

# Lynwood Quarry Water Management Plan

**November 2020**

PA2.1.003.N.LYN R3

## Contents

<b>1. Introduction</b>	<b>4</b>
1.1 Background	4
1.2 Overview of the Project	4
1.2.1 Overview of the Water Management Plan	4
1.3 Purpose and Scope	4
1.4 Objectives	4
<b>2. Stakeholder Consultation</b>	<b>7</b>
2.1 Pre 2020 Consultation	7
2.2 2020 Consultation	7
<b>3. Statutory Requirements</b>	<b>8</b>
3.1 Legislation	8
3.2 Guidelines and Standards	8
3.3 Development Consent Requirements	8
<b>4. Overview of Lynwood Quarry Water Management System</b>	<b>12</b>
<b>5. Site Water Balance</b>	<b>14</b>
5.1 Water Demands	14
5.2 Water Supply and Storage	14
5.3 Site Water Balance	14
5.4 External Water Sourcing	15
5.4.1 External Water Supply – Water Licence Allocation	15
5.4.2 Supernatant from Marulan Water Treatment Plant	15
5.5 Water Minimisation	16
<b>6. Erosion and Sediment Control Plan</b>	<b>17</b>
6.1 Infrastructure and Emplacement Areas	22
6.1.1 Catch Drains	22
6.1.2 Dams	23
6.1.3 Water Treatment Facility	24
<b>7. Site Water Quality</b>	<b>28</b>
<b>8. Surface water and Groundwater Response Plan</b>	<b>29</b>
8.1 Adaptive Management	29
<b>9. Monitoring and Maintenance Requirements</b>	<b>32</b>
9.1 Operational Phase Works	32
9.2 Decommissioning	32
9.3 Water Monitoring	32

<b>10. Reporting and Review</b> .....	<b>34</b>
10.1 Evaluation of Monitoring .....	34
10.2 External Reporting – Annual Review.....	34
10.3 Community Complaints and Independent Review .....	35
10.4 Training .....	35
<b>11. Review and Improvement</b> .....	<b>36</b>
<b>12. Roles and Responsibilities</b> .....	<b>37</b>
<b>13. References</b> .....	<b>38</b>
<b>14. Change Information</b> .....	<b>39</b>

**Tables**

Table 1	Agency Consultation	7
Table 2	Development Consent Conditions (DA 128-5-2005)	8
Table 3	Lynwood Quarry Gross Water Balance (ML/year) with the Lynwood Quarry at 5 Mtpa	15
Table 4	Summary of Key Water Management and Erosion and Sediment Controls	18
Table 5	Existing Site Dams	23
Table 6	Yet to be constructed dams	24
Table 7	Trigger Action Response Plan – Erosion and Sediment Control / Water Management	30
Table 8	Reporting and Exceedances	34
Table 9	Roles and Responsibilities	37
Table 10	Summary of Document Changes	39

**Figures**

Figure 1	Overview of the Modification Project.....	6
Figure 2	Conceptual Water Management System .....	13
Figure 3	Conceptual Water Management System – Stage 1 .....	25
Figure 4	Conceptual Water Management System – Stage 3.....	26
Figure 5	Conceptual Water Management System – Stage 6.....	27
Figure 6	Environmental Monitoring .....	33

**Appendices**

- Appendix 1 - Water Management Design Specifications
- Appendix 2 - Surface Water Monitoring Program
- Appendix 3 - Groundwater Monitoring Program
- Appendix 4 - Agency Consultation

# 1. Introduction

## 1.1 Background

Holcim (Australia) Pty Lid (Holcim) was granted development consent in December 2005 (DA 128-5-2005) (Development Consent) by the then NSW Minister for Planning for the construction and operation of a hard rock quarry known as Lynwood Quarry west of Marulan in the Southern Tablelands region of NSW (refer to **Figure 1**). Holcim has approval to carry out quarrying operations until 1 January 2038 and will include operations in the catchments of Joarimin, Lockyersleigh and Marulan Creeks, all of which form part of the Sydney Drinking Water Catchment. There have been 5 modifications approved to the Development Consent since 2005.

## 1.2 Overview of the Project

The location and extent of the quarry pit at the completion of approved operations is shown on **Figure 1**, including the locations of overburden and excess product emplacement areas and project infrastructure.

The quarry has existing Development Consent approval to produce up to 5 million tonnes per annum (Mtpa) of saleable quarry product until 2038. Some of the material extracted as part of the quarrying process is not suitable for processing and sale, consequently emplacement areas are required. The locations of these emplacement areas are shown on **Figure 1**.

### 1.2.1 Overview of the Water Management Plan

This Water Management Plan provides a framework for the management of water on site. The plan details the following:

- Overview of site water management strategy (refer to **Section 2.0**)
- Site water balance (refer to **Section 5**)
- Erosion and sediment controls (refer to **Section 6**)
- Site water quality (refer to **Section 7**)
- Surface water monitoring program (refer to **Appendix 2**)
- Groundwater monitoring program (refer to **Appendix 3**)
- Surface and groundwater response plan (refer to **Section 8**).

## 1.3 Purpose and Scope

This Water Management Plan outlines the water monitoring and management to be undertaken at Lynwood Quarry. The program addresses the requirements contained in Lynwood Quarry's modified Development Consent (DA-128-5-2005) and the Lynwood Quarry Environment Protection Licence (EPL) no. 12939.

This management plan has been reviewed in January 2020 with details of changes outlined in **Section 14**.

## 1.4 Objectives

The key objective of the WMP is to ensure that impacts on soil and water quality during operations are minimised and within the scope permitted by the development consent.

To achieve this objective, Holcim will undertake the following:

- Ensure feasible and reasonable controls and procedures are implemented during operational activities to maximise water use efficiency and avoid or minimise potential erosion and sedimentation;
- Ensure appropriate measures are implemented to address the relevant Development Consent conditions outlined in **Table 1**; and
- Ensure appropriate measures are implemented to comply with all relevant legislation and other requirements as described in **Section 3** of this SWMP.

The following targets have been established for the water management during the operational lifetime of Lynwood Quarry:

- Ensure full compliance with the relevant legislative requirements and Development Consent;
- Meet Environment Protection Licence (EPL) water quality discharge parameters for all planned discharges; and
- Ensure training on soil and water management is provided to all relevant personnel through site inductions.

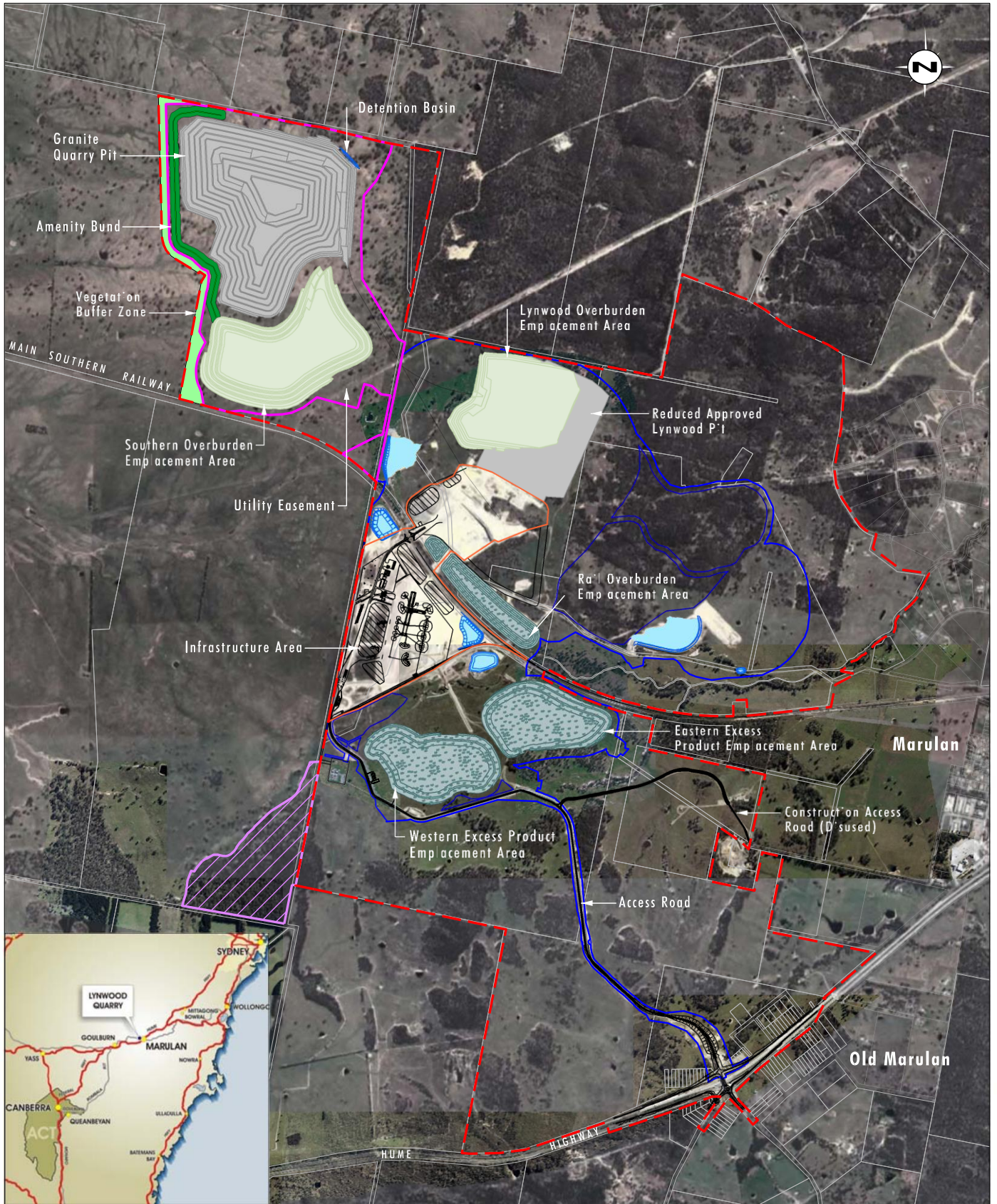


Image Source: Google Earth (2012), Holcim (2012, 2014)  
 Data Source: LPI (2014), Holcim Australia (2015)

0 0.5 1.0 1.5 km  
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Figure supplied by Umwelt Pty Ltd

**Legend**

- |                                   |                             |           |
|-----------------------------------|-----------------------------|-----------|
| Approved Project Area             | Quarry Pit                  | Haul Road |
| Lynwood Infrastructure Area       | Emplacement Area            |           |
| Approved Disturbance Footprint    | Dam                         |           |
| Granite Pit Disturbance Footprint | Overburden Emplacement Area |           |
| Lynwood Infrastructure Layout     | Vegetation Buffer Zone      |           |
| Habitat Management Area           | Amenity Bund                |           |

**FIGURE 1**  
**Lynwood Quarry**

## 2. Stakeholder Consultation

### 2.1 Pre 2020 Consultation

In accordance with Schedule 3 Condition 20 of the Development Consent, the 2020 WMP was prepared in consultation with the Environment Protection Authority (EPA), Water NSW, Dol Water and DPI Fisheries. A copy of this plan has been provided to these agencies for comment. Relevant recommendations from these agencies have been incorporated prior to the plan being submitted to the secretary of DPI&E.

A summary of the consultation undertaken is included in **Table 1** below.

**Table 1 Agency Consultation**

Version	Agency	Consultation Summary n
1	DPIE, 2016	Draft V1 WMP submitted to DPE. Comments from DPE to be addressed in revised WMP with the WMP to then be distributed to agencies for comment.
2	DPE, July 2018	Comments on WMP V1 addressed in revised WMP and resubmitted to DPE.
FINAL	June 2020	Draft WMP submitted to NRAR, EPA, DPI & WaterNSW for comment. No further comments or changes were advised

Copies of previous consultation with relevant agencies are shown in **Appendix 4**.

### 2.2 2020 Consultation

#### Consultation with Dol Water Regarding Lockyersleigh Creek Crossing

Holcim liaised with Dol Water as part of the Creek Crossing. The Lockyersleigh Creek Crossing was built in Quarter 4 2017 with this built for crossing the main haul road to the granite pit.

#### Government Consultation

A copy of the updated Water Management Plan was sent to EPA, WaterNSW, DPI Water and DPI Fisheries for consultation and the DPIE for final approval in June 2020. Evidence of consultation is shown in **Appendix 4**

### 3. Statutory Requirements

#### 3.1 Legislation

Legislation relevant to soil and water management includes:

- *Protection of the Environment Operations Act 1997 (POEO Act);*
- *Water Management Act 2000 (WM Act);*
- *Fisheries Management Act 1994 (FM Act); and*
- *Water Act 1912 (Water Act).*

Relevant provisions of the above legislation are explained in the register of legal and other requirements included in the EMS.

