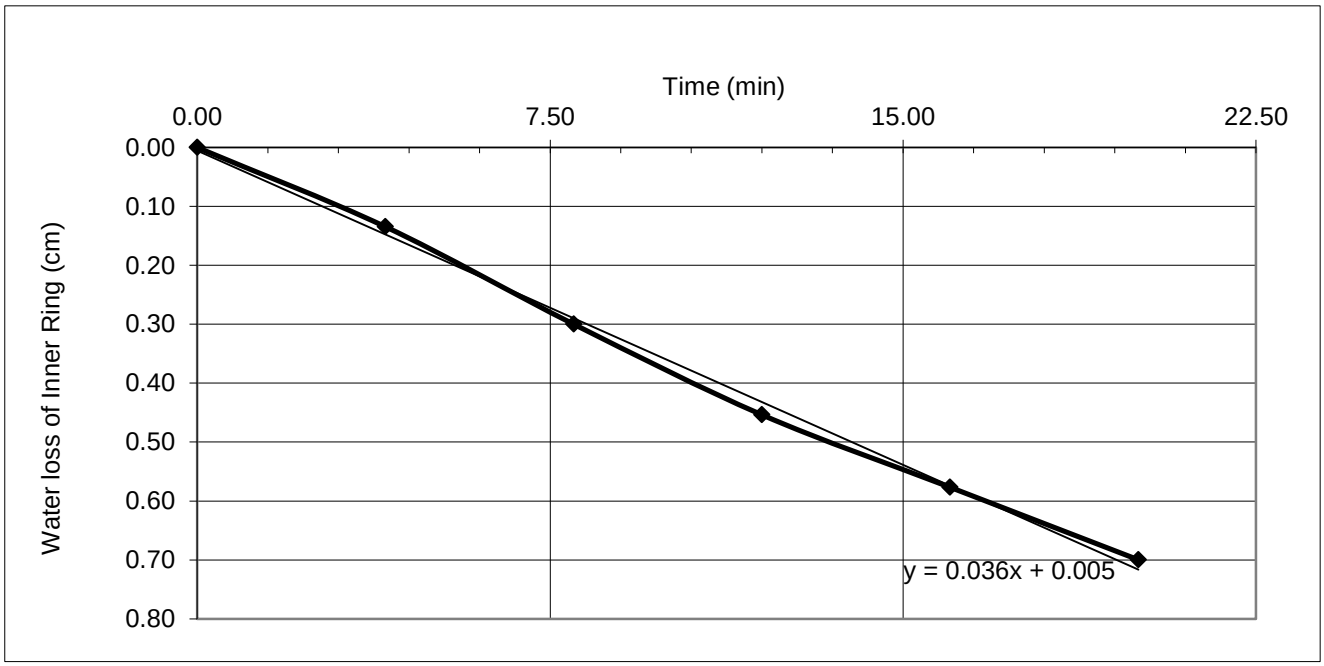
BORE DETAILS

Test No:	1	
Depth:	0	cm
Depth of water in rings:	22	cm
Internal diameter of inner ring:	18.5	cm
Internal diameter of outer ring:	38.5	cm
Area of inner ring:	269	cm^2
Area of annular space between rings:	895	cm^2
Internal diameter of Mariotte tube:	3.75	cm
External diameter of air inlet tube:	0.95	cm
Area of water in Mariotte tube:	10.3	cm^2

Soil Moisture at Time of Test: Moist

RESULTS

Date and time	Elapsed time (min)	Water level in Mariotte tube (cm)	Water loss from inner ring (cm)
22/11/17 12:10	0.00	33.5	0.00
22/11/17 12:14	4.00	30.0	0.13
22/11/17 12:18	8.00	25.7	0.30
22/11/17 12:22	12.00	21.7	0.45
22/11/17 12:26	16.00	18.5	0.58
22/11/17 12:30	20.00	15.3	0.70



CALCULATED INFILTRATION RATE **3.60E-02 cm / min**
6.0E-06 m / sec

RCA Australia	**Tested by: JH**	**Date: 23/11/2017**
	Checked by: CM	**Date: 29/1/18**

