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Environmental & Social Consultants

Holcim

COOMA ROAD QUARRY
WATER MANAGEMENT PLAN

FINAL

July 2019

COOMA ROAD QUARRY WATER MANAGEMENT PLAN

FINAL

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

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Document Status

Rev No.	Reviewer		Approved for Issue	
	Name	Date	Name	Date
1	Adam Bertram – Quarry Manager	08/08/2018	Adam Bertram	08/08/2018
2	Chris Bonomini -Senior Water Engineer (DPIE Approved Suitably Qualified Expert)	30/07/2019	Adam Bertram	30/07/2019

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Definitions

The terminology utilised within this Water Management Plan (WMP) is defined in the table below.

Term	Definition
µs/cm	microSiemens per centimetre is the standard measure of electrical conductivity and is used to indicate the salinity level of water.
AHD	Australia Height Datum. Used to indicate elevation.
Alluvium	Sediment deposited by a flowing stream, e.g. clay, silt, sand etc.
Aquifer	A water bearing rock formation.
ARI	Average Recurrence Interval. Expresses the rarity of a rainfall event and is used to indicate intensity.
Blue Book	Managing Urban Stormwater: Soils and Construction, Volumes 1 and 2 (Landcom 2004 and DECC 2008).
Bore	A hole formed by boring or augering. Groundwater wells are installed within the bore.
P&I	NSW Planning and Infrastructure (formerly DoP/DP&I)
EC	Electrical conductivity
EMS	Environmental Management System
EP&A Act	*Environmental Planning and Assessment Act 1979*
EPL	Environment Protection Licence
Groundwater	Sub-surface water which is within the saturated zone and can supply wells and springs. The upper surface of this saturated zone is called the water table.
kL	Kilolitres or thousands of litres, e.g. 3 kL is the same as 3,000 litres
ML	Megalitres or millions of litres, e.g. 5 ML is the same as 5 million litres
Mtpa	Mega tonnes per annum
NOW	NSW Office of Water
OEH	Office of Environment and Heritage (formerly DECCW)
pH	A measure of acidity
POEO Act	*Protection of the Environment Operations Act 1997*
SIP	Sediment Inception Pond
TARP	Trigger Action Response Plan
VENM	Virgin Excavated Natural Material
WMP	Water Management Plan
WMS	Water Management System

1.0 Introduction

1.1 Background

Holcim (Australia) Pty Ltd (Holcim) operates Cooma Road Quarry (CRQ), an existing hard rock quarry located approximately 6 kilometres south of Queanbeyan New South Wales (NSW) (refer to **Figure 1.1**). CRQ has been operating at the site since 1959. The previous development consent for CRQ was granted on 26 October 1995 and was due to expire in October 2015. To enable continued quarrying operations, Holcim sought a Development Consent under Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act) for an extension of the approved quarry life for an additional 20 years. The CRQ Development Consent (SSD_5109) (the DC) for the CRQ Continued Operations Project (refer to **Figure 1.2**) was granted on 27 September 2013 by the NSW Minister for Planning and Infrastructure. A modification application (SSD_5109_MOD 1) to vary the DC and allow Virgin Excavated Natural Material (VENM) to be received on site was approved in August 2016.

Holcim is committed to implementing continued quarrying operations in the context of updated and contemporary environmental management requirements. This Water Management Plan (WMP) has been prepared in accordance with Condition 20 of Schedule 3 of the DC (refer to **Section 2.1**).

1.2 Purpose and Scope

The purpose of this Water Management Plan (WMP) is to provide a description of the measures to be implemented by Holcim to mitigate surface water and groundwater impacts and to detail management and monitoring requirements associated with the Cooma Road Quarry operations.

This WMP addresses the requirements detailed in Schedule 3 of the DC (refer to **Section 2.1**).

1.3 Preparation of Water Management Plan (WMP)

In accordance with Condition 20 of Schedule 3 of the Development Consent, Holcim received notification from the Secretary of NSW Department of Planning, Industry and Environment (DPIE) that Chris Bonomini, Senior Water Engineer at Umwelt (Australia) Pty Limited (Umwelt), has been appointed as the suitably qualified and experienced person to prepare the WMP (refer to **Appendix 1** for correspondence).

This WMP was prepared by Chris Bonomini of Umwelt in consultation with Holcim. Umwelt has concurrently submitted this revised WMP to the NSW Environment Protection Authority (EPA) and the NSW Department of Industry – Water (DoI Water) requesting comment. Feedback provided by the EPA and DoI Water will be considered and incorporated into a further update of the WMP following the receipt of comments. The WMP will then be resubmitted to the DPIE for approval.

Image Source: Nearmap (Jan 2019)
Data Source: Holcim (2012)

0 0.5 1.0 1.5km
1:35 000

Legend

Approved Project Area

FIGURE 1.1

Locality Map

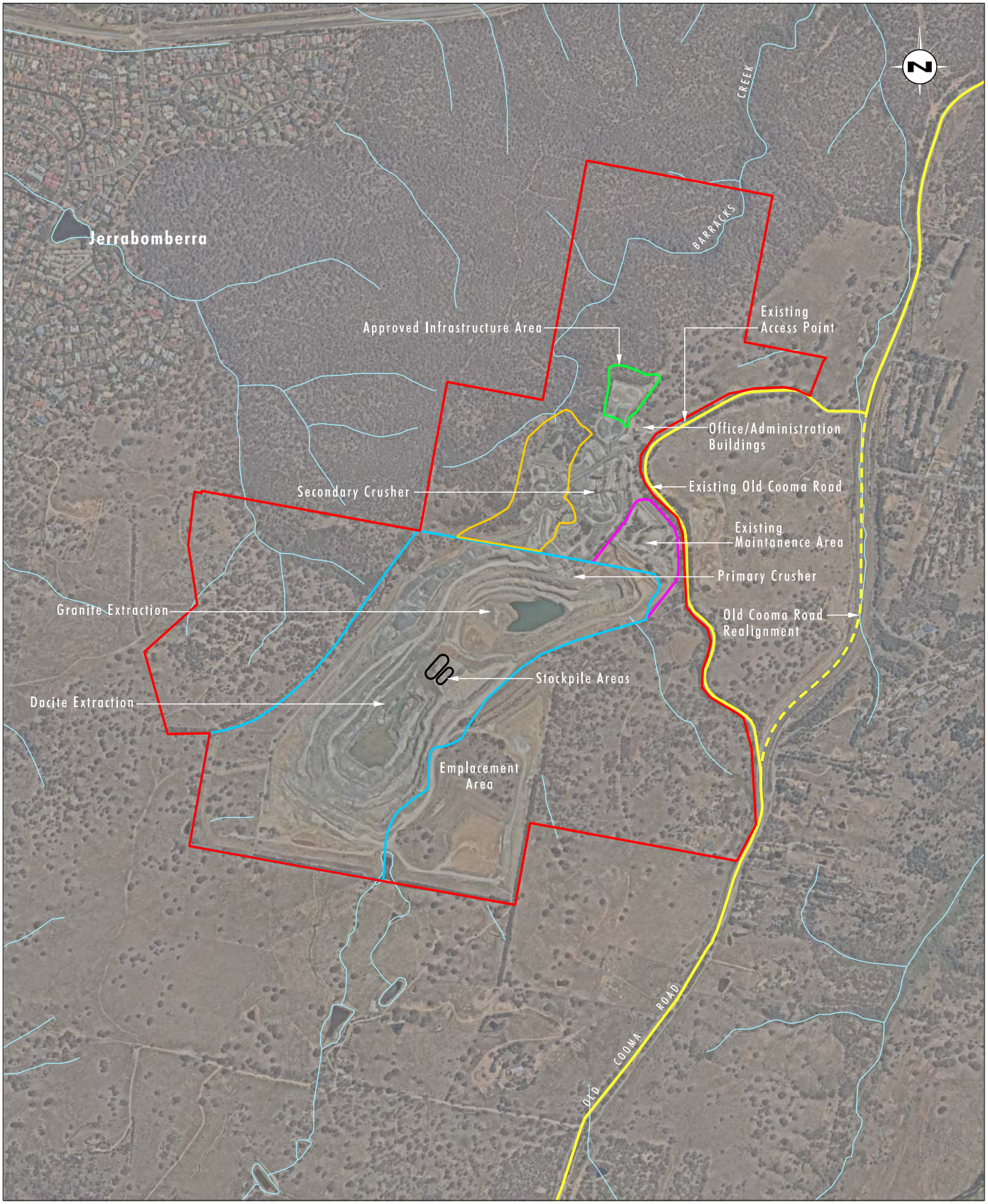


Image Source: Nearmap (Jan 2019)
Data Source: Holcim (2012)

0 0.25 0.5 0.75km
1:15 000

Legend

- Approved Project Area
- Approved Extraction Area
- Approved Additional Extraction Area
- Approved Disturbance Area - Workshop
- Approved Disturbance Area - Overburden Emplacement

FIGURE 1.2

Cooma Road Quarry
Continued Operations Project

2.0 Regulatory Requirements

2.1 Development Consent

The requirement for this WMP arises from Condition 20 of Schedule 3 of the CRQ DC. The requirements of Condition 20 of Schedule 3 of the DC are presented in **Table 2.1** along with the relevant sections of the WMP where each condition is addressed.

Table 2.1 Development Consent Conditions

Development Consent Condition	Section Addressed
20. The Applicant must prepare a Water Management Plan for the development to the satisfaction of the Secretary. This plan must be prepared in consultation with the EPA and DoI – Water by suitably qualified and experienced person/s whose appointment has been approved by the Secretary, and be submitted to the Secretary for approval within 6 months of the date of this consent. This plan must include a:	**Appendix 1**
1. Site Water Balance that includes details of:	**Section 4.0**
• sources and security of water supply, including contingency planning;	**Sections 4.0 and 4.2**
• water use on site; and	**Sections 3.2 and 4.0**
• measures that would be implemented to minimise use of clean water and maximise recycling of dirty water on the site;	**Sections 3.2.1, 3.2.2 and 4.1**
2. Surface Water Management Plan that includes:	**This plan**
• baseline data on surface water flows and quality in the watercourses that could be affected by the development;	**Section 3.1.1**
• a detailed description of surface water management system on site, including the design objectives and performance criteria for the: – clean water diversions; – erosion and sediment controls; – water storages (including Maximum Harvestable Rights requirements); and – control of water pollution from areas of the site that have been rehabilitated;	**Section 3.2**
• performance criteria, including trigger levels for investigating any potentially adverse surface water quality impacts;	**Sections 3.1.1.1 and 5.1**
• a program to monitor: – any surface water discharges; – the effectiveness of the water management system; – surface water flows and quality in local watercourses; and – ecosystem health of local watercourses;	**Section 5.1**
3. Groundwater Monitoring Program that includes:	**Section 5.2**
• baseline data of groundwater levels surrounding the development;	**Section 3.1.2**
• groundwater assessment criteria based upon analysis of baseline data for groundwater, including trigger levels for investigating any potentially adverse; and	**Sections 3.1.2.2 and 5.2**
• a program to monitor and/or validate the impacts of the development on groundwater resources;	**Section 5.2**

Development Consent Condition	Section Addressed
4. Surface and Groundwater Response Plan that describes the measures and/or procedures that would be implemented to:	**Section 7.0**
• respond to any exceedances of the surface water and groundwater assessment criteria; and	**Section 7.0**
• mitigate and/or offset any adverse impacts on surface water and groundwater resources located within and adjacent to the site.	**Section 7.0**
The Applicant must implement the approved management plan as approved from time to time by the Secretary	

Additional general requirements of all Environmental Management Plans are included in Condition 2 of Schedule 5 of the Development Consent and are provided in **Appendix 2**.

2.2 Statement of Commitments

The one statement of commitment relevant to this WMP as contained in Appendix 8 of the DC is presented in **Table 2.3**, along with the relevant section of the WMP where the condition is addressed.

Table 2.2 Statement of Commitments Conditions

Commitment	Section Addressed
4. The walls of all water management dams will be inspected biennially (every two years) for their structural integrity and for any maintenance requirements. The walls of the water management dams will be grassed and kept free of trees and shrubs.	**Section 3.2.7**

2.3 Stakeholder Consultation Regarding this Document

A copy of this WMP will be provided concurrently to the EPA and DoI Water for comment. The WMP will be updated as required to reflect EPA and DoI Water feedback and recommendations following the receipt of comments. Timeframes for Holcim to respond to agency comments on the draft document will be discussed and agreed with DPIE.

2.4 Surface Water Licence

Holcim presently holds Water Access Licence (WAL) 33412 with a share component of 98 units in the Queanbeyan water source. The Queanbeyan water source is within the Murrimbidgee Unregulated and Alluvial Water Sources Water Sharing Plan (WSP) catchment and as such water management at CRQ is governed by the Water Management Act 2000. Detail regarding CRQs surface water licensing, surface water entitlements and surface water take are presented in **Section 6.0**.