#### 3.2 Guidelines and Standards

The main guidelines, specifications and policy documents relevant to this SWMP include:

- *Managing Urban Stormwater: Soils and Construction, Volume 2C Unsealed Roads (DECCW 2008);*
- *Managing Urban Stormwater: Soils and Construction, Volume 2E Mines and Quarries (DECCW 2008);*
- *AS 1940:2004 The Storage and Handling of Flammable and Combustible Liquids;*
- *NSW Department of Primary Industries, Office of Water, Guidelines for Controlled Activities;*
- *Department of Environment and Conservation, Approved Methods for the Sampling and Analysis of Water Pollutants in New South Wales (DEC, 2004a);*
- *Draft NSW MUSIC Modelling Guidelines (Sydney Metropolitan Catchment Management Authority, August 2010);*
- *Holcim Guideline Water Management Guidelines; and*
- *Holcim Water Efficiency Policy (October, 2011).*

#### 3.3 Development Consent Requirements

The preparation of a Water Management Plan is required by Schedule 3 Conditions 20 to 24 and Schedule 5 Conditions 2 and 3 of the Lynwood Quarry Development Consent. These conditions are outlined in **Table 2**, with an indication of where in the plan each requirement is addressed.

**Table 2 Development Consent Conditions (DA 128-5-2005)**

Water Management Plan	Relevant Section of Report
20. The Applicant must prepare a Water Management Plan for the development to the satisfaction of the Secretary. In addition to the standard requirements for management plans (see Schedule 5 Condition 2) this plan must: <ul style="list-style-type: none"> <li>a) be prepared in consultation with the EPA, WaterNSW, DoI Water and DPI Fisheries;</li> <li>b) be submitted to the Secretary for approval by 30 November 2016, unless otherwise agreed by the Secretary;</li> <li>c) include a Water Balance;</li> </ul>	a) Section 2
	b) Section 2
	c) Section 7
	d) Section 4



Water Management Plan	Relevant Section of Report
<ul style="list-style-type: none"> <li>d) include an Erosion and Sediment Control Plan;</li> <li>e) include a Surface Water Monitoring Program;</li> <li>f) include a Ground Water Monitoring Program; and</li> <li>g) include a Surface and Ground Water Response Plan to address any potential adverse impacts associated with the development.</li> </ul>	e) Appendix 2
	f) Appendix 3
	g) Section 8
<p>21. The Water Balance must:</p> <ul style="list-style-type: none"> <li>a) include details of all water extracted (including water make), dewatered, transferred, used and/or discharged by quarry; and</li> <li>b) describe measures to minimise water use by the development.</li> </ul>	Section 5
<p>22. The Erosion and Sediment Control Plan must:</p> <ul style="list-style-type: none"> <li>a) be consistent with the requirements of the Landcom's <i>Managing Urban Stormwater: Soils and Construction</i> manual;</li> <li>b) identify activities that could cause soil erosion and generate sediment;</li> <li>c) describe measures to minimise soil erosion and the potential for the transport of sediment to downstream waters;</li> <li>d) describe the location, function, and capacity of erosion and sediment control structures; and</li> <li>e) describe what measures would be implemented to maintain (and if necessary decommission) the structures over time.</li> </ul>	Section 6
	Section 6
	Section 6.1
	Section 6.1
	Section 9.3 and 9.4
<p>23. The Surface Water Monitoring Program must include:</p> <ul style="list-style-type: none"> <li>a) detailed baseline data on surface water flows and quality in Joarimin Creek, Lockyersleigh Creek, and Marulan Creek;</li> <li>b) surface water impact assessment criteria;</li> <li>c) a program to monitor surface water flows and quality;</li> <li>d) a protocol for the investigation of identified exceedances of the surface water impact assessment criteria; and</li> <li>e) a program to monitor the effectiveness of the Erosion and Sediment Control Plan.</li> </ul> <p><i>Note: Monitoring of surface flows to be completed by visual assessment.</i></p>	Appendix 2

Water Management Plan	Relevant Section of Report
<p>24. The Ground Water Monitoring Program must include:</p> <ul style="list-style-type: none"> <li>a) detailed baseline data on ground water levels, flows, and quality, based on statistical analysis;</li> <li>b) a groundwater impact assessment criteria for monitoring bores;</li> <li>c) a program to monitor regional ground water levels and quality; and</li> <li>d) a protocol for the investigation of identified exceedances of the groundwater impact assessment criteria.</li> </ul> <p><i>Note: The surface and ground water monitoring programs must be consistent with the current version of Approved Methods for the Sampling and Analysis of Water Pollutants in New South Wales (DEC).</i></p>	Appendix 3
<b>Management Plan Requirements</b>	
<p><b>Schedule 5 Condition 2</b> The Applicant must ensure that the Management Plan required under this consent are prepared in accordance with any relevant guidelines, and include:</p>	
a) Detailed baseline data;	Appendix 2 and 3
<p>b) A description of:</p> <ul style="list-style-type: none"> <li>• The relevant statutory requirements (including any relevant approval, licence or lease conditions);</li> <li>• Any relevant limits or performance measures/criteria; and</li> <li>• The specific performance indicators that are proposed to be used to judge the performance of, or guide the implementation of, the development or any management measures;</li> </ul>	Section 3
c) A description of the measures that would be implemented to comply with the relevant statutory requirements, limits of performance measures/criteria	Section 6 and 8
<p>d) A program to monitor and report on the:</p> <ul style="list-style-type: none"> <li>• Impacted and environmental performance of the development; and</li> <li>• Effectiveness of any management measures (see (c) above);</li> </ul>	Section 9. Appendix 2 and 3
e) A contingency plan to manage any unpredicted impacts and their consequences	Section 8.1
f) A program to investigate and implement ways to improve the environmental performance of the development over time;	Section 11
<p>g) A protocol for managing and reporting any:</p> <ul style="list-style-type: none"> <li>• Incidents;</li> <li>• Complaints;</li> <li>• Non-compliances with statutory requirement; and</li> <li>• Exceedance of the impact assessment criteria and/or performance criteria</li> </ul>	Section 10 Appendix 2 and 3 regarding criteria and trigger levels
h) A protocol for periodic review of the plan	Section 11
<p><i>Note: The Secretary may waive some of these requirements if they are unnecessary or unwarranted for particular management plans.</i></p>	
<p><b>Schedule 5 Condition 3</b> Prior to approval of management plans required under Schedule 3, all existing management plans, monitoring programs, strategies, programs, protocols, etc. approved as at the date of approval of Modification 4 shall continue to have full force and effect, and may be</p>	

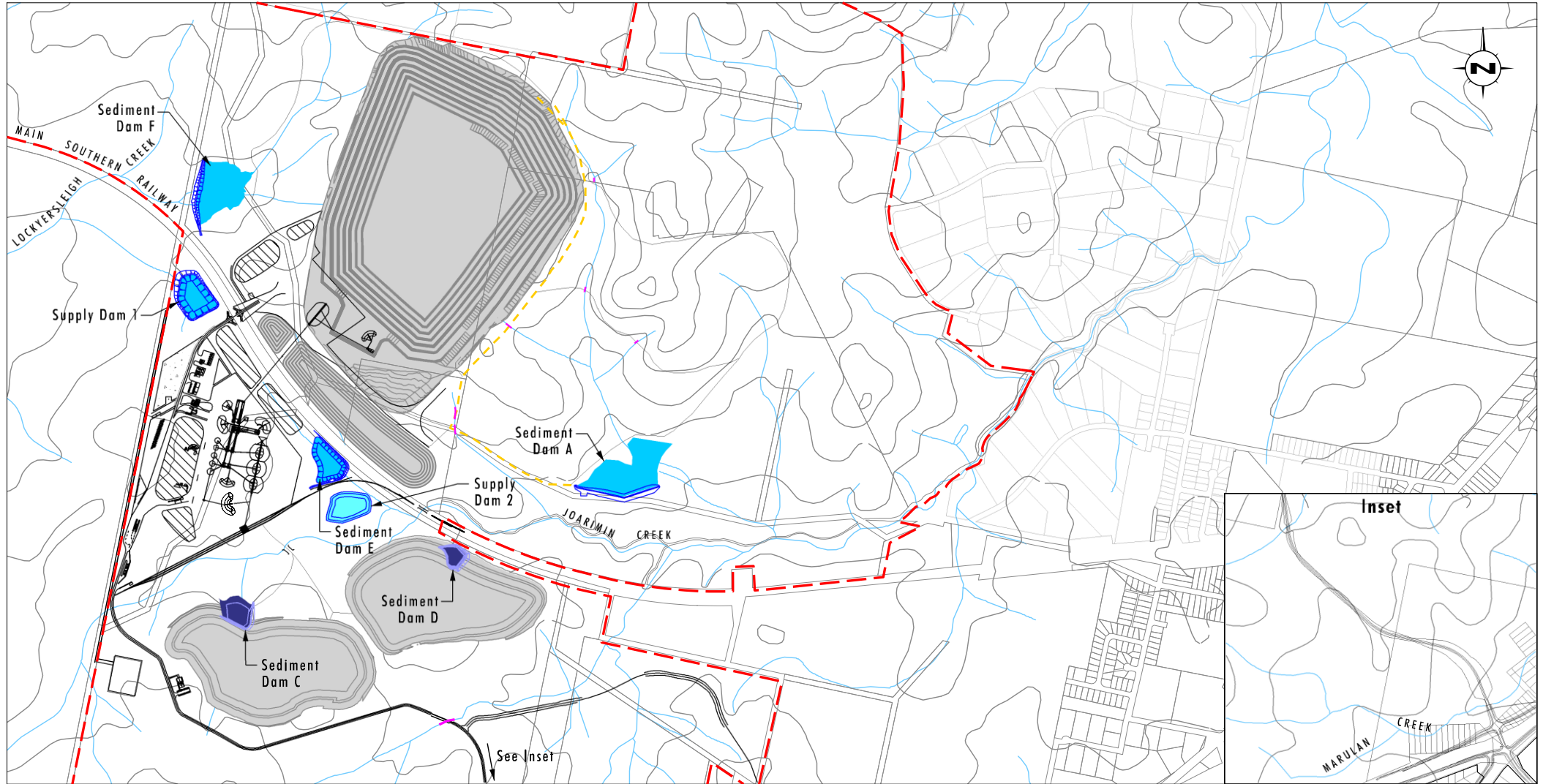
<b>Water Management Plan</b>	<b>Relevant Section of Report</b>
revised under the requirements of condition 5 below as if subject to the conditions of this consent that applied prior to approval of Modification 4, or otherwise with the approval of the Secretary.	

## 4. Overview of Lynwood Quarry Water Management System

The water management strategy for the site, as detailed in the Environmental Assessment Lynwood Quarry Extraction Area Modification (Umwelt, 2015) is to capture runoff from the footprint of the disturbance areas and minimise external water supply requirements for the life of Lynwood Quarry. This includes the Lynwood Pit and the Granite Pit, overburden and excess product emplacement areas, haul road routes as well as the amenity bund and vegetative screen. Water management infrastructure including catch drains, several detention/retention dams will also be developed to assist in managing water quality. Any runoff water captured will be managed on-site within environmental compliance requirements. A conceptual water management system for Lynwood Quarry is shown on **Figure 2-5**.

The water management system described above has been designed with the following objectives:

- To minimise off site impacts;
- To comply with Development Consent conditions;
- To comply with EPL conditions; and
- To maximise water use efficiency.



Data Source: LPI (2009), Holcim Australia (2004)

- Legend**
- - - Approved Project Area
  - Constructed Dam (Existing)
  - Approved Dam (May be Constructed in Future)
  - Indicative Dam Location as Advised by Holcim
  - Culvert
  - - - Haul Road

**Figure 2**  
Approved Water  
Management Infrastructure  
(Lynwood Pit Area)

## 5. Site Water Balance

The site water balance for Lynwood Quarry was originally assessed as part of the Lynwood Quarry Environmental Impact Statement (EIS) (Umwelt, 2005) and then updated as part of the Lynwood Quarry Modification EA (Modification 2, Umwelt 2010). The water used, extracted, dewatered, transferred and discharged by Lynwood Quarry and the predicted site water balance is detailed in **Sections 5.1 to 5.4**.