RCA AUSTRALIA
GEOTECHNICAL • ENVIRONMENTAL

DOUBLE RING INFILTROMETER TEST

CLIENT: CONCRUSH
PROJECT: Permeability Assessment
LOCATION: Teralba,NSW

DATE: 22/11/2017
RCA REF: 13001

SOIL DESCRIPTION: Hardstand - Sandy Gravel / Gravelly Sand

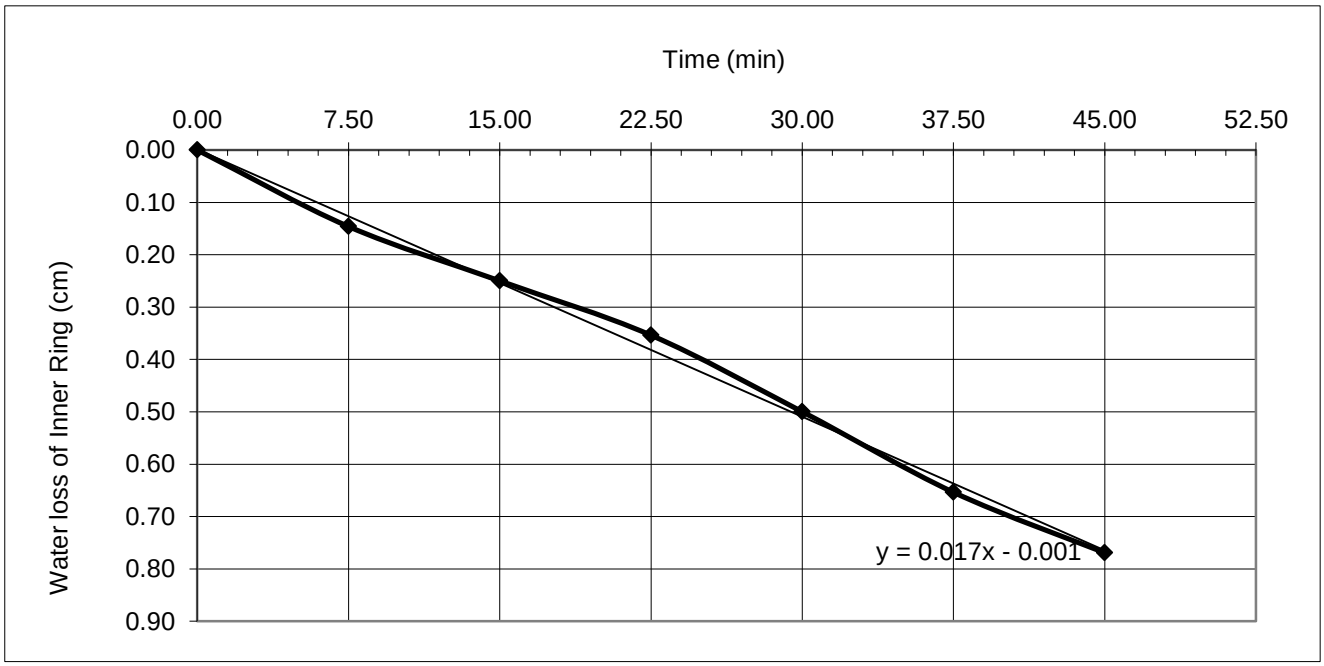
TEST METHOD: Constant Head

BORE DETAILS

Test No:	2
Depth:	0 cm
Depth of water in rings:	25 cm
Internal diameter of inner ring:	18.5 cm
Internal diameter of outer ring:	38.5 cm
Area of inner ring:	269 cm^2
Area of annular space between rings:	895 cm^2
Internal diameter of Mariotte tube:	3.75 cm
External diameter of air inlet tube:	0.95 cm
Area of water in Mariotte tube:	10.3 cm^2

Soil Moisture at Time of Test: Moist

RESULTS			
Date and time	**Elapsed time (min)**	**Water level in Mariotte tube (cm)**	**Water loss from inner ring (cm)**
22/11/17 14:00	0.00	24.0	0.00
22/11/17 14:07	7.50	20.2	0.15
22/11/17 14:15	15.00	17.5	0.25
22/11/17 14:22	22.50	14.8	0.35
22/11/17 14:30	30.00	11.0	0.50
22/11/17 14:37	37.50	7.0	0.65
22/11/17 14:45	45.00	4.0	0.77