2.5 Environment Protection Licence

Holcim is authorised to discharge water to Barracks Creek via Licensed Discharge Point (LDP) 1 in accordance with NSW Environment Protection Licence (EPL) 1453. EPL 1453 contains no discharge volume limit, however, discharge volume monitoring is required. Surface water management and monitoring is discussed further in **Section 3.1**.

3.0 Water Management

3.1 Water Resources Context and Baseline Data Summary

3.1.1 Surface Water

CRQ is located within the catchments of Barracks Creek and Jerrabomberra Creek. Barracks Creek is a minor tributary of the Queanbeyan River which flows into the Molonglo River upstream of Lake Burley Griffin while Jerrabomberra Creek flows directly into Lake Burley Griffin. The Molonglo River which flows through Lake Burley Griffin in the Australian Capital Territory (ACT) forms part of the broader Murrumbidgee River catchment area.

The headwaters of Barracks Creek are approximately 1.5 kilometres south of CRQ. The quarry pit and infrastructure area is located within the catchment area of Barracks Creek.

The headwaters of Jerrabomberra Creek lie to the west of CRQ pit. The approved western overburden emplacement area for CRQ lies within the headwaters of an un-named tributary of Jerrabomberra Creek. At present, and for the foreseeable future, the western overburden emplacement will not be used and therefore remain as undisturbed land.

3.1.1.1 Water Quality

Holcim monitors surface water quality in Barracks Creek on a monthly basis. The surface water monitoring locations are shown on **Figure 3.1**. Due to the dense vegetation along Barracks Creek, the water quality monitoring location is only safely accessible by walking from the Sediment Interception Pond (SIP) along the outer bed of Barracks Creek. As such, the surface water quality monitoring location is inaccessible during high or prolonged rainfall events when the depth of flow in Barracks Creek exceeds approximately 400 mm. Improved access to the water quality monitoring location would require removal of vegetation for the provision of an access track. In addition, Holcim monitors the quality of water discharged from the CRQ Water Management System (WMS) to Barracks Creek in accordance with EPL 1453 (refer to **Section 2.5**). The monitoring location for licensed discharge to Barracks Creek as defined by the EPL is Point 1 and is shown on **Figure 3.1**.

Holcim also monitors water quality in Barracks Creek downstream of LDP 1 to develop a baseline understanding of receiving water quality and identify any potential impacts associated with the CRQ operation. Historical Barracks Creek water quality monitoring results for April 2002 to December 2017 are summarised in **Table 3.1** for the monitoring point in Barracks Creek immediately downstream of the quarry. The most recent discharge recorded from the CRQ WMS to Barracks Creek was in 2010.

Table 3.1 Barracks Creek Water Quality Downstream of the Quarry

Parameter	Unit	Trigger Values	Max	Min	Ave	Number of Results Above EPL Criteria
pH	-	6.5 to 8.5[1]	8.2	6.3	7.4	2
Electrical Conductivity (EC)	µS/cm	125-2200[2]	1600	140	1236	nil
Oil & Grease	mg/L	10[1]	1	0.01	<1	nil
Total Suspended Solids (TSS)[3]	mg/L	<50[1]	57	<2	4.5	1

Notes:

1. Based on limits in EPL 1453
2. Based on Australian and New Zealand Guidelines for Fresh and Marine Water Quality (the Guidelines) (Australian and New Zealand Environment and Conservation Council (ANZECC), 2000) default trigger values for slightly to moderately disturbed lowland river systems.
3. TSS monitoring commenced June 2007

The results presented in **Table 3.1** indicate pH and EC are typically within the ANZECC Guidelines (ANZECC 2000) which are consistent with the NSW Water Quality and River Flow Objectives. Results also indicate TSS in Barracks Creek downstream of CRQ is less than 10 mg/L on average and oil and grease is typically less than 1 mg/L.

3.1.1.2 Barracks Creek Flows

There is no historical baseline flow monitoring data for Barracks Creek flows prior to the development of the Quarry. In the absence of baseline flow monitoring data, the daily flow regimes in Barracks Creek have been estimated using the Australian Water Balance Model (AWBM) runoff model. The AWBM is a catchment water balance model that uses daily or hourly rainfall data to calculate runoff. Runoff from undisturbed catchments is estimated using a daily time step AWBM developed in GoldSim and calibrated to an average annual runoff for the upslope catchment of 0.7 ML/ha/year (Water NSW (https://www.waternsw.com.au/customer-service/water-licensing/basic-water-rights/harvestable-rights-dams/maximum-harvestable-right-calculator), 2019). The baseline flow modelling was based on the following:

- Daily rainfall data input to the AWBM was sourced from the Queanbeyan Bowling Club Bureau of Meteorology (BoM) Station (Station 070072). The period of data used was from 1 January 1900 to 31 December 2018 (119 years).
- Average monthly evaporation data input to the AWBM was sourced from the Canberra Airport BoM Station (Station 070014) for the period 1967 to 2010.
- A pre-development Barracks Creek catchment upslope of the flow monitoring location of 298 hectares (ha).
- No surface water take associated with farm dams was accounted for.

Table 3.2 and **Table 3.2** present the modelled annual and daily baseline flow statistics for Barracks Creek respectively.

Table 3.2 Modelled Annual Barracks Creek Baseline Flows

Statistic	Flow (ML/year)
10th Percentile	95.7
50th Percentile	190.1
90th Percentile	458.7
Mean	247.5

Table 3.3 Modelled Daily Barracks Creek Baseline Flows

Statistic	Flow (ML/day)
10th Percentile	0.07
50th Percentile	0.20
90th Percentile	1.00
Mean	0.56

Quantitative flow monitoring in Barracks Creek has not been undertaken since development of the Quarry, however, quantitative flow monitoring downstream of the Quarry commenced will commence in August 2019 on a monthly basis at the same location surface water quality monitoring is undertaken (refer to **Figure 3.1**). Quantitative flow monitoring is undertaken using a manual staff gauge to measure the depth of flow at the flow monitoring location. The measured depth of flow is converted to a flow using a flow rating curve prepared specifically for the flow monitoring location that relates the depth of flow to a volumetric flow rate. The flow rating curve was developed based on Barracks Creek survey cross sections and modelling using the US Army Corp of Engineers Hydrologic Engineering Center River Analysis System (HEC-RAS) software.

Due to the dense vegetation along Barracks Creek, the flow monitoring location is only safely accessible by walking from the Sediment Interception Pond (SIP) along the outer bed of Barracks Creek. As such, the flow monitoring location is inaccessible during high or prolonged rainfall events when the depth of flow in Barracks Creek exceeds approximately 400 mm. Improved access to the water quality monitoring location would require removal of vegetation for the provision of an access track.

3.1.2 Groundwater

CRQ lies in the upland area of the Queanbeyan/Molongo catchment. The uplands lie mainly on erosion-resistant, ancient, Silurian volcanic rocks and Palaeozoic granites. Groundwater flow in this catchment is from a local flow system found within Palaeozoic rocks or Mesozoic intrusives (Coffey Geotechnics 2012). CRQ experiences negligible groundwater inflow to the existing quarry pit.

Water level records and bail-down tests on the three temporary monitoring bores installed to assess the groundwater at the quarry also indicate that the granite rock has a very low permeability (cm/day) and based on the width of the quarry and the low hydraulic conductivity, the interaction of the granite pit with regional groundwater is considered to be very limited and most likely none at all. With a prospective well yield of less than 0.01 L/s, Coffey Geotechnics, 2012 found the rock mass has not been proven to be a viable aquifer. In terms of aquifer properties, the fractured granite system would yield only 0.34 m^3/d, or 0.004 L/s to a well, which is not considered a productive aquifer (Coffey Geotechnics, 2012).

Following a groundwater assessment (Coffey Geotechnics, 2012), it was concluded the operation of CRQ is not considered likely to have an impact on the regional groundwater resource, as:

- the quarry site is in a tight rock formation where no meaningful groundwater extractions can be attained
- quarrying activities do not impact on a viable aquifer
- the volume of groundwater affected by CRQ is limited to the exposed water table in the granite pit
- interaction of the granite pit with regional groundwater is very limited
- the maximum extraction depth will not be increased.

Given the fact that both rock formations quarried at CRQ, granite and dacite, are relatively stable the potential for the quarried material to affect groundwater water quality is considered negligible.

Notwithstanding the above and the CRQ Continued Operations Groundwater Impact Assessment (Coffey Geotechnics, 2012), Holcim engaged SLR Consulting to complete a groundwater investigation to identify any available baseline groundwater information and select appropriate groundwater monitoring locations.

3.1.2.1 Anthropogenic Groundwater Users

Table 3.4 and **Figure 3.2** present the 13 registered bores within 2 km of the quarry identified by SLR (2019). Of the 13 registered bores, six bores are used for domestic/stock, four domestic, two industrial, and one bore is noted as being for private town water supply (GW416272). However, the actual use of GW416272 requires confirmation.

Seven of the bores are in the Colinton Volcanics, five in the Barracks Creek granite, and one in the Deakin Volcanics (SLR, 2019). The bores are installed from 30 m to 108 m below surface with groundwater works summaries indicating groundwater interception within the granite related to fractured zones within the fresh granite material (SLR, 2019). Groundwater yields of between 0.21 L/s and 2.14 L/s and variable water levels between 1.6 m and 12 m below surface were recorded within the Barrack Creek granite while within the Colinton Volcanics, groundwater yields ranged between 0.33 L/s and 3.5 L/s (SLR, 2019). No groundwater quality data is available for the registered bores.

Table 3.4 Registered Bores

ID	Easting	Northing	Use	Drill Depth (mbgl)	SWL (mbgl)	Yield (L/s)	Geology
GW047361	702246	6080431	Industrial	61	-	-	Colinton Volcanics (Tuffaceous shale)
GW050004	703238	6080747	Domestic	57.5	-	-	Colinton Volcanics (Rhyolitic tuff)
GW050980	702815	6081034	Domestic, Stock	35.4	11.6	1.1	Barrack Creek Adamellite (Leucogranite)

ID	Easting	Northing	Use	Drill Depth (mbgl)	SWL (mbgl)	Yield (L/s)	Geology
GW061449	702980	6080507	Domestic, Stock	80	-	0.33 – 0.6	Colinton Volcanics (Rhyolitic tuff)
GW400534	702094	6080372	Domestic	30	1 - 2	0.75 – 1.5	Colinton Volcanics (Rhyolitic tuff)
GW402859	703026	6081520	Domestic, Stock	-	-	0.21 – 1.89	Barrack Creek Adamellite (Leucogranite)
GW402872	702668	6079839	Domestic	102	14.0	0.38	Colinton Volcanics (Rhyolitic tuff)
GW403321	702151	6080996	Industrial – Sand & Gravel	104	1.6	1.40	Barrack Creek Adamellite (Leucogranite)
GW403921	700449	6081720	Domestic	75	-	0.5 – 1.0	Deakin Volcanics (Rhyodacitic ignimbrite) - shale
GW404089	702545	6079795	Domestic, Stock	81	20.0	-	Colinton Volcanics (Rhyolitic tuff)
GW414667	703146	6081602	Domestic, Stock	192	-	0.38	Barrack Creek Adamellite (Leucogranite) - granite
GW416130	702637	6080862	Domestic, Stock	64	12.0	2.14	Barrack Creek Adamellite (Leucogranite) - granite
GW416272	702954	6080532	Town Water Supply - Private	108	27.9	3.5	Colinton Volcanics (Rhyolitic tuff)
GW047361	702246	6080431	Industrial	61	-	-	Colinton Volcanics (Tuffaceous shale)
GW050004	703238	6080747	Domestic	57.5	-	-	Colinton Volcanics (Rhyolitic tuff)
GW050980	702815	6081034	Domestic, Stock	35.4	11.6	1.1	Barrack Creek Adamellite (Leucogranite)

Source: *Holcim (Australia) Cooma Road Quarry Water Management Plan Groundwater Works* (SLR, 2019)

3.1.2.2 Proposed Monitoring

Based on an assessment of the existing groundwater environment and the Quarry operation, SLR proposed the groundwater level and water quality monitoring program presented in **Table 3.5** to understand the groundwater flow regime and connectivity to surface water (i.e. Barracks Creek) and Quarry operations. The groundwater monitoring bore network will include two new bores (MB01 and MB02) and two existing bores (GW400534 and GW416130) to the east of the Quarry (refer to **Figure 3.1** for indicative locations of MB01 and MB02 as well as location of existing bores). Routine groundwater quality monitoring is included to understand potential changes in water quality in response to drawdown and potential changes in groundwater quality over time near both the surface water discharge point, and overburden emplacement areas. Groundwater level data collected as part of this monitoring program will be used to establish appropriate groundwater level trigger values and inform the ongoing monitoring program requirements. As groundwater occurrence is largely limited to secondary porosity through fractures and faults, the groundwater level trigger values will be highly dependent on each of the individual bores. While there is some historical water level data for registered bores (refer to **Table 3.4**), SLR has advised that the levels may have been measured following bore construction and could be incorrect. As such, use of this data to establish interim groundwater level trigger values was not recommended as it could result in false trigger value exceedances. SLR advised that at least eight groundwater level monitoring results should be obtained before setting trigger values. Therefore, based on the quarterly level monitoring (refer to **Table 3.5**), 24 months of groundwater level monitoring will be required to set trigger values.