Holcim's commitment to minimising water use is outlined in **Section 5.5**.

The following discussion of water balance is based on Lynwood Quarry operating at its approved capacity of 5 Mtpa.

### 5.1 Water Demands

Water required for the operation of Lynwood Quarry includes both process water and potable water. Water demands include:

- The crushing and screening plant;
- Haul road dust suppression;
- Stockpile dust suppression; and
- Potable water for use in administration and amenities areas.

Water will also be lost from the water management system via evaporation from the water surfaces of dams and during dewatering events for the purposes of lowering dam levels to meet freeboard requirements.

### 5.2 Water Supply and Storage

The water management system will capture runoff from the catchment area of the disturbance footprint. This area contains the ignimbrite and granite pits, overburden and excess product emplacement areas, haul road routes and infrastructure area. The runoff water captured will be stored on-site along with groundwater seepage into the quarry pits, externally sourced water and water recycled through the process plant. During above design capacity rainfall events water may overflow from the sediment dams.

Potable water is currently sourced privately from local water suppliers. Wastewater from the administration offices and workshops is treated on-site in an aerated wastewater system. The treated effluent water is irrigated at two locations (Dam F and Dam E catchment areas). The water runs in low volumes into the dams and is then recycled through the plant or used for dust suppression on the roads.

### 5.3 Site Water Balance

Inflows to the water balance include site runoff, groundwater inflows and external water sourced from Johnniefields Quarry (refer to **Section 5.4**). **Table 3** presents a summary of the gross water balance results for Lynwood Quarry Project for Stage 1, Stage 3 and Stage 6 in isolation of any water imports from Johnniefields Dam, at full production level of 5 Mtpa.

**Table 3 Lynwood Quarry Gross Water Balance (ML/year) with the Lynwood Quarry at 5 Mtpa**

Stage	10th Percentile	50th Percentile	90th Percentile
1	-147	130	766
3	-210	79	737
6	-282	11	695

The water balance for Lynwood Quarry predicts a small surplus is likely (i.e. 50th percentile) for all modelled stages. The reduction in water surplus between the stages can be attributed to an increase in haul road surface area, and therefore, an increase in haul road dust suppression water demand as the operation progresses.

During periods of surplus, water will be stored in the Lynwood Pit prior to reuse within the water management system. This will increase the ability for Lynwood Quarry to continue operations during extended dry periods. Should this be insufficient, water supply will be supplemented from Johnniefields Dam. However, during very prolonged sustained dry periods, water deficits at full production might range between 147 ML per year in Stage 1 to 282 ML per year in Stage 6 (refer to **Table 3**).

#### **5.4 External Water Sourcing**

As shown in **Table 3**, analysis indicates Lynwood Quarry will be a net water user during dry rainfall years. To supplement on-site supply, water is sourced from Johnniefields Dam which is considered to be adequate for most cases. At the times this resource is considered not sufficient, Holcim will secure additional off-site water supplies or will limit production to a level that ensures site dust suppression demands are met.

Current potable water demands are met through sourcing from private local water suppliers.

##### **5.4.1 External Water Supply – Water Licence Allocation**

Holcim has a Water Access Licence (80 ML/year) at Johnniefields dam, for use at Lynwood Quarry. This water will meet Holcim's off-site water requirements except for very long, dry periods. Holcim will manage water pragmatically so that in dry periods there is sufficient water available for environmental control purposes at all times (e.g. dust control measures).

##### **5.4.2 Supernatant from Marulan Water Treatment Plant**

Goulburn Mulwaree Council has previously approached Holcim regarding the potential use of the supernatant liquid from the Marulan Township water supply treatment plant. This water is suitable for industrial use and is estimated at a minimum of 3 ML/year. Holcim is continuing discussions investigating the opportunity to use this external water source.

Holcim do not propose to take the supernatant liquid at this time. If Holcim identify a need to source the supernatant liquid DPIE will be approached for approval and any additional controls required to manage water quality will be implemented prior to use of this liquid.

## 5.5 Water Minimisation

Lynwood Quarry monitors the use, importation and discharge of water. Following quantification, processes are in place to evaluate and manage water-related risks with the aim of minimising impacts on water resources; including a focus on reducing water use. This includes:

- Identifying major consumption points and related potential savings;
- Investigating losses and managing them accordingly;
- Installation of closed loop or recycling/reuse systems; and
- Harvesting rainfall wherever possible.

Holcim will also continue to consider the application of additional water minimisation processes to further reduce water usage on site and optimise water re-use across the operation. Any measures implemented to reduce water usage will be reported in the Annual Review. The following strategies will be considered when assessing opportunities for water minimisation:

- Continued staged construction of water management devices to achieve WMP objectives when required;
- Vegetating non-operational areas that generate dust to minimise water use for dust suppression;
- Use of surfactants on haul roads, stockpiles, and in water carts;
- Calibration of water use required for product quality; and
- Use of misting in fixed plant to reduce water consumption by dust suppression sprays.



## 6. Erosion and Sediment Control Plan

This Erosion and Sediment Control Plan (ESCP) provides a framework for the management of erosion and sedimentation at Lynwood Quarry. Activities that have the potential to cause erosion and generate sediment on site include:

- Clearing and topsoil stripping ahead of quarrying operations;
- Quarrying operations, noting that the majority of the quarrying areas are internally draining;
- Construction of site haul roads;
- Construction of overburden emplacement areas (i.e. placement of overburden);
- Rainfall/runoff on active overburden dumping areas;
- Runoff flowing across the disturbed area into drains;
- Irrigation of on-site grassland areas whilst dewatering dams to achieve freeboard; and
- Creek-crossing/movement across natural watercourses.

Practical erosion and sediment controls will be implemented to minimise the generation of sediment on site and transport of sediment around and off site.

Sediment fences are placed around the downslope batter of all topsoil stockpiles to reduce the potential for sediment transport from the stockpile. In accordance with the Managing Urban Stormwater – Soils and Construction, Volume 1 (the Blue Book) (Landcom 2004), topsoil stockpiles will be seeded when they are planned to be stored for longer than 10 days. Long term stockpiles (i.e. greater than 6 months) will be reseeded in accordance with the requirements of the site Rehabilitation and Landscape Management Plan.

A summary of key controls are outlined below. Commitments relating to surface water and groundwater monitoring are outlined in **Appendix 2 and 3. Table 4** outlines further controls relating to infrastructure and emplacement areas and the water treatment facility.

**Table 4 Summary of Key Water Management and Erosion and Sediment Controls**

Mitigation ID	Measure / Requirement	Reference Document	When Required	Responsibility
<b>OPERATIONAL CONTROLS</b>				
MM1	Works consistent with: Managing Urban Stormwater – Soils and Construction, Volume 1 (the Blue Book) (Landcom 2004) Managing Urban Stormwater – Soils and Construction, Volume 2E Mines and Quarries (DECC 2008d).	Previous WMP and Statement of Commitments	During operations	Quarry Manager/ All Holcim personnel and contractors
MM2	Clearly identifying and delineating areas required to be disturbed and ensuring that disturbance is limited to those areas; clearing as little vegetation as required and minimising machinery disturbance outside of these areas.	Previous WMP	During operations	Quarry Manager, Pit Manager, Support Services Supervisor
MM3	Limiting the number of roads and tracks established.	Previous WMP	During operations	Quarry Manager, Pit Manager, Support Services Supervisor
MM4	Construction of drains upslope of areas to be disturbed to convey clean runoff away from most disturbed areas.	Previous WMP	During operations	Quarry Manager, Pit Manager, Support Services Supervisor
MM5	Reshaping, topsoiling and vegetating road and cut and fill batters as soon as practical.	Previous WMP	During operations	Quarry Manager, Pit Manager, Support Services Supervisor
MM6	Construction of sediment dams to capture and treat runoff from disturbed catchment areas. Where required, site dams have been designed with flocculent adding stations to enable clumping of sediment, if required, to minimise risks associated with the discharge of sediment laden water.	Previous WMP	During operations	Quarry Manager, Pit Manager, Support Services Supervisor
MM7	Any proposed flocculent system will be discussed with the EPA prior to use.	Previous WMP	During operations	Quarry Manager, Pit Manager, Support Services Supervisor

Mitigation ID	Measure / Requirement	Reference Document	When Required	Responsibility
MM8	Constructing access road and earthworks cut and fill batters at slopes of 1V:3H or less, where possible, to maximise long term stability.	Previous WMP	During operations	Quarry Manager, Pit Manager, Support Services Supervisor
MM9	Progressively stripping and stockpiling topsoil for later use in rehabilitation.	Previous WMP	During operations	Quarry Manager, Pit Manager, Support Services Supervisor
MM10	Diversion of surface and road runoff away from disturbed areas.	Previous WMP	During operations	Quarry Manager, Pit Manager, Support Services Supervisor
MM11	Regular maintenance of all erosion control works and rehabilitated areas.	Previous WMP	During operations and post closure as per Rehabilitation and Landscape Management Plan	Quarry Manager, Pit Manager, Support Services Supervisor
MM12	Regular inspections of access tracks/roads to ensure drainage is working effectively and tracks/roads are stable, particularly after rain.	Previous WMP	During operations	Quarry Manager, Pit Manager, Support Services Supervisor
MM13	During the operational phase, monthly inspections of long-term erosion and sediment controls will be undertaken..	Previous WMP	During operations	Quarry Manager, Pit Manager, Support Services Supervisor
MM14	Revegetation of areas as soon as practicable following the completion of earthworks, operations, or terminal areas.	Previous WMP	During operations	Quarry Manager, Pit Manager, Support Services Supervisor
MM15	Placement of oil separators downslope of all high risk areas.	Previous WMP	During operations	Quarry Manager, Pit Manager, Support Services Supervisor
MM16	All sediment dams will be managed to ensure that accumulated sediment is kept below 30% of the dam design capacity.	Previous WMP	During operations	Quarry Manager, Pit Manager, Support Services Supervisor
<b>HOLCIM ENVIRONMENTAL STANDARDS – GUIDELINE 6.19 WATER MANAGEMENT</b>				
MM17	Sites shall recycle water back into production processes.	Guideline 4.11	During operations	Quarry Manager
MM18	Runoff from all disturbed areas shall pass through sediment control	Guideline 4.11	During operations	Quarry Manager, Pit

Mitigation ID	Measure / Requirement	Reference Document	When Required	Responsibility
	<p>devices prior to being discharged from the site.</p> <p>Note: Disturbed areas include, but are not limited to, stockpile areas, internal unsealed roadways, processing plant area and quarry development and extraction areas. quarry development and extraction areas.</p>			Manager, Support Services Supervisor
MM19	The capacity of sediment control devices shall be maintained to ensure excess sediment does not build up and impact final water quality.	Guideline 4.11	During operations	Quarry Manager, Pit Manager, Support Services Supervisor
MM20	Sediment control devices shall discharge into drainage lines that are stable and vegetated via properly constructed spillways, ripraps or culverts.	Guideline 4.11	During operations	Quarry Manager, Pit Manager, Support Services Supervisor
MM21	All water discharged from the site (including stormwater and pit dewatering) shall be sampled and tested to ensure it meets state specific water quality objectives and site environmental permit conditions.	Guideline 4.11	During operations	Quarry Manager, Pit Manager, Support Services Supervisor
<b>HOLCIM ENVIRONMENTAL STANDARDS - GUIDELINE 6.11 STORAGE OF LIQUID FUELS &amp; CHEMICALS</b>				
MM22	<p>All liquid fuels and chemicals are stored and handled in accordance with the Holcim bunding guidelines.</p> <p>Note: Liquid fuels and chemicals can include admixtures, acid based truck wash, industrial chemicals, fuels and oils.</p>	Guideline 4.17	During operations	Quarry Manager
MM23	Bunded areas shall be subject to regular inspection and maintenance.	Guideline 4.17	During operations	Quarry Manager, Pit Manager, Support Services Supervisor
MM24	Any spills contained in a bunded area that require disposal are collected by an appropriately licensed waste contractor.	Guideline 4.17	During operations	Quarry Manager, Pit Manager, Support Services Supervisor
MM25	Sites have processes in place to ensure that operators remain with their vehicle at all times during the delivery of liquid fuels and chemicals to permit immediate response in the event of a spill or leakage.	Guideline 4.17	During operations	Quarry Manager, Pit Manager, Support Services Supervisor
<b>HOLCIM ENVIRONMENTAL STANDARDS - GUIDELINE 6.12 SPILL RESPONSE &amp; REPORTING</b>				
MM26	Spill response equipment shall be available and readily accessible in	Guideline 4.18	During operations	Quarry Manager,

Mitigation ID	Measure / Requirement	Reference Document	When Required	Responsibility
	high-risk areas such as fuel and chemical storage areas and workshops.			Support Services Supervisor
MM27	Sites shall develop and implement a spill response procedure.	Guideline 4.18	During operations	Quarry Manager, Support Services Supervisor
MM28	All relevant personnel shall be trained in the sites spill response procedure.	Guideline 4.18	During operations	Quarry Manager, Support Services Supervisor
MM29	Processes shall be in place to ensure any waste or spoil associated with a spill is collected and disposed of in accordance with local and state requirements.	Guideline 4.18	During operations	Quarry Manager, Support Services Supervisor
MM30	Spill response equipment shall be regularly maintained including the replacement of used equipment.	Guideline 4.18	During operations	Quarry Manager , Support Services Supervisor

## 6.1 Infrastructure and Emplacement Areas

### 6.1.1 Catch Drains

A series of catch drains have been established to convey runoff from the current overburden emplacement areas to sediment dams. The installed catch drains have been designed to safely convey peak discharges from critical duration 20 year Average Recurrence Interval (ARI) storm events and will provide a minimum of 0.5 metre freeboard. All overburden emplacement areas will be rehabilitated following placement of the final landform surface to reduce potential erosion.