CALCULATED INFILTRATION RATE **1.70E-02 cm / min**
2.8E-06 m / sec

RCA Australia	**Tested by: JH**	**Date: 23/11/2017**
	Checked by: CM	**Date: 29/1/18**

RCA AUSTRALIA
GEOTECHNICAL • ENVIRONMENTAL

DOUBLE RING INFILTROMETER TEST

CLIENT: CONCRUSH
PROJECT: Permeability Assessment
LOCATION: Teralba,NSW

DATE: 22/11/2017
RCA REF: 13001

SOIL DESCRIPTION: Hardstand - Sandy Gravel / Gravelly Sand, with organic material

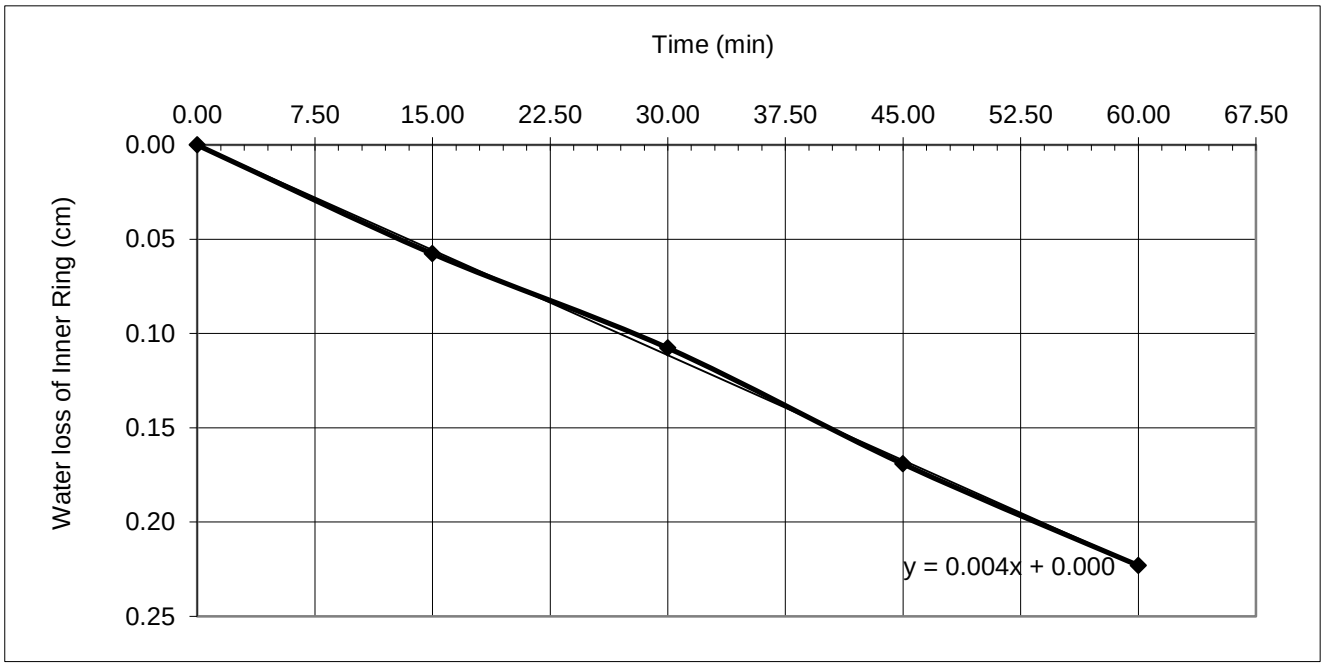
TEST METHOD: Constant Head

BORE DETAILS

Test No:	3
Depth:	0 cm
Depth of water in rings:	25 cm
Internal diameter of inner ring:	18.5 cm
Internal diameter of outer ring:	38.5 cm
Area of inner ring:	269 cm^2
Area of annular space between rings:	895 cm^2
Internal diameter of Mariotte tube:	3.75 cm
External diameter of air inlet tube:	0.95 cm
Area of water in Mariotte tube:	10.3 cm^2