SLR advise the setting of groundwater quality trigger values based on the 5th and 95th percentile values of the ongoing monitoring program, however, suggest interim trigger values (refer to **Table 3.6**) based on the default trigger values for slightly to moderately disturbed lowland river systems presented in the ANZECC 2000 Guidelines and regional groundwater and surface water quality previously reported by Coffey 2012.

Holcim will commence groundwater level and water quality monitoring in the two existing monitoring bores (GW400534 and GW416130) as soon access to the bores is agreed upon with the respective landholders. The two new monitoring bores (MB01 and MB02) will be installed by October 2019 and the first round of monitoring in MB01 and MB02 will be completed immediately following installation. Further details of groundwater level and water quality monitoring are provided in **Section 5.2**.

Table 3.5 Proposed Groundwater Monitoring Program

Bore ID	Easting	Northing	Status	Geology	Water Level	Water Quality
MB01	702021	6081231	Proposed	Barrack Creek Adamellite (Leucogranite)	Quarterly	Quarterly
MB02	701148	6080455	Proposed	Colinton Volcanics (Rhyolitic tuff)	Quarterly	Quarterly
GW400534	702246	6080431	Unknown	Colinton Volcanics (Tuffaceous shale)	Quarterly[1]	Quarterly[1]
GW416130	702637	6080862	Unknown	Barrack Creek Adamellite (Leucogranite) - granite	Quarterly[1]	Quarterly[1]

Note:

1. Pending confirmation of bore condition and landholder access

Table 3.6 Interim Groundwater Quality Trigger Values

Parameter	Unit	Trigger Values
pH	-	6.5 to 8.5[1]
Electrical Conductivity (EC)	µS/cm	125-2200[1]
Total Dissolved Solids (TDS)	mg/L	600[2]

Notes:

1. Based on default trigger values for slightly to moderately disturbed lowland river systems for south east Australia in the ANZECC 2000 Guidelines.
2. Based on *Groundwater Assessment Cooma Road Quarry* (Coffey, 2012)

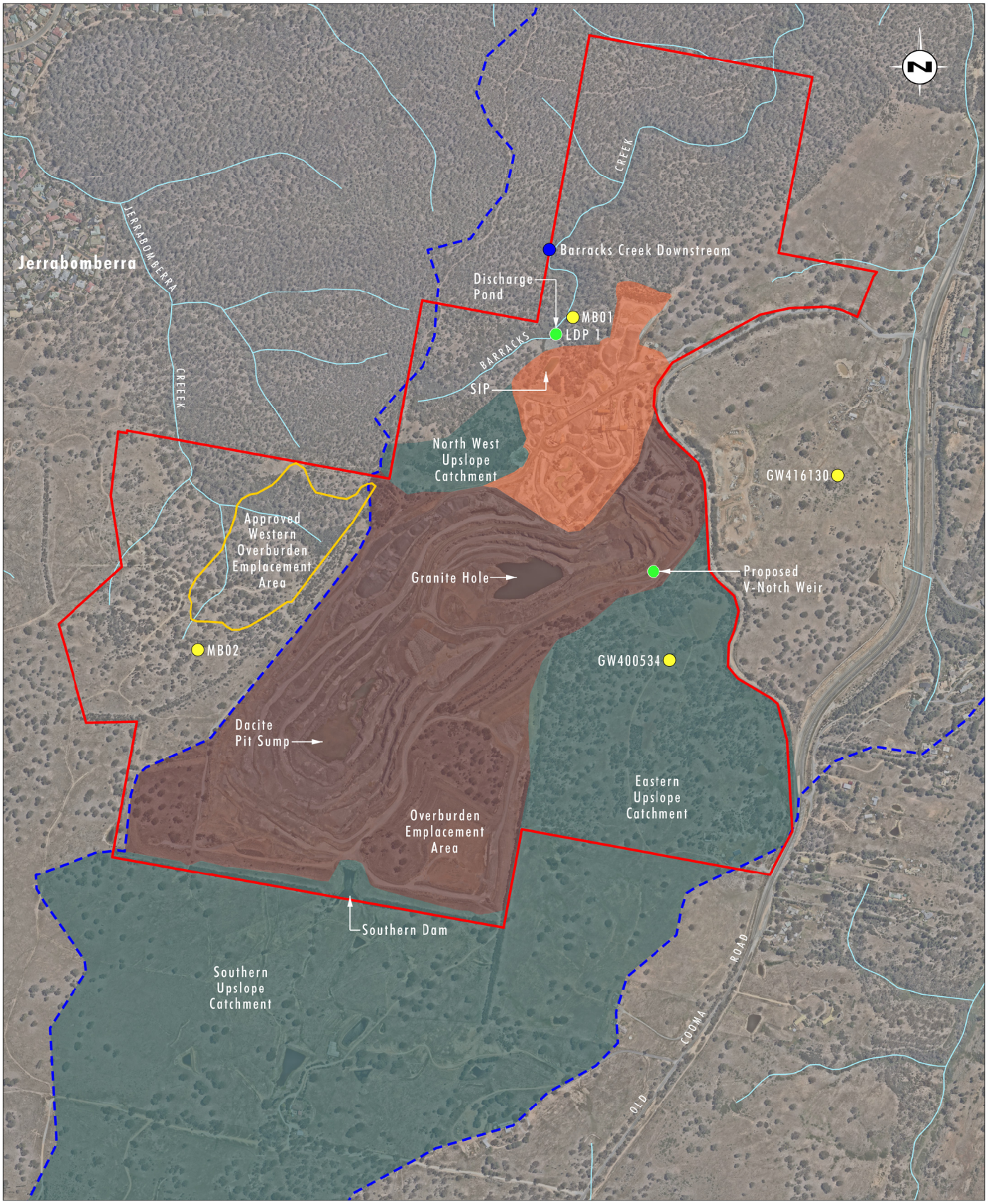


Image Source: Google Earth (2011)
Data Source: Holcim (2012), LPI (2010)

0 100 300 600m
1:12 500

Legend

- Approved Project Area
- Catchment Boundary
- Pit Catchment
- Clean Catchment
- Dirty Catchment
- Surface Water Monitoring Location
- Monitoring Bore Location
- Barracks Creek Downstream Monitoring Location

FIGURE 3.1

Monitoring Locations

File Name (A4): R01/4568_003.dgn
20190729 9.56

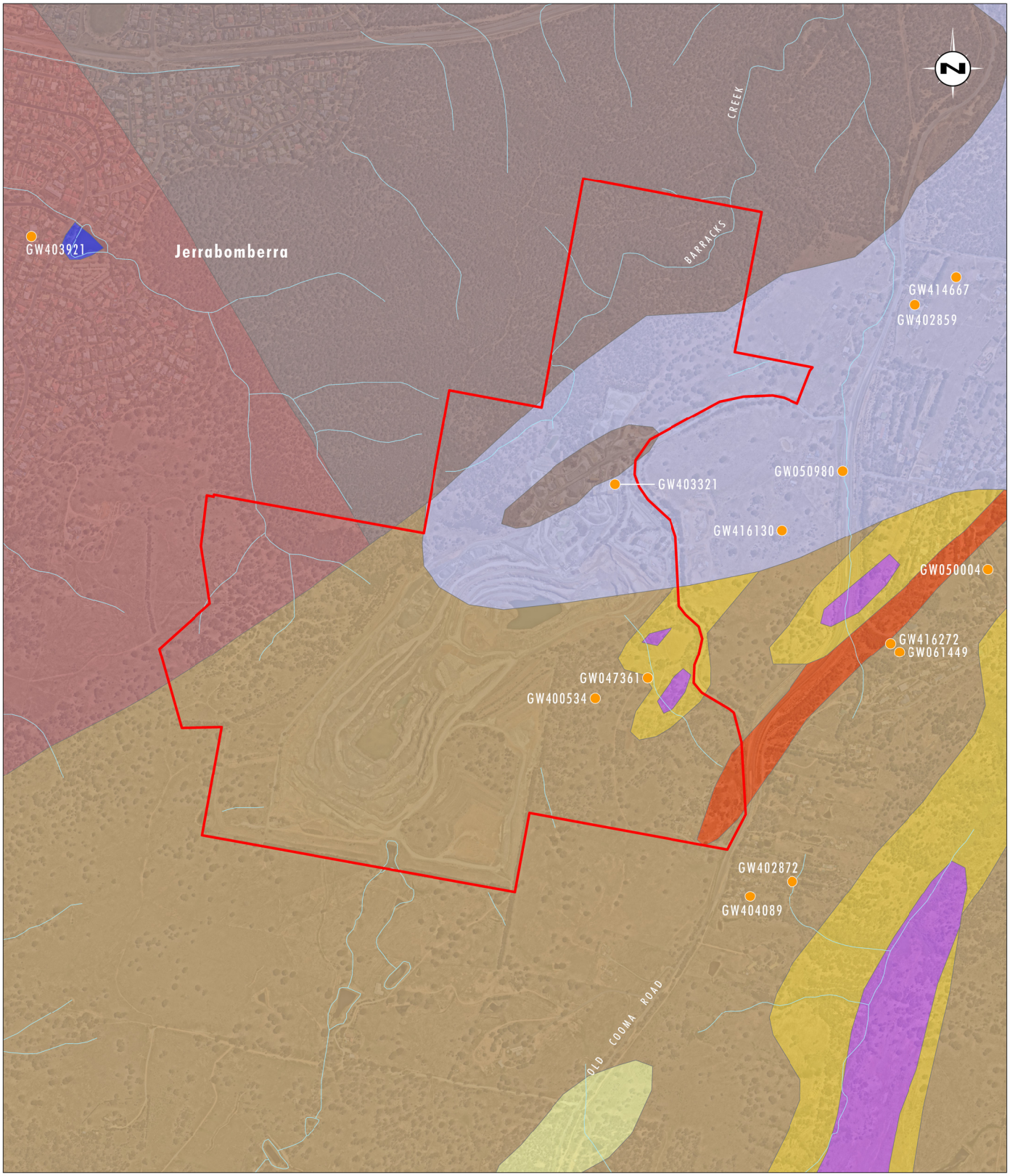


Image Source: Nearmap (Jan 2019)
Data Source: Holcim (2012), SLR (2019)

0 200 400 800m
1:16 000

Legend

- Approved Project Area
- Dbg33 - Barracks Creek Adamellite (Adamellite Leucogranite)
- Oa - Adaminady Group (Turbiditic sequence)
- Oag - Adaminady Group (Black graptolitic siliceous shale)
- Sld - Deakin Volcanics (Rhyodacitic ignimbrite)
- Src - Colinton Volcanics (Rhyolitic tuff)
- Srcy - Colinton Volcanics (limestone and dolomitic limestone)
- Srcz - Colinton Volcanics (Tuffaceous shale)
- w - water
- Unknown
- Registered Bores

FIGURE 3.2

Registered Bores

File Name (A4): R01/4568_006.dgn
20190729 10.34

3.2 Water Management System

The principal objectives of the CRQ water management strategy are to:

- monitor and manage the stormwater runoff from undisturbed upslope catchments entering the CRQ WMS
- ensure discharge water quality meets EPL 1453 criteria (refer to **Section 2.6**)
- provide an adequate and reliable water supply for quarry operations while complying with surface water take entitlement limits.

A plan of the CRQ Water Management System (WMS) is presented in **Figure 3.3**. **Figure 3.4** presents a schematic of the CRQ WMS.

3.2.1 Clean Water Management

During the preparation of the CRQ Continued Operations Project surface water assessment (Umwelt, 2012) a number of clean water diversion options were considered to minimise the volume of clean water entering the WMS. The steep upslope terrain limits the potential diversion channel routes to transfer water to the downstream environment around the quarry pit. Potential diversion channel routes are further compromised by the presence of a locally significant historical heritage site, Moses Morley's Lime Kiln, and the presence of a flora species, the hoary sunray, which is classified as endangered under the *Environment Protection and Biodiversity Act 1999* within the upslope catchment. As such, clean water diversions were considered to be impractical and were not proposed as part of the WMS presented in the approved CRQ Continued Operations Project (Umwelt, 2012).

Runoff from the southern catchment upslope of the quarry pit flows into the CRQ WMS via the Southern Dam which seeps through the rock face, or when full, overflows via the spillway into the Dacite Pit. Some of the runoff from the southern catchment is intercepted by upslope farm dams. Runoff from the east of the quarry pit drains to the Granite Hole. Clean water captured in the WMS is then transferred to the Secondary Dam (formerly referred to in previous WMP versions and other documentations as the Pump Dam) for operational reuse or subsequent transfer to the SIP prior to discharge to Barracks Creek via LDP 1. Runoff from the smaller north western undisturbed upslope drains to the Secondary Dam.