All drains will be constructed to remain stable whilst conveying peak discharges during a 20 year ARI storm event at less than erosive velocities for the channel construction materials. In addition, drains will be constructed to limit the potential for erosion at the base of emplacement areas or along the top of the pit wall.

Drains may either be rehabilitated with grass species or rock armoured if required due to erosivity of flow.

Catch drains will be constructed with 1:3 (v:h) side slopes or less and will be grassed or rock armoured channels, with base widths varying between one metre and eight metres. Peak velocities will generally be kept below 1.5 m/s. Where peak velocities are likely to exceed 1.5 m/s, rock bars will be placed along the drain at intervals no greater than 30 metres to reduce peak velocities, or flumes will be used. In addition, where drains are used in locations where the grade of the drain is in excess of 5 per cent. The indicative sizes and grades of the controls are detailed in **Appendix 1**.

## 6.1.2 Dams

Water is managed and stored on site in a series of dams. The key dams that are currently part of the water management system together with their approximate design capacity and function are listed in **Table 5** and are shown on **Figures 3-5**. The yet to be constructed dams are listed in **Table 5**. The dams listed in **Table 5** are approved and were conceptual dams based on modelling undertaken as part of the initial Lynwood Quarry EIS (Umwelt, 2005) and the Lynwood Quarry Modification EA (Umwelt, 2015). This table was updated in February 2020 based on the status of dams. Additional dam construction will be undertaken as necessary, with broad staging of construction of the remaining dams and drains identified in **Figures 3-5**.

**Table 5 Existing Site Dams**

Dam	Purpose	Minimum Design Criteria <sup>1</sup>	Volume (ML) <sup>2</sup>
Supply Dam 1	Water storage	N/A	63 (24)
Dam E	Sediment control and plant water management	Type C critical storm duration	42 (31)
Dam F	Sediment and water storage	90 <sup>th</sup> percentile 5 day rainfall event type D/F	50 (16)
Dam A	Water harvesting	N/A	117 (83)
Dam C <sup>4</sup>	Sediment control	Type C critical storm duration	8 <sup>3</sup>
Dam D <sup>4</sup>	Sediment control	Type C critical storm duration	8 <sup>3</sup>
Dam R1	Sediment control	90 <sup>th</sup> percentile 5 day rainfall event type D/F	2 (estimated) <sup>4</sup>
Dam R2	Sediment control	90 <sup>th</sup> percentile 5 day rainfall event type D/F	2 (estimated) <sup>4</sup>
Sediment Dam G1	Sediment control	95 <sup>th</sup> percentile 5 day rainfall event type D/F	26.6

Note 1 – Design Criteria specified for sediment control dams in accordance with Managing Urban Stormwater Volumes 1 and 2 (Blue Book) (Landcom, 2004 and DECC, 2008). 90<sup>th</sup> percentile 5 day rainfall event depth is 28.6 mm.

Note 2 – Working volume in parentheses (considering current pump configurations and sediment zones)

Note 3 - Sediment control from excess product emplacement area (Capacities provided by Holcim).

Note 4 – Locations as advised by Holcim

**Table 6**      **Yet to be constructed dams**

<b>Dam</b>	<b>Purpose</b>	<b>Minimum Design Criteria<sup>2</sup></b>	<b>Volume (ML)<sup>3</sup></b>
<b>Supply Dam 2</b>	Water storage	95 <sup>th</sup> percentile 5 day rainfall event type D/F	30

The storage volumes for each of the dams will be required to service runoff, based on the soil type and characteristics of the emplacement area and other disturbed catchment areas.

The basins that will control runoff from overburden emplacement areas, haul roads and the infrastructure area have been designed as Type D/F basins, due to the proportion of fines in the soils found in these areas. The sediment dams will be emptied using a pump and pipe or gravity systems after rainfall events.

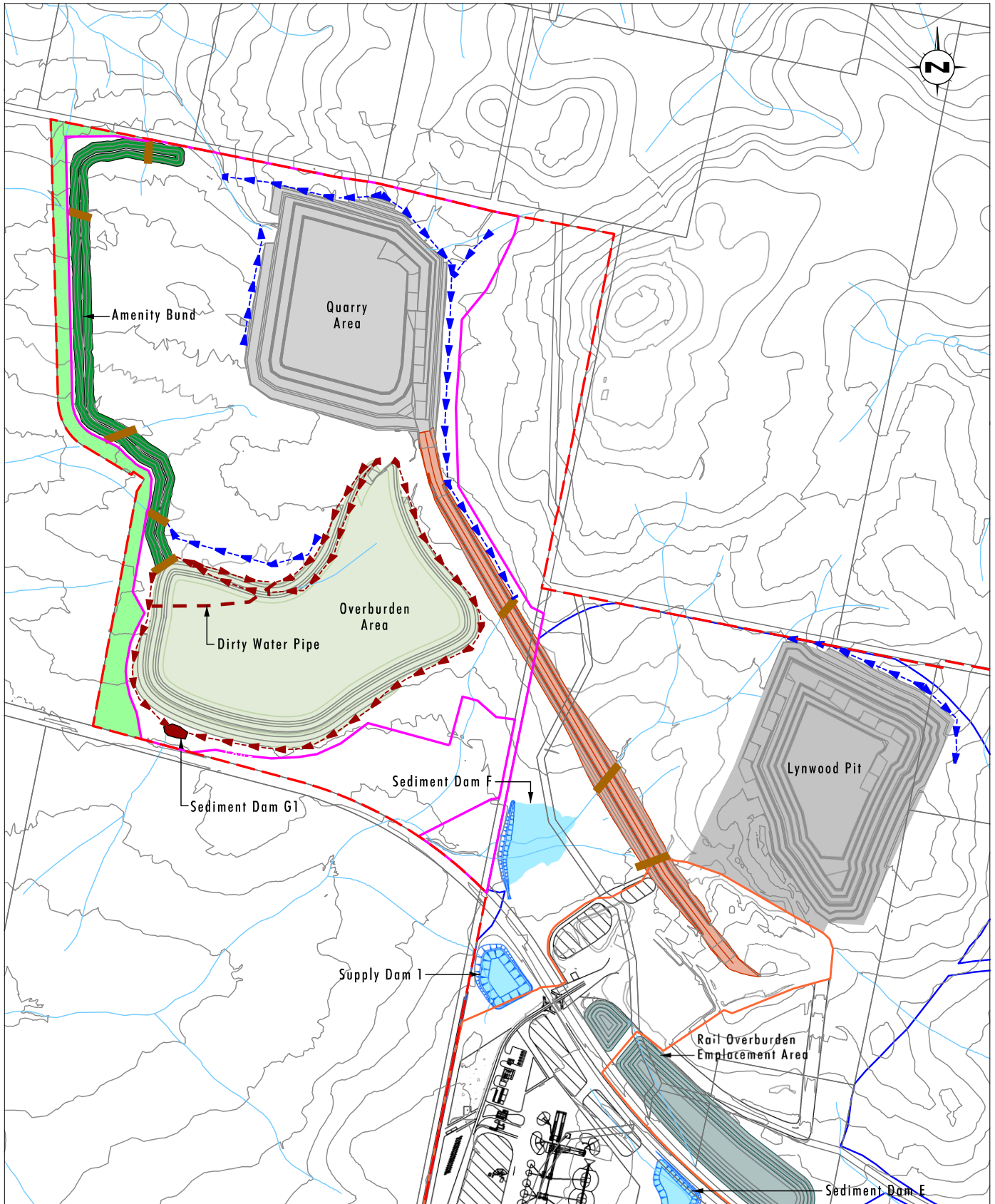
### **6.1.3 Water Treatment Facility**

As identified in the Lynwood Quarry Extraction Area Modification Environmental Assessment (Umwelt, 2015),

Holcim committed to the construction of a water treatment facility to the west of the existing Dam F. The proposed water treatment facility would be used to treat water quality to meet water quality parameters for release to downstream watercourses if required. The intent of the proposed water treatment facility is to assist Lynwood Quarry to deliver a neutral or beneficial effect on water quality for the Lynwood Quarry.

Holcim has completed a review for the current operation of the Water Management System and as a result does not believe Water Treatment Facility is currently required. As part of the Annual Review process, Holcim will review the ongoing water balance and water management requirements for the operation. If the Water Treatment Facility is deemed to be required it will be constructed. These additional studies may include future assessments of water demands and updates/refinements to the site water balance to determine risks associated with water discharge from the site.

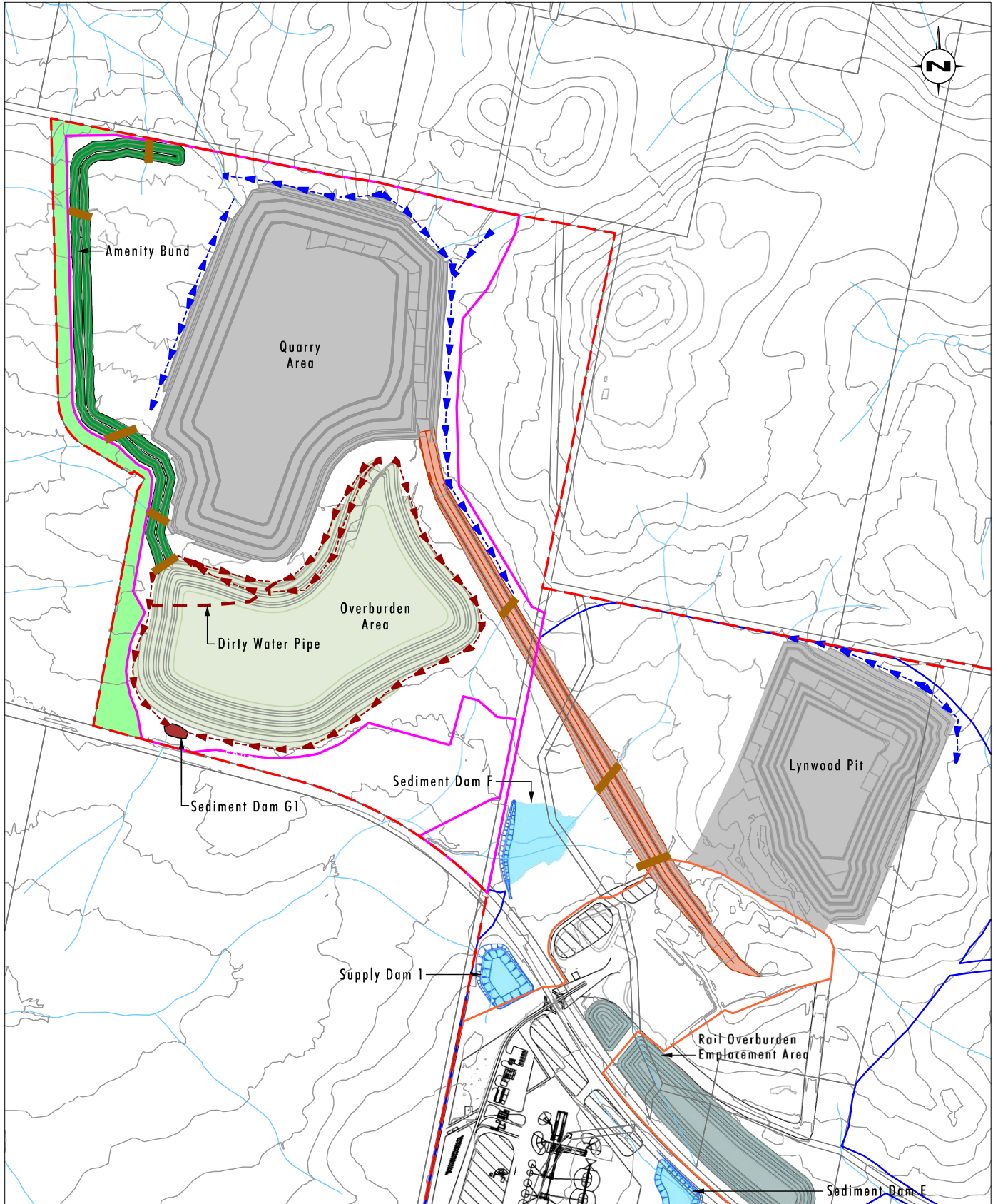




Data Source: LPI (2009), Holcim Australia (2014)  
 Notes: 5m Contour Interval. Conceptual only and subject to detailed design.