Soil Moisture at Time of Test: Moist

RESULTS			
Date and time	**Elapsed time (min)**	**Water level in Mariotte tube (cm)**	**Water loss from inner ring (cm)**
22/11/17 14:00	0.00	98.5	0.00
22/11/17 14:15	15.00	97.0	0.06
22/11/17 14:30	30.00	95.7	0.11
22/11/17 14:45	45.00	94.1	0.17
22/11/17 15:00	60.00	92.7	0.22



CALCULATED INFILTRATION RATE **4.00E-03 cm / min**
6.7E-07 m / sec

RCA Australia	**Tested by: JH**	**Date: 23/11/2017**
	Checked by: CM	**Date: 29/1/18**

Sydney Laboratory
Unit 5/43 Herbert St
Artarmon NSW 2064
email: artarmon@ghd.com.au
web: www.ghd.com.au/ghdgeotechnics
Tel: (02) 9462 4860
Fax:(02) 9462 4710

Aggregate/Soil Test Report

Report No: SYD1702779
Issue No: 1
This report replaces all previous issues of report no 'SYD1702779'.

Client:
RCA Australia
PO Box 175
Carrington NSW 2294

Project: 2120944

Accredited for compliance with ISO / IEC 17025 - Testing

NATA Accredited Laboratory Number: 679

Approved Signatory: D.P Brooke (Sydney Laboratory Manager)

Date of Issue: 9/01/2018

Sample Details

GHD Sample No	SYD17-0555-02
Client Sample ID	Blended Base
Date Sampled	21/11/2017
Sampled By	Supplied by Client
Location	Project Reference 13001
Soil Description	Sandy Gravel / gravelly sand brown with silt

Test Results

Description	Method	Result	Limits
Modified Maximum Dry Density (t/m³)	AS 1289.5.2.1	1.87	
Modified Optimum Moisture Content (%)		13.0	
Retained Sieve 19mm (%)		2	
Date Tested		5/12/2017	
Permeability (m/sec)	AS 1289.6.7.2	1 E -08	
Laboratory Moisture Ratio		101.5	
Laboratory Density Ratio		97.5	
CompactiveEffort		Modified	
Method of Compaction		Compaction Hammer	
Surcharge Applied (Kg)		0.3	
Pressure Applied (Kpa)		0	
Material Retained And Later Discarded (%)		0.0	
Sieve Size (mm)		19.00	
Date Tested		5/01/2018	

Comments

N/A

Sydney Laboratory
Unit 5/43 Herbert St
Artarmon NSW 2064
email: artarmon@ghd.com.au
web: www.ghd.com.au/ghdgeotechnics
Tel: (02) 9462 4860
Fax:(02) 9462 4710

Aggregate/Soil Test Report

Report No: SYD1702778
Issue No: 1
This report replaces all previous issues of report no 'SYD1702778'.

Client:
RCA Australia
PO Box 175
Carrington NSW 2294

Project: 2120944

Accredited for compliance with ISO / IEC 17025 - Testing

NATA Accredited Laboratory Number: 679

Approved Signatory: D.P Brooke (Sydney Laboratory Manager)

Date of Issue: 9/01/2018

Sample Details

GHD Sample No	SYD17-0555-01
Client Sample ID	Concrete Base
Date Sampled	21/11/2017
Sampled By	Supplied by Client
Location	Project Reference 13001
Soil Description	Sandy gravel / gravelly sand: with silt, brown

Test Results

Description	Method	Result	Limits
Modified Maximum Dry Density (t/m³)	AS 1289.5.2.1	1.87	
Modified Optimum Moisture Content (%)		14.0	
Retained Sieve 19mm (%)		3	
Date Tested		5/12/2017	
Permeability (m/sec)	AS 1289.6.7.2	9 E -09	
Laboratory Moisture Ratio		103.5	
Laboratory Density Ratio		97.5	
CompactiveEffort		Modified	
Method of Compaction		Compaction Hammer	
Surcharge Applied (Kg)		0.3	
Pressure Applied (Kpa)		0	
Material Retained And Later Discarded (%)		0.0	
Sieve Size (mm)		19.00	
Date Tested		2/01/2018	

Comments

N/A

umwelt
Environmental & Social Consultants

Newcastle | Perth | Canberra | Brisbane | Sydney | Orange

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