CRQ's surface water take entitlement consists of water sourced under WAL 33412 (refer to **Section 2.4**) and land holders harvestable rights provisions. Given all clean water runoff from catchments upslope of the CRQ operation all drains to the WMS, there is the potential during years with higher runoff for the quantity of surface water take to exceed CRQ's entitlement. To manage CRQ's compliance with surface water take limits, suitable volumes of water will be returned to downstream environment (i.e. Barracks Creek) via LDP 1. Further detail regarding CRQ's surface water take entitlement and management strategy are presented in **Section 6.0**.

3.2.2 Dirty Water Management

Runoff from the overburden emplacement areas and the workshop is directed into the Granite Pit while runoff from the Processing Plant drains to the Secondary Dam (refer to **Figure 3.3** and **Figure 3.4**). The SIP receives runoff from the stockpile area and a small undisturbed local catchment.

Water is sourced from the Secondary Dam for operational reuse including haul road dust suppression, material processing and other dust suppression activities. Excess water from the Dacite Pit and Granite Pit is transferred to the Secondary Dam for reuse or subsequent transfer to the SIP prior to discharge via LDP 1 to Barracks Creek.

3.2.3 WMS Water Storages

The site water storages and their estimated capacities are presented in **Table 3.7** below.

Table 3.7 Water Storages

Storage	Type	Estimated Capacity (ML) (as provided by Holcim)
Southern Dam	Clean	16.8
Secondary Dam	Dirty	3.8
SIP	Dirty	7.7

Notes:

1. Estimated volume up to spill point into the Granite Hole
2. Estimated volume up to the spill point into the Dacite Pit

3.2.3.1 Rehabilitation Area Water Management

Runoff from all existing areas undergoing rehabilitation drains to the quarry pits and is contained within the WMS. During the later stages of rehabilitation there may be areas of rehabilitation that have the potential to drain to the downstream environment. Holcim will ensure that these areas have appropriate erosion and sediment controls (ESCs) put in place until adequate vegetative coverage is established and runoff from the area can be considered clean. The ESCs will be designed and implemented in accordance with *Managing Urban Stormwater Volume 1* (Landcom, 2004) and *Volume 2E Mines and Quarries* (DECC, 2008) (the Blue Book). **Appendix 3** contains site specific design parameters for ESCs at CRQ and **Section 3.3** contains the general ESC principals that will be applied.

3.2.4 Licensed Discharges

As outlined in **Section 2.5**, CRQ may discharge water to Barracks Creek via LDP 1 provided water quality is within the limits specified in EPL 1453 (refer to **Table 5.1**). Water is released from the SIP to the Discharge Pond (which is essentially an energy dissipation structure) via a pipe fitted with a manually operated valve. Water quality in the SIP is tested prior to discharge to ensure the water to be discharged meets EPL criteria. EPL 1453 does not provide a discharge volume limit for LDP 1, however, discharge volume monitoring is required in addition to discharge water quality monitoring. The discharge volume is estimated based a theoretically calculated flow rate through the discharge pipe and the duration of the discharge. It is however noted that no discharges have occurred via LDP 1 since 2010.

3.2.5 Potable Water

Potable water demand for the quarry operation is approximately 0.5 ML per year. All potable water for CRQ is delivered to site via tanker.

3.2.6 Wastewater

Wastewater from the ablutions and staff facilities is disposed of within two septic tanks with absorption trenches and one Envirocycle system. Sludge from the septic tanks is periodically removed from site as required by a suitably licensed contractor and disposed of at the Queanbeyan Sewerage Treatment Works. Water from the Envirocycle system is used to irrigate landscaped areas around the weighbridge.

3.2.7 Inspection and Maintenance Requirements

The SIP dam is visually inspected on a monthly basis during water quality monitoring and during part of the monthly site inspection undertaken by the Quarry Manager or his / her delegate. The walls of all water dams will be inspected biennially (every two years) for their structural integrity by an appropriately qualified and competent person. The walls of the water management dams are maintained free of trees and shrubs and are inspected on a monthly basis by the Quarry Manager (or delegate).

3.3 Erosion and Sediment Control

Erosion and sediment controls are installed as required at Cooma Road quarry to mitigate the impact on nearby watercourses and the surrounding environment. Site specific design parameters are detailed in **Appendix 3**.

3.3.1 Erosion and Sediment Control Principles

Holcim will install and maintain erosion and sediment controls in accordance with the Blue Book (Landcom 2004 and DECC 2008) at Cooma Road Quarry. The general measures include, but are not limited to, the following:

- installation of erosion and sediment control measures as the first step in the process for land disturbance as per the Blue Book
- minimising all disturbed areas and stabilisation by progressive rehabilitation/stabilisation as soon as practicable
- clearly identifying and delineating areas required to be disturbed and ensuring disturbance is limited to those areas. Clearing as little vegetation as required, leaving mulch on cleared areas as long as possible and minimising machinery disturbance outside of these areas
- construction of diversion drains upslope of areas to be disturbed to direct clean water runoff away from disturbed areas, where practical
- runoff from disturbed areas will be directed into on site water storage to ensure no dirty water affects the receiving environment
- construction of other erosion and sediment control measures as per the Blue Book
- construction of drainage controls
- addition of flocculent to dams, where required, to aid the settlement of entrained sediment
- regular maintenance of controls
- topsoil stockpiles to be located away from high traffic areas and watercourses

- level or gently sloping areas will be selected as stockpile sites, where required, to minimise erosion and potential soil loss where possible
- appropriate sediment controls upslope of stockpiles to divert water and downslope to prevent soil loss
- vegetation of topsoil stockpiles if stored for longer than three months.

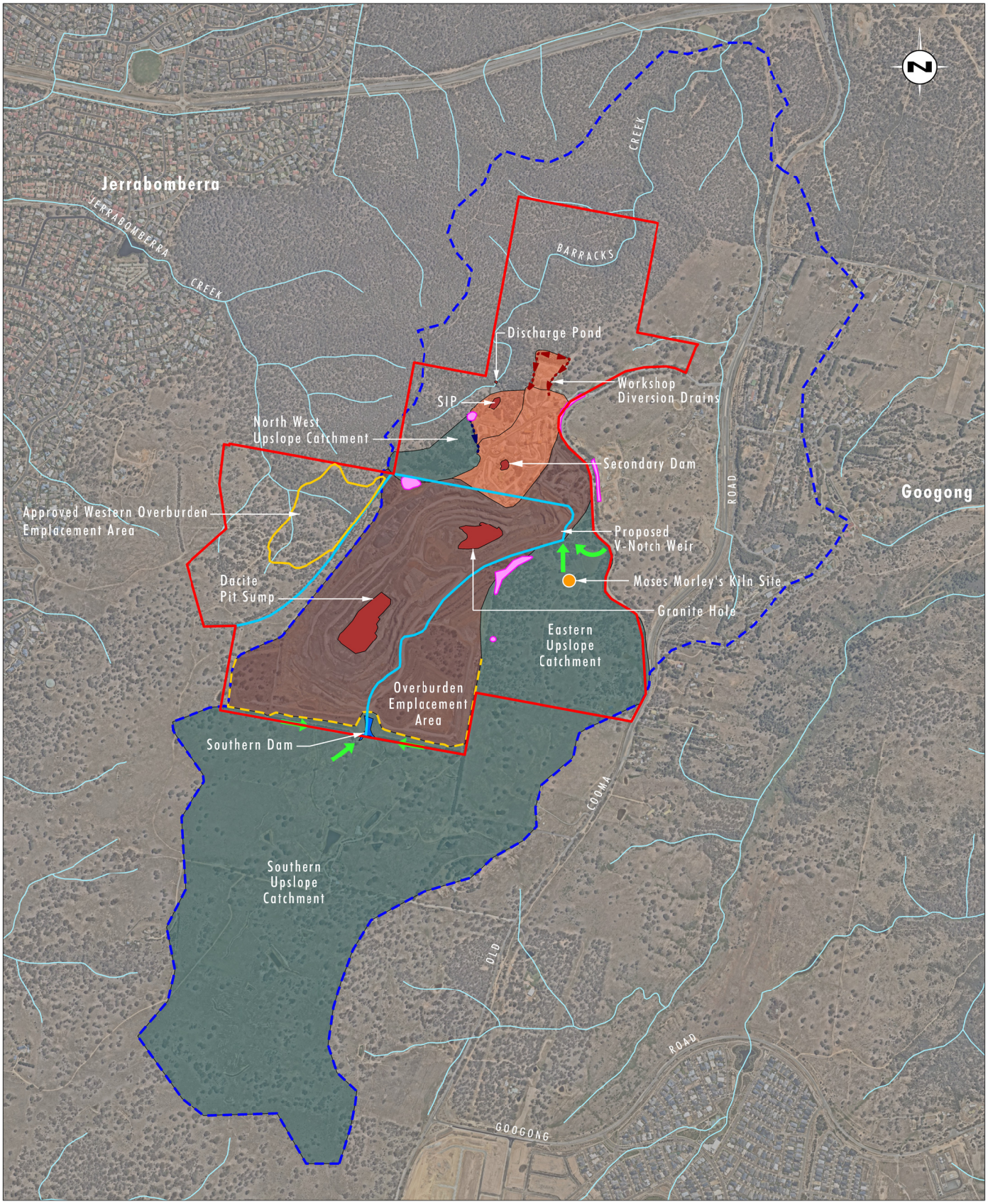


Image Source: Nearmap (July 2018)
Data Source: Holcim (2012)

0 0.25 0.5 1.0km
1:20 000

Legend

- Approved Project Area
- Approved Extraction Area
- Barracks Creek Catchment Boundary
- Internal Catchment Boundary
- Pit Catchment
- Clean Catchment
- Dirty Catchment
- Bund
- Clean Drain
- Dirty Drain
- Clean Dam
- Dirty Dam
- Flow Direction
- Hoary Sunray Location

FIGURE 3.3

Water Management System Plan

File Name (A4): R01/4568_004.dgn
20190729 15.27

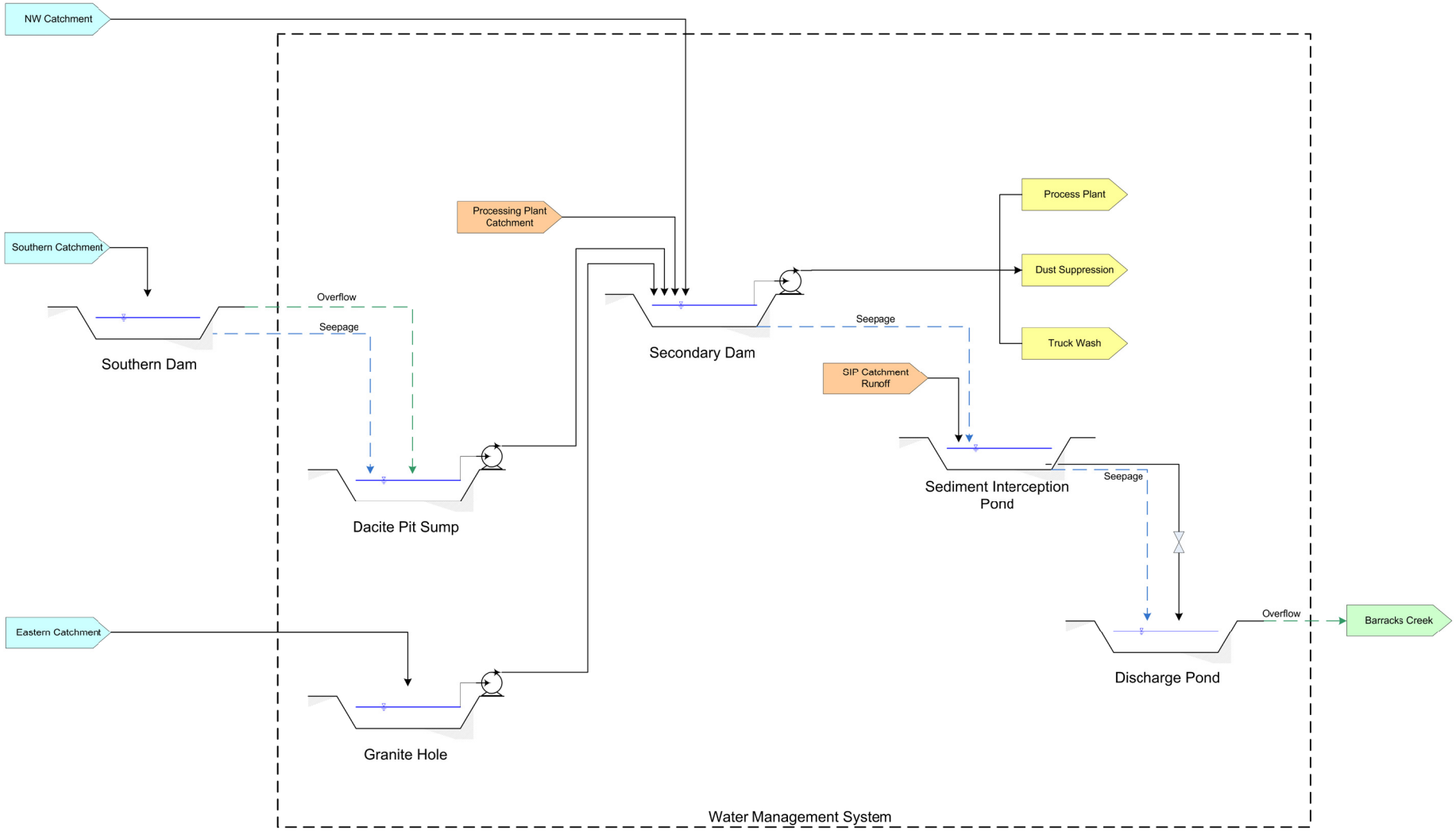


FIGURE 3.4

Water Management System Schematic

4.0 Site Water Balance

The water balance for the CRQ Continued Operations Project (Umwelt, 2012) was determined using historical rainfall data sourced from the Queanbeyan Bowling Club Bureau of Meteorology (BoM) Station (Station 070072) which is located approximately six kilometres to the north of CRQ. Evaporation data was sourced from the Canberra Airport BoM Station (Station 070014) which is located approximately 15 kilometres north of CRQ.