Legend		
	Approved Project Area	
	Lynwood Infrastructure Area	
	Approved Disturbance Footprint	
	Granite Pit Disturbance Footprint	
	Lynwood Infrastructure Layout	
	Quarry Pit	
	Emplacement Area	
	Existing Dam	
	Overburden Emplacement Area	
	Vegetation Buffer Zone	
	Amenity Bund	
	Haul Road	
	Clean Dam	
	Diversion Drain	
	Sediment Dam	
	Dirty Drain	
	Culvert	

Figure 3  
 Conceptual Water Management System - Stage 1

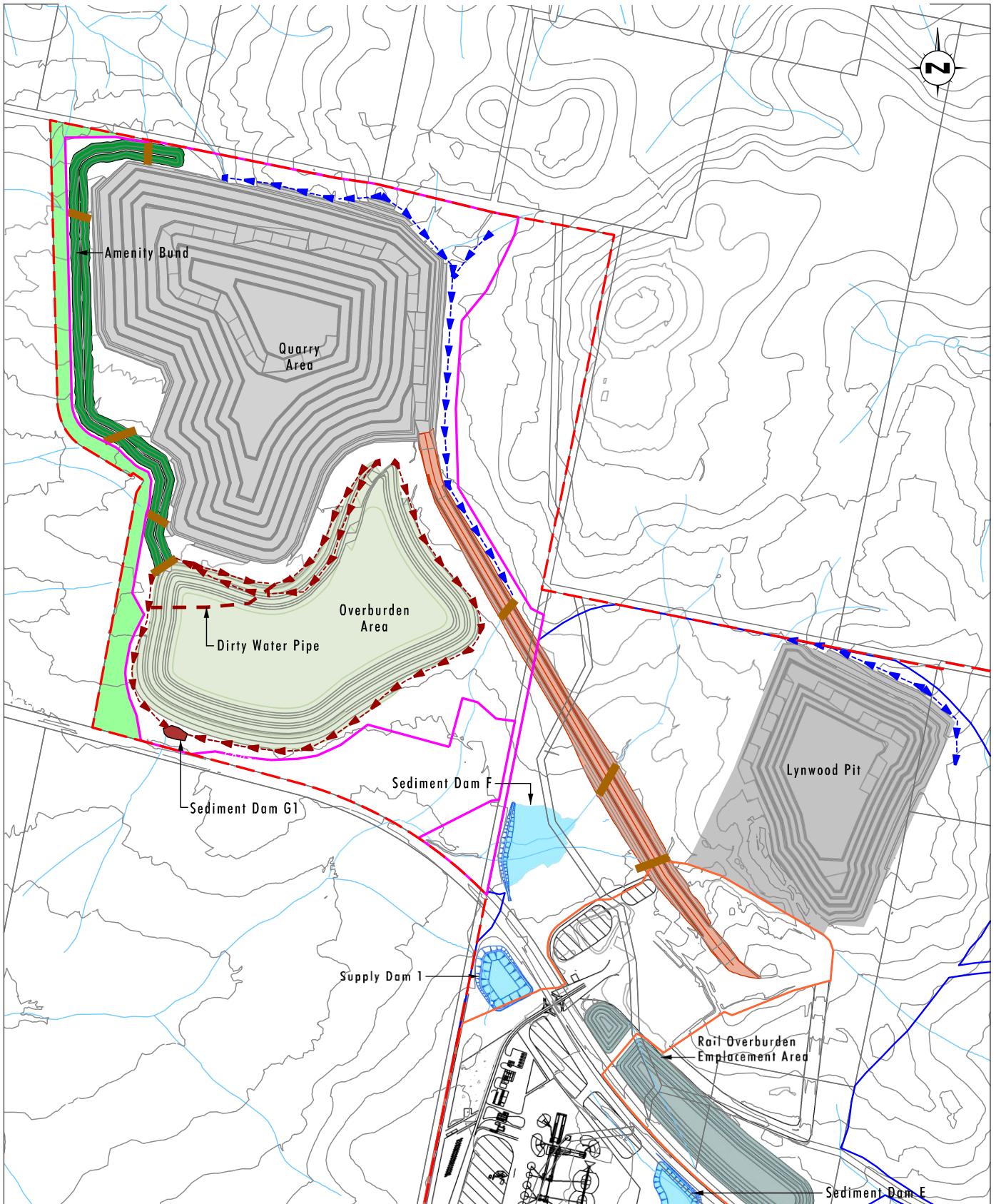


Data Source: LPI (2009), Holcim Australia (2014)  
 Notes: 5m Contour Interval. Conceptual only and subject to detailed design.

**Legend**

- |                                   |                             |         |
|-----------------------------------|-----------------------------|---------|
| Approved Project Area             | Overburden Emplacement Area | Culvert |
| Lynwood Infrastructure Area       | Vegetation Buffer Zone      |         |
| Approved Disturbance Footprint    | Amenity Bund                |         |
| Granite Pit Disturbance Footprint | Haul Road                   |         |
| Lynwood Infrastructure Layout     | Clean Dam                   |         |
| Quarry Pit                        | Diversion Drain             |         |
| Emplacement Area                  | Sediment Dam                |         |
| Existing Dam                      | Dirty Drain                 |         |

Figure 4  
**Conceptual Water Management System - Stage 3**



Data Source: LPI (2009), Holcim Australia (2014)  
 Notes: 5m Contour Interval. Conceptual only and subject to detailed design.

- Legend**
- Approved Project Area
  - Lynwood Infrastructure Area
  - Approved Disturbance Footprint
  - Granite Pit Disturbance Footprint
  - Lynwood Infrastructure Layout
  - Quarry Pit
  - Emplacement Area
  - Existing Dam
  - Overburden Emplacement Area
  - Vegetation Buffer Zone
  - Amenity Bund
  - Haul Road
  - Clean Dam
  - Diversion Drain
  - Sediment Dam
  - Dirty Drain

Figure 5  
 Conceptual Water Management System - Stage 6

## 7. Site Water Quality

Implementation of the operational erosion and sediment controls for Lynwood Quarry (refer to **Section 6**) will enable the management of runoff from the site reducing the potential impact on water quality in the downstream creeks and to deliver a neutral or beneficial effect on water quality.

Water quality on site and in the downstream creeks will be monitored in accordance with the Surface Water Monitoring Program (refer to **Appendix 2**). This program has been developed to encompass all potential sediment dam overflow locations. Faecal coliforms will be measured monthly at Dams E and F as they capture runoff from areas used for recycled water including the office complex

Riparian Area Management Plans (RAMPs) have been prepared for each of the three catchment areas, i.e. Joarimin Creek, Lockyersleigh Creek and Marulan Creek. These plans identify all proposed works, including erosion and sediment controls and rehabilitation within waterfront land under the Water Management Act 2000. The RAMPs are appended to the Rehabilitation and Landscape Management Plan.

## 8. Surface water and Groundwater Response Plan

The site has been identified as varying between being a net water user in dry years, to being a net water maker in wet years. As such, the water levels in each of the supply and sediment dams will be monitored weekly to assist in operational water sourcing requirements and to understand the likelihood of overflows from sediment dams.

In periods of rainfall above the design capacity of the sediment dams, water may overflow from controlled discharge points at Dam A and Dam F. Sediment dam water level monitoring will also be undertaken prior to predicted rainfall events of greater 25 mm in a 24 hour period. Monitoring will be undertaken of all discharge events to assist in any post event investigations. In accordance with Development Consent Schedule 3 Condition 19 a), Holcim will ensure sufficient water will be available for Lynwood Quarry at all stages of development and will source water externally if required.

### 8.1 Adaptive Management

As outlined in Schedule 5 Condition 6 of the Development Consent, Holcim will manage the surface water related risks of the operation to ensure that there are no exceedances of the criteria and/or performance measures for the site.

Should an exceedance of the criteria provided in the Development Consent for surface or groundwater occur due to quarrying activities, Holcim will, at the earliest opportunity:

- a) Take all reasonable and feasible measures to ensure that the exceedance ceases and does not recur;
- b) 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; and
- c) Implement remediation measures as directed by the Secretary, to the satisfaction of the Secretary.

**Table 7 Trigger Action Response Plan – Erosion and Sediment Control / Water Management**

Key Element	Trigger / Response	Condition Green	Condition Amber	Condition Red
Erosion	Trigger	No evidence of erosion.	Minor gully or tunnel erosions present and/or rilling. Evidence of sediment or sediment laden water leaving the site.	Significant gully or tunnel erosions present and/or rilling. Evidence of sediment or sediment laden water leaving the site.
	Response	Continue Soil and Water Management Plan implementation.	A suitably trained person to inspect the site. Review of erosion and sediment structures. Remediate as appropriate.	A suitably trained person to inspect the site. Review of erosion and sediment structures. Remediate as soon as practical.
Water management structures	Trigger	Water management structures have been designed, constructed and managed in accordance with the Blue Book and the ESCPs.	Inspections indicate that water management structures illustrate minor issues with erosion and sediment control.	Inspections indicate a failure of the water management structures.
	Response	Continue Soil and Water Management Plan implementation.	A suitably trained person to inspect the site. Review of water management structures. Remediate as appropriate.	A suitably trained person to inspect the site. Remediate as soon as practical. Review of engineering design and revise ESCPs. Update WMP.
Uncontrolled Discharges (EPL Criteria)	Trigger	No uncontrolled discharge	Uncontrolled discharge water quality results within Project Approval criteria.	Uncontrolled discharge outside the Project Approval criteria limits.
	Response	Continue Soil and Water Management Plan implementation.	Continue to monitor water quality during discharges as per this plan. Provide details in the Annual Review.	Reporting as per <b>Section 10</b> of this Plan. Possible implementation of additional mitigation measures such as water treatment. This could include water treatment, pumping water to different dams. Continue to monitor water quality during discharges.
Water Quality Outside Triggers surface water and	Trigger	Within Trigger Levels	One off exceedance of Trigger Levels	Two or More Exceedances of Trigger Levels (Consecutive months)

Lynwood WMP

Key Element	Trigger / Response	Condition Green	Condition Amber	Condition Red
groundwater triggers in Appendix 2 and 3	Response	No action	Inspection of surface water monitoring location. Comparison of results against previous trends. No reporting required.	Review of trends. Reporting to DPIE and the EPA. Possible implementation of additional mitigation measures in liaison with the DPIE and EPA.

## **9. Monitoring and Maintenance Requirements**

### **9.1 Operational Phase Works**

The water supply and sediment dam walls will be reviewed biennially (every two years) for their structural integrity and any major maintenance required. The walls of these dams will be grassed and kept free of any trees and shrubs, dam walls will be rock lined in areas of high erosion.

During the operational phase, monthly inspections of long-term erosion and sediment controls will be undertaken.

### **9.2 Decommissioning**

Assuming the quarry is decommissioned at the end of the current approved development period (30 years), all sediment dams will remain in use as farm dams after decommissioning, although the capacity of the dams will be reviewed. The water supply dams will be rehabilitated into the final landform as free draining areas. Catch drains will remain as part of the final landform. Any future development application for continued quarry operations beyond 30 years will include a revision of the existing water management system.

### **9.3 Water Monitoring**

Surface water and groundwater monitoring are outlined in **Appendix 2 and 3** of this plan. A summary figure for environmental monitoring is outlined in **Figure 6**.