The water balance results for the pre CRQ Continued Operations Project (i.e. 1 Mtpa production) indicated that the quarry typically had a net water deficit in the order of 47 ML per year. The net water deficit was predicted to increase to 64 ML per year for a 50th percentile year for the CRQ Continued Operations Project (i.e. 1.5 Mtpa production). Water balance results for the pre and post Continued Operations Project scenarios are presented in **Table 4.1**.

Table 4.1 Water Balance (ML per year)

Rainfall Condition	1 Mtpa Production (pre CRQ Continued Operations)	1.5 Mtpa Production (CRQ Continued Operations Project)
10th percentile	-92	-112
50th percentile	-47	-64
90th percentile	27	17

Water balance results presented in **Table 4.1** are based on capture of rainfall runoff within the CRQ WMS and does not account for inflows from upslope undisturbed catchments. As outlined in **Section 3.2.1**, runoff from upslope undisturbed catchments drain to the CRQ WMS. The predicted water deficit as estimated from modelling is mitigated by water sourced under CRQs harvestable rights provisions and surface water licence (WAL 33412) from upslope catchments. **Section 6.0** provides further detail regarding CRQs surface water take entitlements and surface water take management.

The water balance also indicates that CRQ may at times have a surplus of water. During these periods the focus of the WMS is to manage water quality for discharge to Barracks Creek via the existing LDP 1, in accordance with the EPL 1453 (refer to **Section 3.2.4**). The quarry has a large in-pit storage capacity that will continue to allow suitable carryover storage in the event of extended dry or wet periods.

Table 4.2 provides the measured CRQ water usage for 2016, 2017 and 2018. CRQ use water captured in the WMS for production in the Processing Plant, haul road dust suppression and other dust suppression activities (e.g. stockpiles).

Table 4.2 Operational Water Usage

Year	Usage (ML)
2016	21.5
2017	21.7
2018	60.5

Note: Water usage figures provided by Holcim based on flow meter.

The relatively low water usage in 2016 and 2017 was due to low haul road dust suppression demands during a period of pit development. **Table 4.3** presents the estimated breakdown of operational water usage at CRQ as estimated by site personnel.

Table 4.3 Breakdown of Operational Water Usage

Task	Percentage
Processing Plant and other	30%
Haul Road Dust Suppression	70%

4.1 Water Efficiency

Water efficiency on site is maximised by reusing excess process water draining from the Processing Plant for dust suppression activities. Water efficiency is also achieved through the use of water efficient dust suppression sprays and limiting the use of the water cart to haul routes and other working areas while still controlling fugitive dust emissions.

4.2 Water Usage Contingency

During extended dry periods there is the potential for operational water source shortages. Holcim will implement the following contingency measures to ensure sufficient water is available to facilitate that environmental controls are maintained:

- import water from off-site sources, e.g. truck water to site
- manage production to reduce operational water demands.

5.0 Monitoring

The section below details the surface water and groundwater monitoring undertaken at CRQ. Monitoring locations are shown in Figure 3.1 with baseline data related to the surface and groundwater monitoring programs included in **Section 3.1**.

5.1 Surface Water

5.1.1 Monitoring Standards

Surface water monitoring at CRQ will be undertaken in accordance with relevant Australian Standards, legislation and the EPA approved methods for sampling, including:

- Approved Methods for the Sampling and Analysis of Water Pollutants in NSW (DEC 2004)
- AS/NZS 5667.1:1998 Water Quality – Sampling – Guidance on the Design of Sampling Programs, Sampling Techniques and the Preservation and Handling of Samples
- AS/NZS 5667.10:1998 Water Quality – Sampling – Guidance on Sampling of Waste Waters.

5.1.2 Water Quality Impact Assessment Criteria

In accordance with the conditions of EPL 1453, Holcim monitors surface water discharged via LDP 1 for the analytes prescribed in **Table 5.1.**

Table 5.1 EPL 1453 Discharge Limit Conditions

Parameter	Unit	Limits
Oil and grease	mg/L	10
pH	-	6.5 to 8.5
Total Suspended Solids	mg/L	<50

The results of water quality monitoring in Barracks Creek is are compared with the trigger values presented in **Table 5.2**.

Table 5.2 Barracks Creek Water Quality Trigger Values

Parameter	Unit	Trigger Values
pH	-	6.5 to 8.5[1]
EC	µS/cm	125-2200[2]
Oil & Grease	mg/L	10[1]
TSS[3]	mg/L	<50[1]

Notes:

1. Based on limits in EPL 1453
2. Based on Australian and New Zealand Guidelines for Fresh and Marine Water Quality (Australian and New Zealand Environment and Conservation Council, 2000) default trigger values for slightly to moderately disturbed lowland river systems.
3. TSS monitoring commenced June 2007

5.1.3 Monitoring Program

5.1.3.1 Discharge Water Quality and Flow

Holcim monitor discharge water quality in accordance with the conditions of EPL 1453 (refer to **Section 2.5**). The discharge volume from LDP 1 is estimated based a theoretically calculated flow rate through the discharge pipe and the duration of the discharge.

5.1.3.2 Barracks Creek Water Quality and Flow

Water quality monitoring of pH, EC, oil and grease and TSS is undertaken on a monthly basis at the Barracks Creek downstream monitoring location (refer to Figure 3.1**)**.

Holcim will commence quantitative flow monitoring in Barracks Creek in August 2019 at the Barracks Creek downstream monitoring location (refer to Figure 3.1). Quantitative flow monitoring is undertaken using a manual staff gauge to measure the depth of flow at the flow monitoring location. The measured depth of flow is converted to a flow using a flow rating curve prepared specifically for the flow monitoring location that relates the depth of flow to a volumetric flow rate. The flow rating curve was developed based on Barracks Creek survey cross sections and modelling using the US Army Corp of Engineers Hydrologic Engineering Center River Analysis System (HEC-RAS) software.

Due to the dense vegetation along Barracks Creek, the downstream Barracks Creek surface water monitoring location is only safely accessible by walking from the Sediment Interception Pond (SIP) along the outer bed of Barracks Creek. As such, the surface water quality monitoring location is inaccessible during high or prolonged rainfall events when the depth of flow in Barracks Creek exceeds approximately 400 mm. Improved access to the water quality monitoring location would require removal of vegetation for the provision of an access track.

5.1.3.3 Upslope Catchment Inflows

As described in **Section 3.2.1** and **Section 6.0**, Holcim are planning to install a v-notch weir to monitor the volume of runoff from the two largest undisturbed upslope catchments entering the CRQ WMS. The v-notch weir will have a level sensor to record flow height above the weir which can then be converted to flow using appropriate calculations with respect to the weir design, refer to **Section 6.3**.

5.1.3.4 Operational Water Usage

The volume of water drawn from the Secondary Dam for operational water demands is monitored with a totalising flow meter.

5.1.3.5 Ecosystem Health of Local Watercourses

Annual ecosystem health monitoring will be undertaken in Barracks Creek and will include:

- monitoring at two sites downstream of the operation. One of these sites will be located immediately downstream from the SIP water quality monitoring site (refer to Figure 3.1)
- monitoring to assess stream health and ongoing change within stream habitats using visual observations and checklist approach
- preparation of a brief report of the monitoring outcomes, including an assessment of change over time.

5.2 Groundwater

Table 5.3 presents the ongoing groundwater monitoring program. As detailed in **Section 3.1.2** groundwater level trigger values will be developed based on the monitoring data collected as part of the ongoing groundwater monitoring program. Prior to the establishment of appropriate trigger values Holcim will visually monitor inflow seepage to the quarry pits, refer to **Section 7.2** which includes a groundwater Trigger Action Response Plan (TARP).

Table 5.3 Ongoing Groundwater Monitoring Program

Bore ID	Easting	Northing	Status	Geology	Water Level	Water Quality
MB01	702021	6081231	Proposed	Barrack Creek Adamellite (Leucogranite)	Quarterly	Quarterly
MB02	701148	6080455	Proposed	Colinton Volcanics (Rhyolitic tuff)	Quarterly	Quarterly
GW400534	702246	6080431	Unknown	Colinton Volcanics (Tuffaceous shale)	Quarterly[1]	Quarterly[1]
GW416130	702637	6080862	Unknown	Barrack Creek Adamellite (Leucogranite) - granite	Quarterly[1]	Quarterly[1]

Note:

1. Pending confirmation of bore condition and landholder access

Groundwater monitoring will be conducted in accordance with industry guidelines and will include keeping the following records:

- Date and time.
- Depth to groundwater from the top of casing.
- Field measurements of pH, electrical conductivity (EC) and temperature.
- Purge volumes and methodology.
- Groundwater quality observations (i.e. colour/odour etc).

The depth to groundwater should be recorded manually using an electronic dip-meter prior to purging the bore. Groundwater sampling should be conducted in accordance with industry guidelines to ensure a representative sample is collected. Quarterly monitoring will include analysis EC, pH and Total Dissolved Solids (TDS).

Prior to the establishment of groundwater level trigger values based on groundwater monitoring data, Holcim will continue to visually monitor inflow seepage to the quarry pits and should inflow rates show a significant increase the Unforeseen Groundwater Inflow Trigger Action Response Plan (TARP) (refer to **Table 7.2**) will be implemented. Further to this, Holcim will adopt an interim groundwater level trigger based on a two metre decline in groundwater level in any monitoring bore over a 12 month period as advised by SLR (2019). Groundwater level trigger values are set after 24 months of monitoring (refer to **Section 3.1.2.2**).

5.3 Effectiveness of Water Management System

The effectiveness of the CRQ WMS will be assessed and reported on in the Annual Review (refer to **Section 8.1)** based on the following:

- a review of receiving surface water quality results outside of trigger value range that can be attributed to CRQ operations (refer to **Table 3.1**)
- a review of discharges from LDP 1 outside of the limit conditions for EPL 1453 (refer to **Section 5.1.3.1**)
- a review of any instance of measured or modelled surface water take with respect to CRQs surface water take entitlements (refer to **Section 6.0**)
- whether the groundwater TARP in **Section 7.2** has been triggered.

6.0 Surface Water Licensing

CRQ is located within the catchments of Barracks Creek and Jerrabomberra Creek. Barracks Creek is a minor tributary of the Queanbeyan River which flows into the Molonglo River upstream of Lake Burley Griffin while Jerrabomberra Creek flows directly into Lake Burley Griffin. The Molonglo River which flows through Lake Burley Griffin in the ACT forms part of the broader Murrumbidgee River catchment area.

Water licensing in this catchment is governed by the *Water Management Act 2000* under the *Murrimbidgee Unregulated and Alluvial Water Sources Water Sharing Plan* (WSP) which commenced in 2012. The WSP is divided in four Extraction Management Units (EMUs); the Unregulated Billabong EMU, the Unregulated Murrumbidgee Above Burrinjuck Dam EMU, the Unregulated Murrumbidgee Below Burrinjuck Dam to Gogeldrie EMU and the Unregulated Murrumbidgee Gogeldrie to Weimby EMU. Further, the WSP is divided into 45 water sources, including six groundwater sources, corresponding to sub-catchment boundaries.

Barracks Creek is located in the Queanbeyan Water Source within the Unregulated Murrumbidgee above Burrinjuck Dam EMU. The headwaters of Barracks Creek are approximately 1.5 kilometres south of CRQ. CRQ operations intercept a significant area of the Barracks Creek catchment and therefore surface water licensing impacts must be considered and are within the following sections of this plan.

The headwaters of Jerrabomberra Creek lie to the west of CRQ pit. The approved western overburden emplacement area for CRQ lies within the headwaters of an un-named tributary of Jerrabomberra Creek. At present, and for the foreseeable future, the western overburden emplacement will not be used and therefore remain as undisturbed land. As such, there are no surface water licensing implications associated with CRQ for Jerrabomberra Creek.

6.1 Surface Water Licence

Holcim presently holds Water Access Licence (WAL) 33412 with a share component of 98 units in the Queanbeyan water source. The allowable water take associated with WAL 33412 is defined in the excerpt from the licence presented below. Based on the licence conditions presented below, CRQ are entitled to a water take of up to 294 ML in three consecutive water years assuming a 100% allocation for each unit share and no additional water is assigned or re-credited to the water account.

MW0004-00001	From 1 July 2013, the total volume of water taken in any three (3) consecutive water years under this access licence must not exceed a volume which is equal to the lesser of either: A. the sum of: i. water in the account from the available water determinations in those 3 consecutive water years, plus ii. water in the account carried over from the water year prior to those 3 consecutive water years, plus iii. any net amount of water assigned to or from this account under a water allocation assignment in those 3 consecutive water years, plus iv. any water re-credited by the Minister to the account in those 3 consecutive water years, or B. the sum of: i. the share component of this licence at the beginning of the first year in those 3 consecutive water years, plus ii. the share component of this licence at the beginning of the second year in those 3 consecutive water years, plus iii. the share component of this licence at the beginning of the third year in those 3 consecutive water years, plus iv. any net amount of water assigned to or from this account under a water allocation assignment in those 3 consecutive water years, plus v. any water re-credited by the Minister to the account in those 3 consecutive water years.

■ Extract from Water Access Licence 33412

6.2 Harvestable Rights Entitlement

Harvestable rights legislation entitles landholders to capture surface runoff being 10% of the average regional runoff from a catchment area equivalent to the size of the property without the water take being subject to licensing. Holcim's harvestable right based on a landholding of approximately 270 ha and an average annual regional runoff of 0.7 ML/ha/year (Water NSW, (https://www.waternsw.com.au/customer-service/water-licensing/basic-water-rights/harvestable-rights-dams/maximum-harvestable-right-calculator), 2019) is 19 ML/year.

6.3 Estimated Surface Water Take

At present CRQ does not measure undisturbed upslope catchment inflows to the WMS and as such the inflows need to be estimated based on a rainfall runoff model as was done for the Cooma Road Continued Operations project surface water assessment (Umwelt, 2012). As part of this WMP review and update, the estimated undisturbed upslope catchment inflows to CRQ have been revised. The calculations have been undertaken on the following basis:

- Runoff from undisturbed catchments is estimated using a daily time step AWBM developed in GoldSim and calibrated to an average annual runoff for the upslope catchment of 0.7 ML/ha/year (Water NSW (https://www.waternsw.com.au/customer-service/water-licensing/basic-water-rights/harvestable-rights-dams/maximum-harvestable-right-calculator), 2019).

- Daily rainfall data input to the AWBM was sourced from the Queanbeyan Bowling Club Bureau of Meteorology (BoM) Station (Station 070072). The period of data used was from 1 January 1900 to 31 December 2018 (119 years).

- Average monthly evaporation data input to the AWBM was sourced from the Canberra Airport BoM Station (Station 070014) for the period 1967 to 2010.
- It has been assumed that the properties with farm dams upslope of CRQ capture 10% of the average annual regional runoff each year (i.e. in the southern catchment).

The predicted 10th percentile, 50th percentile and 90th percentile Quarry surface water take (excludes harvestable rights entitlement) are presented in **Table 6.1**.

Table 6.1 Statistical Quarry Surface Water Take

Statistic	Annual Surface Water Take (ML)	3 Year Surface Water Take (ML)
10th Percentile	16.5	133.7
50th Percentile	76.5	256.8
90th Percentile	212.1	589.2

Rainfall runoff modelling results (refer to **Table 6.1**) indicate in a median three year period of runoff CRQ should not need to return water to Barracks Creek to comply with the water take limits specified in WAL 33412. However, during periods of higher runoff Holcim will need to return water captured in CRQ WMS via LDP 1 (refer to **Section 2.5** and **Figure 3.1**) to Barracks Creek to ensure compliance with the WAL.

The estimated annual and three year volumes of surface water take (excluding harvestable rights entitlement) entering CRQ WMS from the 2012/2013 to 2017/2018 water years are presented in **Table 6.2**. The NSW Water Register indicates that available water determinations for this period were 100% per unit.

Table 6.2 Recent Quarry Surface Water Take

Year	Annual Surface Water Take (ML)	3 Year Surface Water Take (ML)	3 Yearly WAL Entitlement (ML)
2012/2013	70.0	-	
2013/2014	121.8	-	
2014/2015	88.6	280.5	298
2016/2017	96.8	307.2	298
2017/2018	100.6	286.0	298

Rainfall runoff modelling results (refer to **Table 6.2**) indicate that CRQ may have exceeded the allowable surface water take for the consecutive three year period from water year 2013/2014 to water year 2016/2017. The possible exceedance was due to high runoff in water year 2013/2014. While this water year did not have particularly high rainfall (625 mm) there were a few high rainfall events that generated large volumes of runoff. Water take for this three year period was estimated to be 307 ML, approximately 13 ML in excess of the WAL entitlement (298 ML).

Holcim are presently in the planning process to install a v-notch weir at the point where the eastern catchment runoff enters the CRQ pit (refer to **Figure 3.3**). Holcim considered installing another v-notch weir in the spillway of the Southern Dam, however, the majority of inflows to the pit from the Southern Dam seep through the rock face rather than overflowing via the spillway (refer to **Section 3.2.1**). The eastern catchment v-notch weir will provide measurements of the inflow to the WMS and assist in further

calibration of the AWBM for rainfall runoff response that can be used to model inflows from the catchments not gauged by the v-notch weir. Holcim will install the v-notch weir by April 2020.

Given the constraints associated with diverting runoff from upslope undisturbed catchments around CRQ (refer to **Section 3.2.1**), Holcim will develop a strategy to further refine management of captured runoff with respect to surface water take entitlements. This strategy will be developed in consultation with DoI Water to return appropriate volumes of captured runoff to Barracks Creek via LDP 1 (refer to **Section 2.5** and **Figure 3.1**). This strategy may incorporate short to medium term predictive water balance modelling to estimate suitable discharge volumes that manage risk of exceeding CRQ's surface water take entitlement as well as managing the risk associated with meeting operational water demand deficits. As CRQ's water demands (refer to **Section 4.0**) are below their total surface water take entitlement (WAL and harvestable right), it should be feasible to manage water inventories to maintain operational water security and comply with surface water take limits.

7.0 Trigger Action Response Plans

Section 7.1 contains a Trigger Action Response Plans (TARP) related to surface water monitoring results that are observed to be outside of the normal range. **Section 7.2** contains groundwater TARPs relating for unforeseen groundwater inflows, an interim groundwater level trigger based on a two metre decline in groundwater level in any monitoring bore over a 12 month period (refer to **Section 5.2**) and groundwater quality. The final groundwater level TARP will be developed once groundwater level trigger values are set after 24 months of monitoring (refer to **Section 3.1.2.2**).

The procedures to be implemented in response to a water pollution incident are outlined in the CRQ Pollution Incident Response Management Plan (PIRMP). Incident reporting requirements related to exceedances of criteria contained within the CRD DC are also discussed in **Section 8.2**.

7.1 Surface Water Quality TARP

Table 7.1 Receiving Water Quality TARP

Observation	Strategy for Mitigation	Monitoring	Monitoring Action	Response
Up to two consecutive monthly Barracks Creek water quality results outside of trigger values range in Table 5.2	Water management strategy minimises the likelihood of uncontrolled off-site discharges.	Barracks Creek Downstream	Repeat water quality sampling and analysis as required to confirm result and continue monitoring on a monthly basis.	**Results considered to have the potential for Material Harm** • If the water quality result is considered to have the potential to cause material immediately notify the EPA, DPIE, DoI Water and any potentially impacted land owners of the result. **Results not considered to have the potential for Material Harm** • If the water was not discharging (either controlled discharges or spills from site water storages) from the Quarry WMS preceding or around the time of water quality monitoring, the water quality result will be recorded and discussed in the Annual review, however, DPIE will not be notified at the time. • If it is known that water was discharged (either controlled discharges or spills from site water storages) from the Quarry WMS preceding or around the time of water quality monitoring in Barracks Creek will notify DPIE of the result. However, it is noted that elevated results above WMP trigger levels will not necessarily be considered a non-compliance in accordance with the conditions of the DC. **Investigation** • Compare water quality monitoring result with historical data to confirm whether it is within the historically measured range. If the result is within the historically measured range no further investigation will be undertaken. If the result is outside of the historically measured range, investigate potential contributing factors including but not limited to: o Erroneous laboratory result o Climatic conditions o Changes in quarry operating practices o Assess the SIP Dam for excessive seepage o Discharges from LDP outside of EPL limit conditions • If subsequent month's water sample is within range of trigger values no further investigation is required.

Observation	Strategy for Mitigation	Monitoring	Monitoring Action	Response

Three consecutive monthly water quality results outside of the trigger value range in Table 5.2	Water management strategy minimises the likelihood of uncontrolled off-site discharges.	Barracks Creek Downstream	Maintain monthly monitoring until:
			• cause is identified; or
			• water quality results are confirmed not to be a result of quarry operations; or
			• water quality results return to within the trigger value range.
				• Investigate potential contributing factors including but not limited to:
				  ○ Climatic conditions
				  ○ Changes in quarry operating practices
				  ○ Sample and analyse water quality in Barracks Creek upslope of CRQ.
				  ○ Assess the SIP Dam for excessive seepage
				  ○ Discharges from LDP outside of EPL limit conditions
				• Engage a water quality specialist (if required) to undertake a preliminary investigation.
				• If the investigation determines that the contributing factors are not as a result of CRQ operations, then the issue will be reported in the Annual Review only.
				• If the deviation of receiving water quality is found to be a result of CRQ operations take actions agreed in consultation with the EPA, DPIE and DoI Water to mitigate the CRQ impacts on receiving water quality. Such actions are likely to include:
				  ○ Transferring water from any water storages contributing to the deviation in water quality to another storage
				  ○ Implementing water treatment measures to treat site water
				• Undertake remediation of the impacted receiving environment to the satisfaction of the EPA, DPIE and DoI Water.

7.2 Groundwater TARPs

Table 7.2 Unforeseen Groundwater Inflow TARP

Observation	Strategy for Mitigation	Monitoring	Monitoring Action	Response
Seepage inflow to quarry pits is observed.	Previous study (Coffee Geotechnics, 2012) indicates that fractured rock system is not considered a productive aquifer and groundwater inflows are negligible.	Daily visual monitoring of pit faces for seepage.	If seepage is observed, continue daily monitoring.	Investigate potential contributing factors: • Climatic conditions, e.g. is seepage a result of surface water recharge. • Estimate the inflow rate if possible (e.g. direct inflow to a sump and measuring time to fill or time to discharge with a pump of known flow rate). • Engage a groundwater specialist to undertake a preliminary investigation if required. If groundwater inflow is confirmed, immediately notify DPIE and DoI Water. Should the groundwater inflow persist, obtain the required licences and approvals with sufficient shares in the water source (the Lachlan Fold Belt water source within the Murray Darling Basin Fractured Rock Groundwater Sources) to account for the groundwater inflow.

Table 7.3 Interim Groundwater Level Decline TARP

Observation	Strategy for Mitigation	Monitoring	Monitoring Action	Response
Groundwater level in one or more monitoring bores has declined by 2 m or more over a period of 12 months or less.	Previous study (Coffee Geotechnics, 2012) indicates that fractured rock system is not considered a productive aquifer and groundwater inflows are negligible.	Quarterly level monitoring		Engage a groundwater specialist to undertake an investigation into the groundwater level decline and assess potential causes including climatic conditions and Quarry drawdown impacts. If the investigation determines that the contributing factors are not as a result of CRQ operations the groundwater quality results will be reported in the Annual Review only and will contribute to the understanding of the natural groundwater level variation. If the decline in groundwater quality is found to be a result of CRQ operations immediately notify DPIE and DoI Water and take actions agreed in consultation with the DPIE and DoI Water to mitigate the CRQ impacts on the groundwater source. If required, obtain the required licences and approvals with sufficient shares in the water source (the Lachlan Fold Belt water source within the Murray Darling Basin Fractured Rock Groundwater Sources) to account for any identified groundwater take.