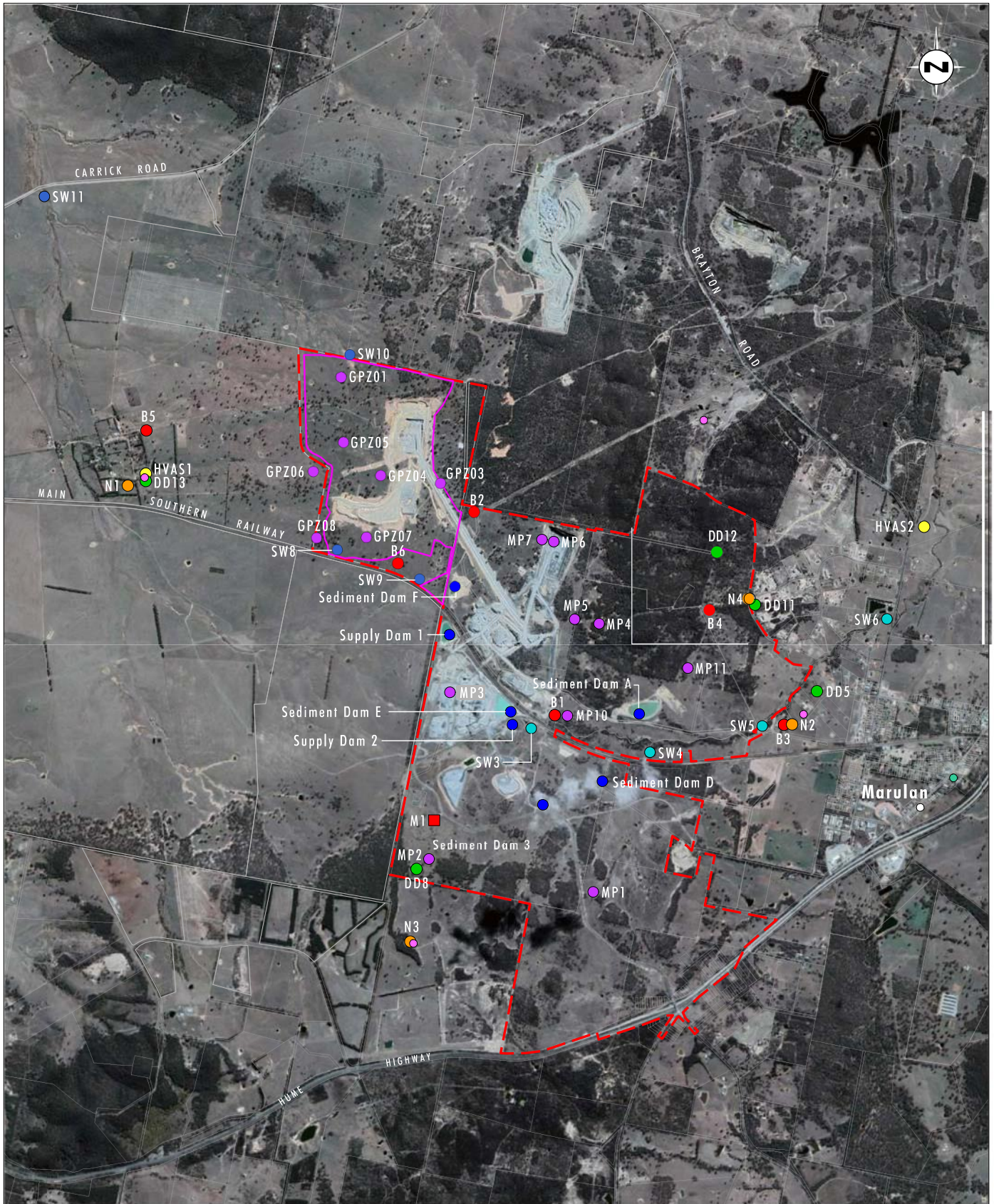


Image Source: Google Earth (2018)  
 Data Source: LPI (2014), Holcim Australia (2015)

0 0.5 1.0 2.0 km  
 1:45 000

**Legend**

- Approved Project Area
- Granite Pit Disturbance Footprint
- Meteorological Station
- Depositional Dust Monitoring Location
- HVAS Location
- Blasting Monitoring Location
- Noise Monitoring Location
- Groundwater Piezometer
- Surface Water Monitoring Location
- Site Water Management Dams
- Granite Pit Surface Water Monitoring Location SW8 to SW11
- Residence Location
- Marulan Public School
- Marulan Childrens Centre

Figure 6

Environmental Monitoring Network



## 10. Reporting and Review

### 10.1 Evaluation of Monitoring

If the monitoring results are found to be outside the sites Project Approval water quality criteria the Quarry Manager will initiate the following protocol:

**Table 8 Reporting and Exceedances**

Aspect	Summary
Initial Notification	<p>As soon as practical after becoming aware of the breach of results due to quarry activities, the Quarry Manager will notify the Holcim NSW Planning and Environment Manager and enter the incident into INX.</p> <p>The Quarry Manager will notify the Secretary of the DPIE of the EPA of the incident as soon practicable.</p>
Reporting	<p>A report will be prepared and submitted by the Quarry Manager to the DPIE and EPA within 7 days of becoming aware of the incident, this report will include:</p> <ul style="list-style-type: none"><li>• Cause of the non-compliance.</li><li>• Environmental Harm caused due to the non-compliance.</li><li>• Actions undertaken to rectify the non-compliance and ensure.</li></ul>
Subsequent Review	<p>Following the reporting of subsequent review, should it be concluded that the Quarry is the source of elevated pollutant levels, the continuous improvement process outlined in the EMS is to be implemented and corrective actions identified.</p>

### 10.2 External Reporting – Annual Review

A summary of water monitoring results will be provided in the Lynwood Quarry Annual Review. The Annual Review will be prepared and submitted to the Secretary, in accordance with Schedule 5 Condition 10 of the Lynwood Quarry Development Consent. The Annual Review will be made available to the public through the CCC and the Lynwood Quarry web site.

In addition, in accordance with *Protection of the Environment Legislation Amendment Act 2011* (Amendment Act) and Schedule 5 Condition 13 of the Development Consent, Holcim Australia will also publish water quality monitoring results on the Holcim (Australia) website <http://www.holcim.com.au>.

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

The effectiveness of the water management controls utilised at Lynwood Quarry will be reported to DPIE within the Annual Review by the reporting of monitoring data. The Annual Review will also identify whether any additional water management controls are required to be implemented at Lynwood Quarry.

Any investigations related to exceedances will be detailed in the Annual Review and EPL Annual Returns.

### **10.3 Community Complaints and Independent Review**

Complaints relating to water management from the Lynwood Quarry are to be managed in accordance with the requirements of the Lynwood Quarry EMS. A summary of complaints will be published on the Lynwood Quarry website and provided in the Annual Review.

### **10.4 Training**

All employees and contractors working on site will undergo a site induction and training, which will cover issues relating to water management, including:

- The existence and requirements of this Plan;
- Water management/erosion and sediment control measures;
- Incident management;
- Complaints reporting.

Further details regarding staff induction and training are outlined in the EMS.

## 11. Review and Improvement

Continuous improvement of this WMP will be achieved in accordance with the EMS, through the ongoing evaluation of environmental management performance against environmental policies, objectives and targets for the purpose of identifying opportunities for improvement.

The continuous improvement process is designed to:

- Identify areas of opportunity for improvement of environmental management and performance;
- Determine the cause or causes of non-conformances and deficiencies;
- Develop and implement a plan of corrective and preventative action to address any non-conformances and deficiencies;
- Verify the effectiveness of the corrective and preventative actions;
- Document any changes in procedures resulting from process improvement; and
- Make comparisons with objectives and targets.

This WMP will be reviewed, and revised as necessary, in accordance with the requirements of Schedule 5 Condition 5 of the Development Consent which states: *within 3 months of the submission of an:*

- (a) incident report under condition 8 below;*
- (b) Annual Review under condition 10 below;*
- (c) audit report under condition 11 below; and*
- (d) any modifications to this consent,*

*the Applicant must review, and if necessary revise, the strategies, plans, and programs required under this consent, to the satisfaction of the Secretary.*

In terms of sub clause b), the requirement to review and update management plans will be assessed during the preparation of each Annual Review. The Annual Review will state which management plans require updating and which management plans do not require updating. Details on the requirements to prepare Annual Reviews are outlined in the Environmental Management Strategy.

Update versions of management plans will be put on the website.

## 12. Roles and Responsibilities

Environmental roles and responsibilities for Lynwood Quarry personnel are outlined below.

**Table 9 Roles and Responsibilities**

Personnel	Responsibilities
Quarry Manager	Provide that sufficient resources are allocated for the implantation of this Plan.
Line Manager	Have a working knowledge of this WMP  Be aware of the environmental legislative requirements associated with the Lynwood Quarry and take measures to ensure compliance.
Support Services Supervisor	Coordinate the water quality monitoring requirements of this plan.  Evaluate and report monitoring results as required.  Coordinate water and erosion related incident investigations and reporting as required by legislation and internal standards and guidelines.  Assist with the review of this plan.
All employees and contractors	Comply with all requirements of this WMP.  Report all potential environmental incidents to the Quarry Manager immediately.  Seek approval from the Quarry Manager prior to making changes to infrastructure/processes which may result in changes to the water management system.

## 13. References

Department of Land and Water Conservation. 1999. *Guidelines for Establishing Drainage Lines on Rehabilitated Minesites* (Draft).

Department of Environment and Climate Change (DECC), 2008a. *Managing Urban Stormwater – Soils and Construction, Volume 2A – Installation of Services*.

Department of Environment and Climate Change (DECC), 2008b. *Managing Urban Stormwater – Soils and Construction, 2C – Unsealed Roads*.

Department of Environment and Climate Change (DECC), 2008c. *Managing Urban Stormwater – Soils and Construction, 2D – Main Road Construction*.

Department of Environment and Climate Change (DECC), 2008d. *Managing Urban Stormwater – Soils and Construction, Volume 2E – Mines and Quarries*.

Landcom, 2004. *Managing Urban Stormwater – Soils and Construction, Volume 1, 4th Edition*.

Umwelt (Australia) Pty Limited 2005. *Environmental Impact Statement. Readymix Holdings Pty Ltd. Proposed Lynwood Quarry, Marulan*.

Umwelt (Australia) Pty Limited 2010. *Environmental Assessment Proposed Modifications to Lynwood Quarry, Marulan*. Prepared for Holcim (Australia) Pty Limited

Umwelt (Australia) Pty Limited 2015. *Environmental Assessment Lynwood Quarry Extraction Area Modification, Marulan*. Prepared for Holcim (Australia) Pty Limited

## 14. Change Information

Table 10 summarises the main changes in the management plan updates.

**Table 10 Summary of Document Changes**

Version	Date	Change Summary
1	October 2016	Update for MOD 5 Modification
2	July 2018	Update following 2017 Annual Review
3	May 2020	<p>Review of the template for all Lynwood management plans;</p> <ul style="list-style-type: none"> <li>• General structure updates throughout the document;</li> <li>• Section 2- Consultation (new section added);</li> <li>• Section 3 – Statutory requirements – separate section and expanded;</li> <li>• Section 6 – Update to controls in the management. Inclusion of roles and timings requirements;</li> <li>• Section 8 – addition of TARP relating to adaptive management;</li> <li>• Section 15 – inclusion of change information;</li> <li>• Appendix 2 – SWMP (including updated baseline information and triggers; and</li> <li>• Appendix 3 – GWMP (including baseline information and triggers).</li> <li>• Figure updates.</li> </ul> <p>The following did not change:</p> <ul style="list-style-type: none"> <li>• Water balance;</li> <li>• No change to monitoring or reporting requirements; and</li> </ul>
4	November 2020	Updated the email correspondence with Government agencies for consultation of management plans

# Appendix 1

## Water Management Design Specifications

**Table A1 - 1 - Catch Drain Design Specifications and Indicative Sizes and Grades**

<b>Design Aspect</b>	<b>Criteria</b>
<b>Flow capacity</b>	Critical duration 20 year ARI storm event
<b>Runoff rates</b>	Disturbed areas - 0.7 pre vegetative stage, 0.35 post vegetative stage Impervious areas - 0.9
<b>Stability</b>	Typical velocities less than 1.5 m/s
<b>Longitudinal grades</b>	Typically 0.5% to 1.0%
<b>Base widths</b>	Typically 1 metre to 8 metres
<b>Side batters</b>	No steeper than 1:3 (v:h)
<b>Lining</b>	Grassed where < 1.5 m/s, otherwise rock lined
<b>Exit structures</b>	Level spreaders where required

**Design References**

Managing Urban Stormwater: Volume 1 Soils and Construction (Landcom 2004) and Volume 2E Mines and Quarries (DECC 2008d).

(Draft) Guideline for Establishing Stable Drainage Lines on Rehabilitated Mine Sites (DLWC 1999).



# Appendix 2

## Surface Water Monitoring Program



# Lynwood Quarry Surface Water Monitoring Program

R3 November 2020

# Contents

<b>1. Scope</b> .....	<b>3</b>
<b>2. Baseline Data</b> .....	<b>4</b>
2.1 Joarimin Creek .....	5
2.2 Lockyersleigh Creek.....	7
2.3 Marulan Creek.....	8
<b>3. ANZECC Guidelines</b> .....	<b>10</b>
<b>4. Surface Water Impact Assessment Criteria</b> .....	<b>11</b>
4.1 Response to Criteria Exceedances.....	14
<b>5. Surface Water Monitoring</b> .....	<b>15</b>

## Tables

Table 1	Development Consent 128-5-2005-Surface Water Monitoring Requirements	3
Table 2	Summary of Baseline Monitoring Locations	4
Table 3	Joarimin Creek – pH	5
Table 4	Joarimin Creek – Electrical Conductivity (µS/cm)	6
Table 5	Joarimin Creek – Total Nitrogen (mg/L)	6
Table 6	Joarimin Creek – Total Phosphorus (mg/L)	6
Table 7	Joarimin Creek – Total Suspended Solids (mg/L)	6
Table 8	Lockyersleigh Creek – pH	7
Table 9	Lockyersleigh Creek – Electrical Conductivity (µS/cm)	7
Table 10	Lockyersleigh Creek – Total Nitrogen (mg/L)	7
Table 11	Lockyersleigh Creek – Total Phosphorus (mg/L)	7
Table 12	Lockyersleigh Creek – Total Suspended Solids (mg/L)	8
Table 13	Marulan Creek – pH	8
Table 14	Marulan Creek – Electrical Conductivity (µS/cm)	8
Table 15	Marulan Creek – Total Nitrogen (mg/L)	9
Table 16	Marulan Creek – Total Phosphorus (mg/L)	9
Table 17	Marulan Creek – Total Suspended Solids (mg/L)	9
Table 18	ANZECC Trigger Values for Key Water Quality Parameters	10
Table 19	Schedule 3 Condition 17 Water Quality Discharge Criteria	11
Table 20	Trigger Values for Key Water Quality Parameters (Revised 2020 Criteria)	12
Table 21	Trigger Values for Key Water Quality Parameters (Previous Management Plan and now superseded)	13
Table 22	Response to Criteria Exceedances	14

## 1. Scope

This Surface Water Monitoring Program (SWMP) outlines the surface water monitoring required to be undertaken by Holcim, to ensure compliance with statutory requirements at Lynwood Quarry. The program addresses the requirements contained in the Lynwood Quarry Development Consent (DA-128-5-2005 MOD 5) and the Lynwood Quarry EPL 12939.

The SWMP is included as part of the Water Management Plan for Lynwood Quarry, in accordance with Schedule 3 Condition 20, of the Lynwood Quarry Development Consent. The SWMP has been updated in 2019 to include updated baseline data and trigger levels.

Schedule 3 Condition 23, of the Development Consent specifies the requirements for the SWMP. These requirements are summarised in **Table 1** below.

**Table 1 Development Consent 128-5-2005-Surface Water Monitoring Requirements**

Condition	Requirements	Relevant Section of Program
23.	The Surface Water Monitoring Program must include:	
23. a)	detailed baseline data on surface water flows and quality in Joarimin Creek, Lockyersleigh Creek, and Marulan Creek;	Section 2
23. b)	surface water impact assessment criteria;	Section 3
23. c)	a program to monitor surface water flows and quality;	Section 4
23. d)	a protocol for the investigation of identified exceedances of the surface water impact assessment criteria; and	Section 10 of the main WMP document.
23. e)	a program to monitor the effectiveness of the Erosion and Sediment Control Plan.	Section 10 of the main WMP document.

Note: The SWMP must be consistent with the current version of Approved Methods for the Sampling and Analysis of Water Pollutants in New South Wales (DEC).

## 2. Baseline Data

As per Schedule 3 Condition 23 a) of the Development Consent, a surface water quality monitoring program was established at Lynwood Quarry in July 2004 to provide baseline surface water data. The following is a summary of the surface water monitoring locations (Refer to **Figure 6** in main document) at Lynwood Quarry and the monitoring period:

**Table 2 Summary of Baseline Monitoring Locations**

Monitoring Location	Monitoring Period
SW1 – Marulan Creek (Ephemeral Creek)	January 2012 – June 2013. No longer monitored. Marulan Creek monitoring locations SW1 and SW2 have been subsequently removed from the monitoring program due to the completion of works for the Hume Highway interchange.
SW2 – Marulan Creek (Ephemeral Creek)	July 2004 – December 2016. No longer monitored.
SW3 - Joarimin Creek (Upstream)	July 2004 – June 2013. No longer monitored.
SW4 - Joarimin Creek (Upstream)	July 2004 – June 2013. Monitoring will recommence in Quarter 2 2020.
SW 5 – Joarimin Creek (Downstream)	July 2004 – September 2019. Monitoring to continue.
SW 6 - Joarimin Creek (Downstream)	July 2004 – September 2019. Monitoring to continue.
SW 7 – Lockyersleigh Creek	February 2005 – February 2008. Baseline monitoring at SW7 was used prior to the construction of Sediment Dam F. No longer monitored.
SW 8 – Lockyersleigh Creek (Upstream)	January 2019 - September 2019. Monitoring to continue. Note, it has been dry for every proposed monitoring event to date except July 2019.
SW 9 – Lockyersleigh Creek (Upstream)	January 2019 - September 2019. Monitoring to continue. Note, it has been dry for every proposed monitoring event to date.
SW 10 – Lockyersleigh Creek (Downstream)	January 2019 - September 2019. Monitoring to continue. Note, it has been dry for every proposed monitoring event to date.
SW 11 – Lockyersleigh Creek (Downstream)	April 2017 - September 2019. Monitoring to continue. Note, it has been dry for most of the monitoring events.

The data has been collated from the following sources:

- The summary data from 2004 – 2010 was outlined in the previous Water Management Plan;
- The data from 2010 – 2018 was summarised in the Annual Reviews;
- Data from 2019 was outlined in the surface water tab of the 2019 Monitoring data spreadsheet.

The initial baseline monitoring was completed for several sites listed in Table 2 (between July 2004 and April 2011), with these initially monitored monthly for:

- Flow (by way of observation as streams are ephemeral);
- pH;
- Electrical conductivity;
- Total Dissolved Solids (TDS);
- Chloride (Cl);
- Iron (Fe);
- Manganese (Mn);
- Arsenic (As);
- Nitrite;
- Nitrate;
- Total phosphorous;
- Oxidised nitrogen;
- Total Nitrogen; and
- Benzene, Toluene, Ethylbenzene, and Xylene (BTEX).

Since 2011 the number of monitoring parameters has reduced, with monitoring now completed for:

- pH;
- Electrical conductivity;
- Total suspended solids (TSS);
- Total phosphorous;
- Total nitrogen; and
- Total oil and grease.

The key results of the monitoring program are summarised below (**Sections 2.1 to 2.3**).

### 2.1 Joarimin Creek

Joarimin Creek (monitoring sites SW3 to SW6) is ephemeral causing inconsistency in the results of water quality monitoring over the sampling period. The ranges for key water quality parameters for Joarimin creek are outlined in **Tables 3-7**. SW5 and 6 continue to be monitored, with SW 3 and 4 no longer monitored.

**Table 3 Joarimin Creek – pH**

	SW3	SW4	SW5	SW6	Combined
<b>Minimum</b>	5.6	5.3	5.3	5.5	5.3
<b>Maximum</b>	7.4	7.6	7.9	9.7	9.7
<b>Average</b>	6.6	6.4	6.6	7.0	6.7

**Table 4 Joarimin Creek – Electrical Conductivity (µS/cm)**

	SW3	SW4	SW5	SW6	Combined
<b>Minimum</b>	118	193	75	180	75
<b>Maximum</b>	1085	1540	1461	3255	3255
<b>Average</b>	548	674	585	904	678

**Table 5 Joarimin Creek – Total Nitrogen (mg/L)**

	SW3	SW4	SW5	SW6	Combined
<b>Minimum</b>	0.8	0.51	0.40	0.04	0.04
<b>Maximum</b>	3.8	2.50	5.60	2.12	5.6
<b>Average</b>	1.9	1.25	1.51	0.95	1.40

**Table 6 Joarimin Creek – Total Phosphorus (mg/L)**

	SW3	SW4	SW5	SW6	Combined
<b>Minimum</b>	0.00	0.00	0.00	0.00	0.00
<b>Maximum</b>	0.38	0.22	0.63	0.89	0.89
<b>Average</b>	0.11	0.05	0.05	0.04	0.06

**Table 7 Joarimin Creek – Total Suspended Solids (mg/L)**

	SW3	SW4	SW5	SW6	Combined
<b>Minimum</b>	7	5	3	2	2
<b>Maximum</b>	620	270	810	320	810
<b>Average</b>	163	64	44	16	71.8

## 2.2 Lockyersleigh Creek

Monitoring at SW7 was completed prior to quarrying from February 2005 to February 2008. No monitoring has been completed since that time.

Monitoring for SW8-11 commenced in January 2018. Very few samples have been obtained for these sites as they are mostly dry. There has been no results to date for SW9 and SW10.

**Table 8 Lockyersleigh Creek – pH**

	SW7	SW8	SW9	SW10	SW 11	Combined
Minimum	6.4	7.8	No result	No result	7.6	6.4
Maximum	7.7	7.8	No result	No result	7.8	7.7
Average	7.0	7.8	No result	No result	7.7	7.5

**Table 9 Lockyersleigh Creek – Electrical Conductivity (µS/cm)**

	SW7	SW8	SW9	SW10	SW 11	Combined
Minimum	529	380	No result	No result	2750	380
Maximum	3922	380	No result	No result	3260	3922
Average	2435	380	No result	No result	3046	1953

**Table 10 Lockyersleigh Creek – Total Nitrogen (mg/L)**

	SW7	SW8	SW9	SW10	SW 11	Combined
Minimum	1.80	1.89	No result	No result	0.45	0.45
Maximum	3.20	1.89	No result	No result	0.68	3.20
Average	2.53	1.89	No result	No result	0.54	1.7

**Table 11 Lockyersleigh Creek – Total Phosphorus (mg/L)**

	SW7	SW8	SW9	SW10	SW 11	Combined
Minimum	0.11	0.08	No result	No result	0.02	0.02
Maximum	0.25	0.08	No result	No result	0.04	0.25
Average	0.06	0.08	No result	No result	0.03	0.06



**Table 12 Lockyersleigh Creek – Total Suspended Solids (mg/L)**

	SW7	SW8	SW9	SW10	SW 11	Combined
Minimum	Not sampled	16	No result	No result	3	3
Maximum	Not sampled	16	No result	No result	8	16
Average	Not sampled	16	No result	No result	5.6	10.8

### 2.3 Marulan Creek

Marulan Creek is also ephemeral at the two monitoring locations (SW1 and SW2), as a result, sampling has also been intermittent. The ranges for the key water quality variables for Marulan Creek are shown in **Tables 13-17**, with data ranging from July 2004 to June 2013 for SW1 and July 2004 to December 2016 for SW2. No ongoing monitoring is proposed to be undertaken for the Marulan Creek catchment as no Lynwood Quarry operations are undertaken within the catchment. As there is no ongoing monitoring, no trigger levels have been developed in **Section 4**.