Table 7.4 Interim Groundwater Quality TARP

Observation	Strategy for Mitigation	Monitoring	Monitoring Action	Response

Quarterly groundwater quality in monitoring bore result outside of interim trigger value range in Table 3.6	The Quarry site is in a tight rock formation where surface and groundwater connectivity is limited. Therefore the likelihood of measurable impacts on groundwater associated with Quarry operations is considered low.	Quarterly monitoring of groundwater monitoring bores as per **Section 5.2**	Resample monitoring bore(s) with result(s) outside of trigger value range or previously recorded values.	**Results considered to have the potential for Material Harm**
				• If the original or resample water quality result is considered to have the potential to cause material immediately notify the EPA, DPIE, DoI Water and any potentially impacted land owners of the result.
				Results not considered to have the potential for Material Harm
				• If the resample result is consistent with original result investigate potential contributing factors:
				  ○ Undertake water quality monitoring of the Dacite Pit Sump, the Granite Hole and SIP for the parameters in **Table 3.6** to assess potential surface water impacts
				  ○ Climatic conditions
				• Engage a groundwater quality specialist (if required) to undertake a preliminary investigation
				• If the investigation determines that the contributing factors are not as a result of CRQ operations the groundwater quality result will be reported in the Annual Review only and will contribute to the understanding of the natural groundwater quality range and the development of groundwater quality trigger values.
				• If the deviation of groundwater quality is found to be a result of CRQ operations take actions agreed in consultation with the EPA, DPIE and DoI Water to mitigate the CRQ impacts on receiving water quality. Such actions are likely to include:
				  ○ Transferring water from any water storages contributing to the deviation in water quality to another storage
				  ○ Implementing water treatment measures to treat site water
				• Undertake remediation of the impacted receiving environment to the satisfaction of the EPA, DPIE and DoI Water.

7.3 Unforeseen Impacts Protocol

In the event of unforeseen impacts associated with surface water or groundwater, the following protocol will be implemented:

- conduct a preliminary review of the nature of the impact, including:
    - any relevant monitoring data
    - current quarry activities and land use practices
- commission an investigation into the impact to confirm cause and consider relevant options for amelioration of impact(s) as appropriate
- prepare an action plan in consultation with the appropriate regulatory agency
- mitigate causal factors where possible
- implement additional monitoring as necessary to measure the effectiveness of the controls implemented.

The outcomes of the investigations into any unforeseen impacts and the controls/remediation actions implemented will be undertaken in consultation with DPIE, the EPA and DoI Water and will be reported in the Annual Review (refer to **Section 8.1**).

8.0 Reporting

8.1 Annual Review

A summary of surface monitoring results will be provided in the CRQ Annual Review. The following information will be reported in the Annual Review in accordance with Condition 4 of Schedule 5 of the DC.

By the end of March each year, the applicant (Holcim) shall review of the environmental performance of the development to the satisfaction of the Secretary. This review must:

- *describe the development (including any rehabilitation) carried out in the past calendar year, and the development that is proposed to be carried out over the current calendar year;*
- *include a comprehensive review of the monitoring results and complaints records of the development over the past calendar year, which includes a comparison of these results against the:*
    - *relevant statutory requirements, limits or performance measures/criteria;*
    - *monitoring results of previous years; and*
    - *relevant predictions in the EIS;*
- *identify any non-compliance over the past calendar year, and describe what actions were (or are being) taken to ensure compliance;*
- *identify any trends in the monitoring data over the life of the development;*
- *identify any discrepancies between the predicted and actual impacts of the development, and analyse the potential cause of any significant discrepancies; and*
- *describe what measures will be implemented over the current calendar year to improve the environmental performance of the development.*

In addition, in accordance with *Protection of the Environment Legislation Amendment Act 2011* (Amendment Act) and Condition 11 of Schedule 5 of the Development Consent, Holcim will also publish surface and groundwater monitoring results on the Holcim website (http://www.holcim.com.au).

Performance monitoring, which includes an assessment of the effectiveness of surface and ground water monitoring and compliance with the relevant Development Consent and EPL conditions, may also be discussed at Community Consultative Committee (CCC) meetings.

8.2 Incident and Non-Compliance Notifications

8.2.1 Incidents

An incident is defined by DPIE as an occurrence or set of circumstances that causes or threatens to cause material harm and which may or may not be or cause a non-compliance. Where an incident relating to surface water or groundwater management has occurred Holcim will immediately notify the Department and any other relevant agencies immediately after it becomes aware of an incident. The notification will be in writing to compliance@planning.nsw.gov.au and identify the development (including the development. application number – **SSD_5109** and name – **Cooma Road Quarry Continued Operations Project**) and set out the location and nature of the incident.

8.2.2 Non-Compliance

Within seven days of becoming aware of a non-compliance, the Holcim will notify DPIE of the non-compliance. The notification will be in writing to compliance@planning.nsw.gov.au and identify the development (including the development. application number – **SSD_5109** and name – **Cooma Road Quarry Continued Operations Project**), set out the condition of this consent that the development is non-compliant with, the way in which it does not comply and the reasons for the non-compliance (if known) and what actions have been, or will be, undertaken to address the non-compliance.

Where a non-compliance has been notified as an incident there is no need to also provide a non-compliance notification.

8.2.3 Complaint Response

Complaints relating to surface water or groundwater at CRQ will be managed in accordance with the process detailed within the CRQ Environmental Management Strategy.

9.0 Implementation and Review

Ongoing monitoring and review on the performance and implementation of this WMP will be undertaken in accordance with CRQ Environmental Management Strategy.

In accordance with Condition 4 of Schedule 5, Holcim shall review, and if necessary revise, the strategies, plans, and programs required under DC to the satisfaction of the Secretary, within three months of the submission of:

(a) an incident report under condition 7 of Schedule 5 of the DC

(b) an annual review under condition 9 of Schedule 5 of the DC

(c) an audit report under condition 10 of Schedule 5 of the DC

(d) any modifications to this DC.

Holcim will review, and if necessary revise, the strategies, plans, and programs required under this approval to the satisfaction of the Secretary. The review will if necessary trigger revisions and a resubmission to DPIE. A copy of the revised WMP will be supplied to the EPA and DoI Water for their review and then to DPIE. The WMP will reflect changes in environmental requirements, technology and operational procedures. Updated versions of the approved WMP will be made publicly available on the Holcim website (www.holcim.com.au).

9.1 Adaptive Management

Holcim implements a continuous improvement framework across its operations. Where a non-compliance relating to surface water or groundwater has occurred, Holcim will, to the satisfaction of the Secretary:

- take all reasonable and feasible measures to ensure the exceedance ceases and does not recur
- consider all reasonable and feasible options for remediation (where relevant) and submit a report to the DPIE describing those options and any preferred remediation measures or other course of action
- implement remediation measures as directed by the Secretary.

10.0 Accountabilities

Relevant roles and responsibilities associated with this WMP are presented in **Table 10.1**.

Table 10.1 Roles and Responsibilities

Role	Accountabilities for this document
Holcim Regional Manager	• Approve appropriate resources for the effective implementation of this Plan. • Authorise internal and external reporting requirements of this Plan.
Cooma Road Quarry Manager	• Provide that sufficient resources are allocated for the implementation of this Plan. • Ensure inspections and monitoring are undertaken in accordance with the requirements of the Plan. • Coordinate the implementation of water management controls and strategies in accordance with this Plan. • Coordinate the surface water and groundwater monitoring requirements of this Plan, and evaluate and report monitoring results as required. • Coordinate water related incident investigations and reporting as required by legislation and internal standards and guidelines. • Coordinate the review of this Plan in accordance with the requirements of the Development Consent.
Holcim Environmental Personnel	• Assist with water related incident investigations and reporting as required by legislation and internal standards and guidelines. • Assist in the review of this Plan.
All employees and contractors	• Comply with all requirements of this Plan. • Report all potential environmental incidents to their supervisor immediately. • Seek approval from the Cooma Road Quarry Manager prior to making changes to the water management system.

11.0 References

ANZECC guidelines (ANZECC 2000). Australian and New Zealand guidelines for fresh and marine water quality: Volume 1 – The guidelines.

Coffey Geotechnics 2012. *Groundwater Assessment Cooma Road Quarry*. Prepared on behalf of Holcim (Australia).

DEC 2004. Approved Methods for the Sampling and Analysis of Water Pollutants in NSW. DECC 2008. Managing Urban Stormwater: Soils and Construction Volume 1 and Volumes 2A, 2C, 2D and 2E (the Blue Book).

Institution of Engineers 1987. Australian Rainfall & Runoff (AR&R) – Time of concentration for storm event and Mannings Equation for flow rate.

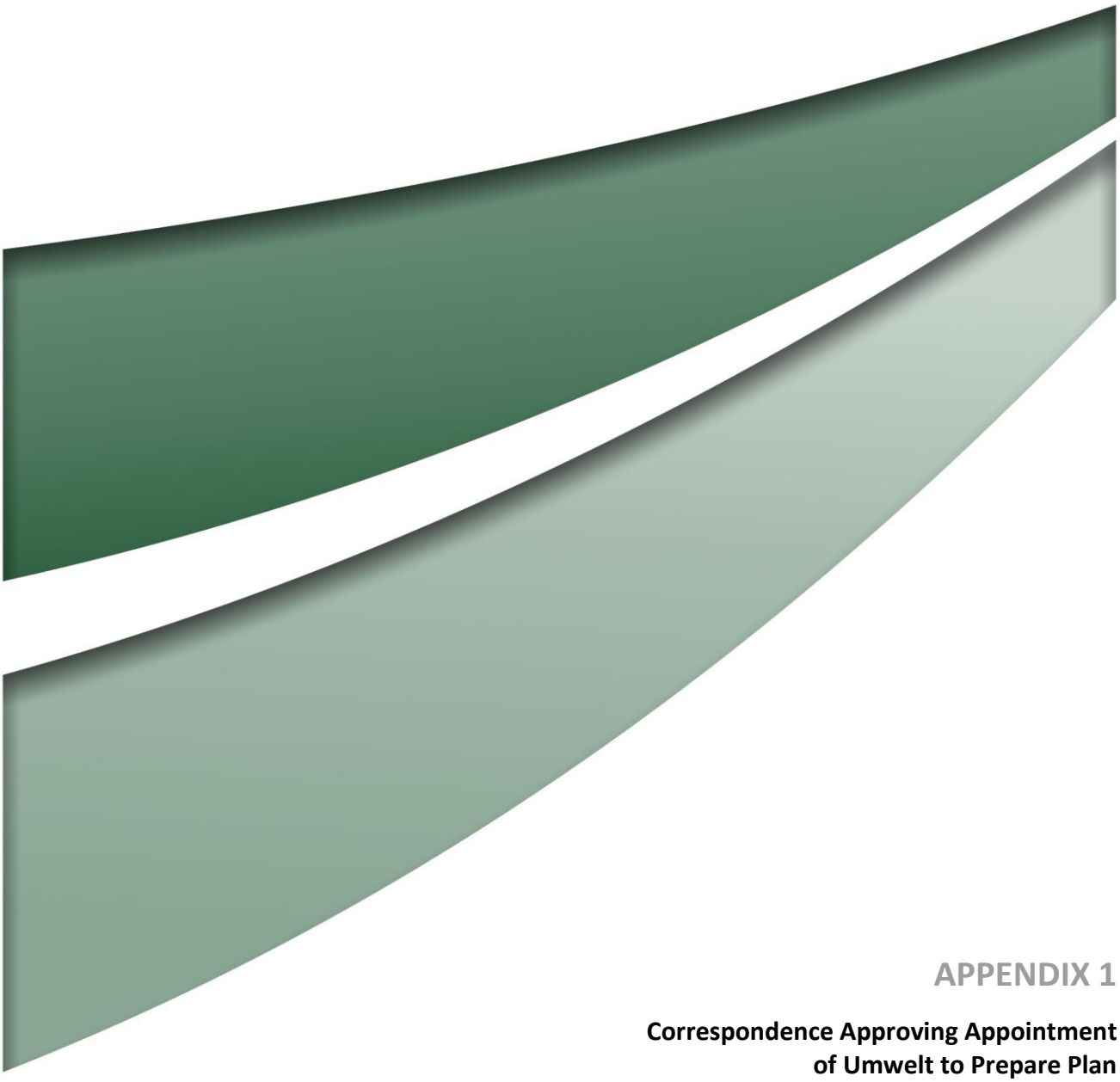
Landcom 2004 and DECC 2005. Landcom – Blue Book (Managing Urban Stormwater: Volumes 1 and 2.

Standards Australia, AS/NZS 5667.1:1998 *Water Quality – Sampling – Guidance on the Design of Sampling Programs, Sampling Techniques and the Preservation and Handling of Samples*.

Standards Australia, AS/NZS 5667.10:1998 *Water Quality – Sampling – Guidance on Sampling of Waste Waters.*

Umwelt 2012. *Cooma Road Quarry Continued Operations Project Environmental Impact Statement*. Prepared for Holcim (Australia) Pty Limited.

SLR Consulting 2019, *Cooma Road Quarry Water Management Plan Groundwater Works*



APPENDIX 1

Correspondence Approving Appointment of Umwelt to Prepare Plan

Planning Services
Resource Assessments
Contact: Andrew Rode
Phone: (02) 8289 6744
Email: andrew.rode@planning.nsw.gov.au

Mr Luke Edminson
Planning and Environment Manager NSW
Holcim (Australia) Pty Ltd
Level 8 Tower B - 799 Pacific Highway
CHATSWOOD NSW 2067

By email: luke.edminson@lafargeholcim.com

Dear Mr Edminson,

Cooma Road Quarry (SSD 5109)
Water Management Plan - Appointment of Suitably Qualified Expert

I refer to your letter dated 15 March 2019, seeking the Planning Secretary's approval of a suitably qualified expert to prepare the Water Management Plan as required under condition 20 of Schedule 3 of the development consent for the Cooma Road Quarry project.

The Department has reviewed the CV of Mr Chris Bonomini of Umwelt (Australia) Pty Ltd and is satisfied that he is suitably qualified and experienced.

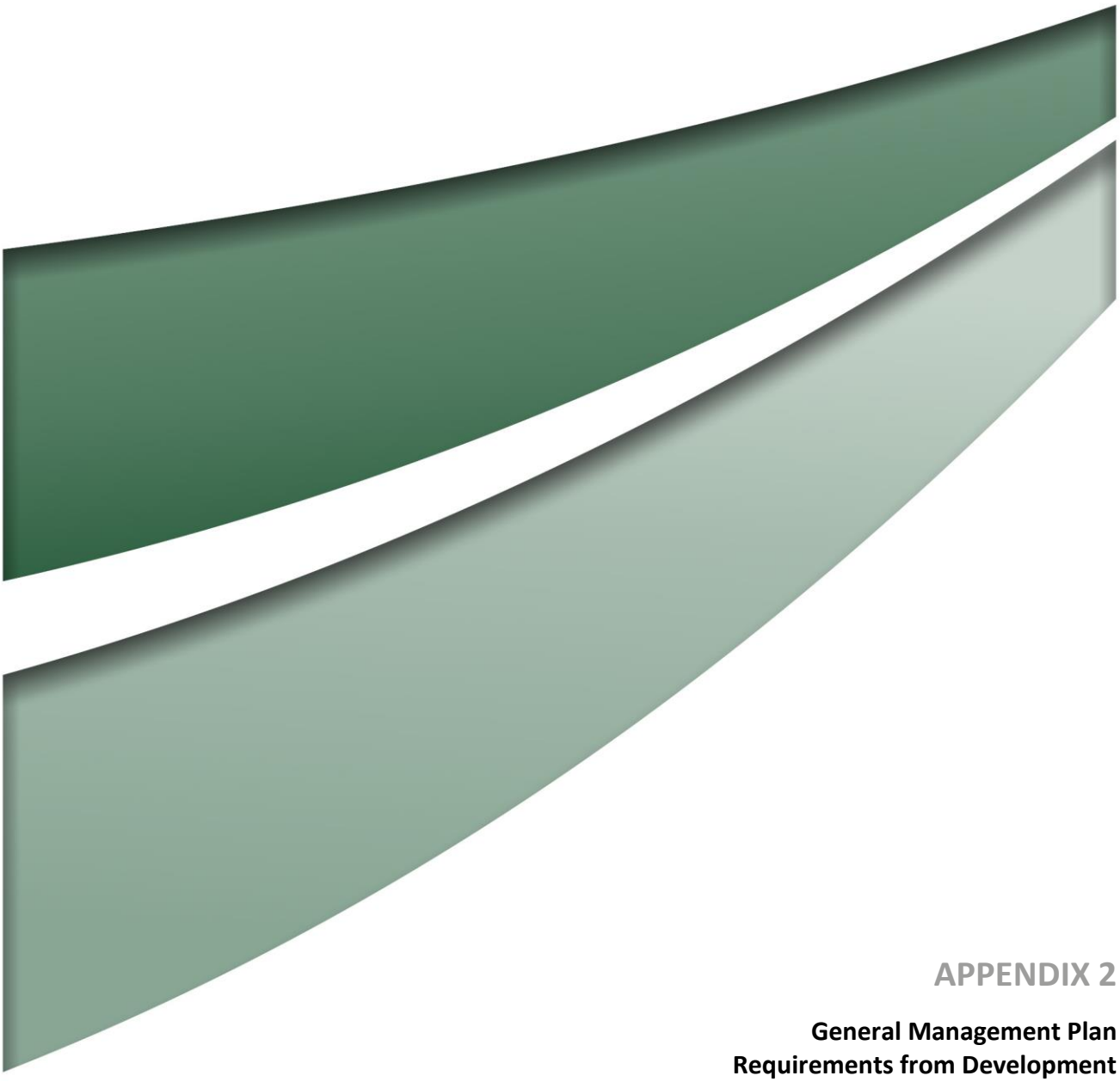
In accordance with condition 20 of Schedule 3, the Secretary approves the appointment of Mr Bonomini to prepare the Water Management Plan.

If you have any enquiries in relation to this matter, please contact Andrew Rode on the details above.

Yours sincerely,

Howard Reed

Howard Reed 25.3.19
Director
Resource Assessments
As nominee of the Secretary

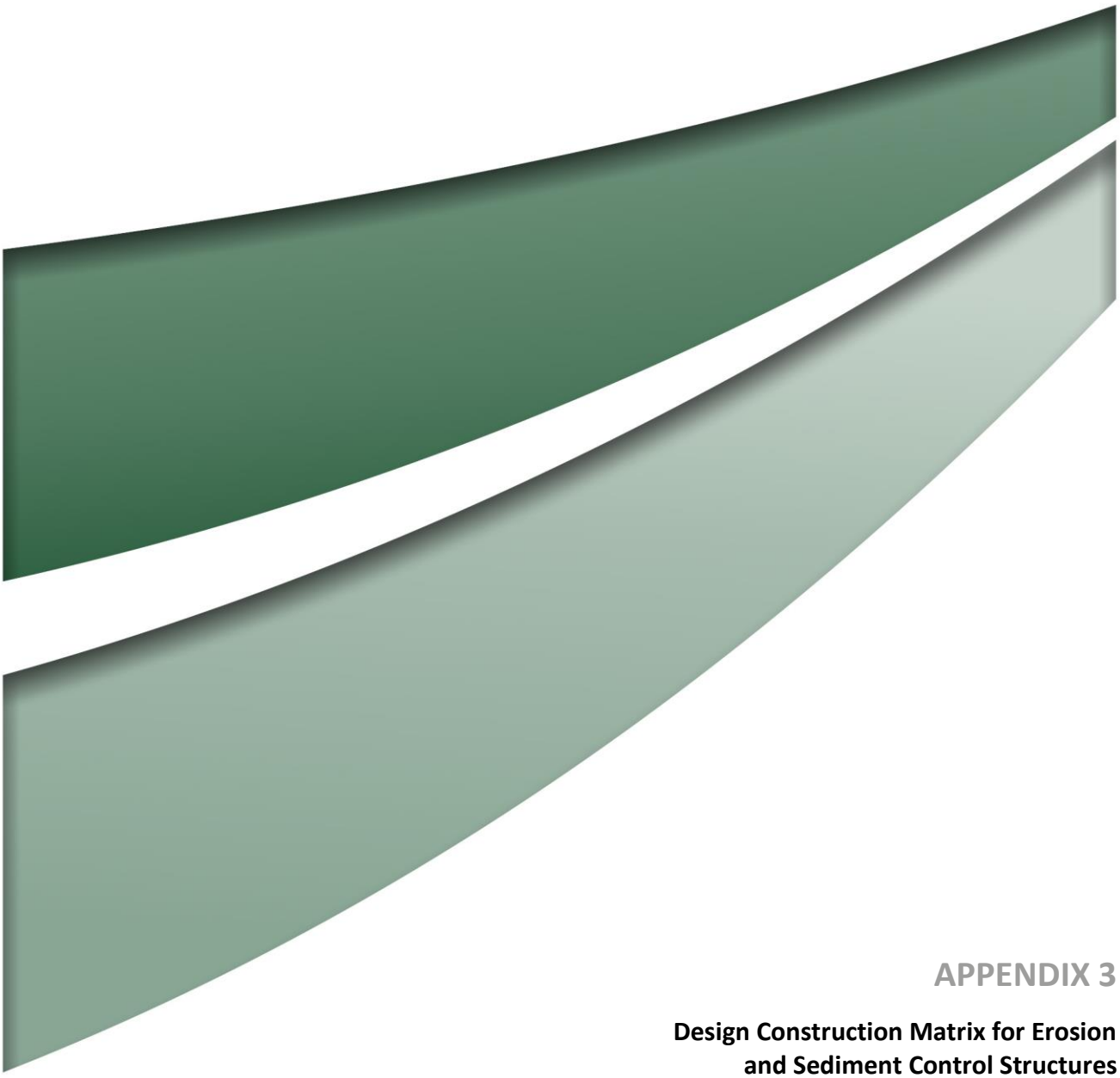


APPENDIX 2

General Management Plan
Requirements from Development Consent

General Management Plan Requirements from Development Consent

Schedule 5	
Management Plan Requirements 1. The Proponent shall ensure that the management plans required under this approval are prepared in accordance with any relevant guidelines, and include:	
a) detailed baseline data	3.0
b) a description of: • the relevant statutory requirements (including any relevant approval, licence or lease conditions); • any relevant limits or performance measures/criteria; and • the specific performance indicators that are proposed to be used to judge the performance of, or guide the implementation of, the project or any management measures;	2.0 2.0 5.3
c) a description of the measures that would be implemented to comply with the relevant statutory requirements, limits, or performance measures/criteria;	3.0, 4.0
d) a program to monitor and report on the: • impacts and environmental performance of the project; and • effectiveness of any management measures (see (c) above);	5.0, 8.0
e) a contingency plan to manage any unpredicted impacts and their consequences and to ensure that ongoing impacts reduce to levels below relevant impact assessment criteria as quickly as possible;	7.0
f) a program to investigate and implement ways to improve the environmental performance of the project over time;	5.1.3
g) a protocol for managing and reporting any: • incidents; • complaints; • non-compliances with conditions of this approval and statutory requirements; and • exceedances of the impact assessment criteria and/or performance criteria;	8.2 8.3 7.0 and 8.2 8.2
h) a protocol for periodic review of the plan.	9.0



APPENDIX 3

Design Construction Matrix for Erosion and Sediment Control Structures

Design Construction Matrix for Erosion and Sediment Control Structures

The following matrix provides design details for the construction of erosion and sediment control structures outlined in the Cooma Road Quarry Water Management Plan.

Table 1 – Drain Design Criteria

Drain Type	Location	ARI Storm Event	Storm Duration	Freeboard	Typical Grade	Side Batters	Comments
Diversion[2]	Entire site	20 year	Time of concentration[1]	Minimum of 0.5 metre	0.5% to 1.0%	No steeper than 1:2 (v:h)	Where velocity >1.5 m/s in 20 year ARI storm event place rock bars every 100 metres to reduce scour potential. All drains to be vegetated and/or rock lined. Level spreaders to be located at ends of all drains.
Catch[2]	Entire site	20 year	Time of concentration[1]	Minimum of 0.5 metre	0.5% to 1.0%	No steeper than 1:2 (v:h)	Where velocity >1.5 m/s place rock bars every 100 metres to reduce scour potential. Level spreaders to be located at ends of all drains.

Note 1: To be determined based on methods outlined in Australian Rainfall & Runoff (AR&R) (Institution of Engineers 1987) – Time of concentration for storm event and Mannings Equation for flow rate.

Note 2: For permanent drains that are to be in place for greater than 3 months.

Table 2 – Sediment Dam Design Criteria

Location	Soil Type	Method	Sediment Zone 1	Runoff Coefficient	Freeboard	Treatment and Pump Out	
						Overflow Pathway	**Requirement[2]**
Disturbed areas	Dispersive	Blue Book[4] Type D (dispersive) for 5 day Blue Book rainfall event	Sediment zone = 50% of settling zone	Runoff coefficient (C_v) = 0.9 (hardstand) Runoff coefficient (other areas) = 0.79	Design for minimum of 1 metre	Quarry Water Management System	Ability to pump out in 5 days and sufficient downstream volume to contain spills.
						Downstream creek systems	Ability to treat and pump out full dam volume in 5 days.
	Non-dispersive	Blue Book[4] Type F (fine) for 5 day Blue Book rainfall event	Sediment zone = 50% of settling zone	Runoff coefficient (C_v) = 0.9 (hardstand) Runoff coefficient (other areas) = 0.79	Design for minimum of 1 metre	Quarry Water Management System	Ability to pump out in 5 days and sufficient downstream volume to contain spills.
						Downstream creek systems	Ability to treat and pump out full dam volume in 5 days.

Note 1: Total dam volume = Settling Zone + Sediment Zone (Blue Book – Landcom 2004).

Note 2: Treat suitable for discharge or pump out to mine water management system dams – refer to Site Water Management Plan.

Note 3: To be determined based on methods outlined in Australian Rainfall & Runoff (AR&R) (Institution of Engineers 1987) – Time of concentration for storm event. Note 4: Managing Urban Stormwater: Soils and Construction (the Blue Book) – Volume 1 (Landcom 2004) and Volume 2E (DECC 2008).

Note: Percentile rainfall should be selected based on site specific risk profile (refer to Table 6.2 Volume 2E (DECC 2008).

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