**Table 13 Marulan Creek – pH**

	SW1	SW2	Combined
Minimum	5.4	5.7	5.4
Maximum	7.3	7.5	7.5
Average	6.3	6.5	6.4

**Table 14 Marulan Creek – Electrical Conductivity (µS/cm)**

	SW1	SW2	Combined
Minimum	184	54	54
Maximum	1003	2200	2200
Average	433	236	334

**Table 15 Marulan Creek – Total Nitrogen (mg/L)**

	<b>SW1</b>	<b>SW2</b>	<b>Combined</b>
<b>Minimum</b>	0.58	0.48	0.48
<b>Maximum</b>	2.00	2.00	2.00
<b>Average</b>	1.07	1.14	1.10

**Table 16 Marulan Creek – Total Phosphorus (mg/L)**

	<b>SW1</b>	<b>SW2</b>	<b>Combined</b>
<b>Minimum</b>	0.00	0.00	0.00
<b>Maximum</b>	0.23	0.28	0.28
<b>Average</b>	0.04	0.05	0.045

**Table 17 Marulan Creek – Total Suspended Solids (mg/L)**

	<b>SW1</b>	<b>SW2</b>	<b>Combined</b>
<b>Minimum</b>	3	4	3
<b>Maximum</b>	32	180	180
<b>Average</b>	12.5	21.8	17.1

### 3. ANZECC Guidelines

The Australian and New Zealand Guidelines for Fresh and Marine Water Quality (2000) (ANZECC Guidelines) define a number of default trigger values for physical and chemical stressors. The trigger values for upland rivers in slightly disturbed ecosystems in south-east Australia are outlined in **Table 18**. Upland rivers are defined as rivers with an elevation >150mAHD. The elevation at the Lynwood Quarry is typically higher than 630mAHD.

**Table 18 ANZECC Trigger Values for Key Water Quality Parameters**

Water Quality Parameter	Trigger value			
	NSW Upland Rivers		NSW Lowland Rivers	
Total Nitrogen (mg/L)	0.25		0.50	
Total Phosphorus (mg/L)	0.02		0.05	
pH	Lower limit	Upper Limit	Lower limit	Upper Limit
	6.5	7.5	6.5	8.5
Conductivity (µS/cm)	30 - 350		125 - 2200	

Source: ANZECC (2000): Australian and New Zealand Guidelines for Fresh and Marine Water Quality.

Note: Lowland rivers default triggers have been included for reference.

These criteria have since been replaced with more site specific criteria based on Development Consent criteria or historical water quality ranges. See **Section 4** for further details.

## 4. Surface Water Impact Assessment Criteria

Discharge water quality limits for Total Suspended Solids (TSS), pH and oil and grease are specified in the Schedule 3 Condition 17 of the Lynwood Quarry Development Consent. If surface water overtops a sediment basin, Lynwood Quarry will also measure temperature, electrical conductivity and dissolved oxygen as agreed with the EPA.

A summary of the Schedule 3 Condition 17 water quality discharge criteria is outlined below:

**Table 19 Schedule 3 Condition 17 Water Quality Discharge Criteria**

Pollutant	Unit of Measure	100 <sup>th</sup> Percentile Limit
<b>Total Suspended Solids</b>	mg/L	50
<b>pH</b>	pH	6.5-8.5
<b>Oil and Grease<sup>1</sup></b>	mg/L	10 or none visible

Schedule 3 Condition 17 water quality discharge criteria states that these limits apply to the controlled discharge points at Sediment Dams A to F.

For the 2020 update to the Water Management Plan, site specific trigger values have been collected for key surface water parameters with these based on the following:

- Water quality discharge criteria for onsite dams as per Schedule 3 Condition 17;
- Minimum and maximum of monitoring results for other SW sites (creeks) at Lynwood Quarry. The baseline data is outlined in **Section 2**.

**Table 20** outlines the revised 2020 criteria and **Table 21** outlines the criteria outlined in the previous version of the Water Management Plan.

**Table 20 Trigger Values for Key Water Quality Parameters (Revised 2020 Criteria)**

Water Quality	Trigger Value			
Variable	<sup>3</sup> SW 1 and 2 (Marulan Creek) SW 3 and 4 Joarimin Creek SW 7 Lockyersleigh Creek	Joarimin Creek (SW4-SW6)	SW8 to SW11	<sup>4</sup> Site Water Management System Dams (excluding SW5, SW6 and SW8 to SW11)
pH	No longer monitored. No trigger levels proposed.	5.3 to 9.7	6.4 to 7.8	6.5 to 8.5 <sup>1</sup>
Electrical Conductivity		Maximum of 3255 µS/cm	Maximum of 3922 µS/cm	No criteria listed in the Development Consent. No trigger levels proposed.
Oil and Grease		10 mg/L or none visible	10 mg/L or none visible	10 mg/L or none visible <sup>1</sup>
Total Suspended Solids		Less than 320 mg/L	Less than 320 mg/L <sup>2</sup>	50 mg/L <sup>1</sup>

**Notes:**

<sup>1</sup> Triggers marked with a <sup>1</sup> are from Schedule 3 Condition 17;

<sup>2</sup> For SW8 to 11 there has been very few samples obtained. The highest TSS level recorded across a total of four sampling events has been low (16 mg/L). Holcim have therefore used the Joarimin Creek TSS range for the TSS trigger value for SW8 to 11.

<sup>3</sup> SW1 – 4 are no longer monitored, hence there are no proposed criteria. SW7 is also no longer monitored.

<sup>4</sup> criteria associated with site water dams are only applicable during discharge events offsite from these dams (controlled discharge dams).

**Table 21 Trigger Values for Key Water Quality Parameters (Previous Management Plan and now superseded)**

Water Quality	Trigger Value			
	SW5	SW6	SW8 to SW11	Site Water Management System Dams (excluding SW5, SW6 and SW8 to SW11)
<b>pH</b>	5.8 to 6.8	6.2 to 7.2	6.5 to 7.5	6.5 to 8.5 <sup>1</sup>
<b>Electrical Conductivity</b>	732 µS/cm	1197 µS/cm	2200 µS/cm	2200 µS/cm
<b>Oil and Grease<sup>1</sup></b>	10 mg/L or none visible	10 mg/L or none visible	10 mg/L or none visible	10 mg/L or none visible
<b>Total Suspended Solids<sup>1</sup></b>	50 mg/L	50 mg/L	50 mg/L	50 mg/L
<b>Total Nitrogen</b>	2.0 mg/L	1.0 mg/L	2.1 mg/L	2.1 mg/L
<b>Total Phosphorus</b>	0.17 mg/L	0.06 mg/L	0.21 mg/L	0.21 mg/L

Note 1: Specified in DA-128-5-2005, Schedule 3, Condition 17

#### 4.1 Response to Criteria Exceedances

The response to water quality criteria exceedances are outlined in **Section 8.1** of the Main Water Management Plan document and are summarised in the table below:

**Table 22 Response to Criteria Exceedances**

Key Element	Trigger/Response	Condition Green	Condition Amber	Condition Red
Water Quality Outside Triggers surface water triggers	Trigger	Results Within Trigger Levels	One off exceedance of Trigger Levels	Two or More Exceedances of Trigger Levels (Consecutive months)
	Response	No action	Inspection of surface water monitoring location. Comparison of results against previous trends. No reporting required.	Review of trends. Reporting to DPIE and liaison. Possible implementation of additional mitigation measures in liaison with the DPIE and EPA.

## 5. Surface Water Monitoring

Surface water monitoring will continue throughout the operation of Lynwood Quarry at two monitoring sites (SW5 and SW6) across Joarimin Creek and four monitoring sites (SW8 to SW11) in the Lockyersleigh Creek catchment. In addition, water quality monitoring will be undertaken from site water management dams prior to any release of water from sediment dams into the environment as agreed with the EPA and outlined in the Development Consent. Monitoring of site water dams is undertaken for due diligence purposes in the event of sediment dam overtop. Monitoring of water quality in site dams may be undertaken at other times for site environmental management purposes.

Monthly surface water sampling at sites SW4, SW5 and SW6 and SW8 to SW11 will consist of:

- pH;
- Total suspended solids (TSS);
- Oil and grease (mg/L);
- Electrical conductivity ( $\mu\text{S}/\text{cm}$ );
- Flow (by way of observation as streams are ephemeral).

For the 2020 review, Holcim has removed the commitment to monitor total phosphorus and nitrogen as we believe this is not relevant. These parameters are usually used to assess nutrients into waterways and there has been many years of monitoring which indicate little or no impact on these parameters. Holcim will continue to monitor phosphorus and nitrogen unless DPIE approves removing the testing of these parameters from the monitoring program.

Faecal coliforms will be measured monthly at Dams E and F as they capture runoff from areas used for recycled water.

Trigger levels relating to monitoring parameters are outlined in **Section 4**.





# - Appendix 3

## Groundwater Monitoring Program

# Lynwood Quarry Groundwater Monitoring Program

R3 November 2020

## Contents

<b>1. Scope.....</b>	<b>3</b>
<b>2. Baseline Data.....</b>	<b>4</b>
<b>2.1 Groundwater Levels.....</b>	<b>5</b>
<b>2.2 Groundwater Flows.....</b>	<b>6</b>
<b>2.3 Groundwater Quality.....</b>	<b>6</b>
2.3.1 Electrical Conductivity .....	6
2.3.2 pH.....	7
2.3.3 Trace Elements .....	8
2.3.4 Nutrients .....	9
2.3.5 Total Petroleum Hydrocarbons .....	10
<b>3. Groundwater Impact Assessment Criteria – Updated for 2020.....</b>	<b>12</b>
<b>3.1 Summary of Groundwater Impact Assessment Criteria .....</b>	<b>12</b>
<b>3.2 Response to Criteria Exceedances .....</b>	<b>13</b>
<b>3.3 Monitoring Standards .....</b>	<b>13</b>
<b>4. Groundwater Management Measures .....</b>	<b>14</b>

### Tables

Table 1	DA-128-5-2005 Condition 24 - Requirements for the Groundwater Monitoring Program..	3
Table 2	Groundwater Monitoring Locations .....	4
Table 3	Groundwater Monitoring Summary for Electrical Conductivity .....	7
Table 4	Groundwater Monitoring Summary for pH .....	8
Table 5	Groundwater Monitoring Summary for Nutrients (mg/L) July 2004 to September 2019....	9

Lynwood GMP R3 November 2020

Table 6	Groundwater Monitoring Summary for Total Petroleum Hydrocarbons (µg/L) .....	10
Table 7	Groundwater Criteria 2020 .....	12
Table 8	Response to Criteria Exceedances .....	13

**Appendices**

**Appendix A – Depth to Groundwater**

**Appendix B – Ranges for Selected Groundwater Quality Parameters**

**Appendix C – Groundwater Analytes to be tested**

## 1. Scope

This Groundwater Monitoring Program (GMP) outlines the groundwater monitoring required to be undertaken by Holcim to ensure compliance with Lynwood Quarry Development Consent (DA-128-5-2005). There have been five modifications approved to the Development Consent since 2005.

The GMP is included as part of the Water Management Plan for Lynwood Quarry, in accordance with Part f of Schedule 3 Condition 20, of the Lynwood Quarry Development Consent. These requirements are summarised in **Table 1** below.

**Table 1 DA-128-5-2005 Condition 24 - Requirements for the Groundwater Monitoring Program**

Condition	Requirements	Relevant Section of Program
<b>24.</b>	The Groundwater Monitoring Program must include:	
<b>24a)</b>	detailed baseline data on groundwater levels, flows, and quality, based on statistical analysis	Section 2 / Appendix A
<b>24b)</b>	groundwater impact assessment criteria for monitoring bores	Section 3
<b>24c)</b>	a program to monitor regional groundwater levels and quality	Section 4
<b>24d)</b>	a protocol for the investigation of identified exceedances of the groundwater impact assessment criteria	Section 5

Note: The GMP must be consistent with the current version of Approved Methods for the Sampling and analysis of Water Pollutants in New South Wales (OEH).

## 2. Baseline Data

A groundwater monitoring program was established in 2004 to provide baseline groundwater data, with a network of 11 piezometers installed ranging from MP1 – MP11. The piezometers were tested quarterly for water quality and monthly for groundwater level.

Since April 2017 a series of additional groundwater monitoring locations (GPZ bores) were established in the Granite Pit area. However due to dry conditions there has been few samples obtained from the GPZ bores.

A summary of the groundwater monitoring locations and sampling period is outlined below. It should be noted quarterly monitoring has generally been completed for groundwater monitoring sites since 2010. Prior to that during the pre - quarrying baseline sampling the monitoring frequency varied.

**Table 2 Groundwater Monitoring Locations**

Monitoring Location	Monitoring Period
MP1	July 2004 - current
MP2	July 2004 - current
MP3	July 2004– April 2015
MP4	July 2004 - current
MP5	July 2004 – current
MP6	July 2004 – April 2015
MP7	July 2004 - current
MP8	July 2004 – January 2011
MP9	July 2004 – October 2011
MP10	July 2004 - current
MP11	July 2004 - current
GPZ01	April 2017 - current
GPZ02	April 2017 – March 2020. This point is being removed due to pit extension. This has been removed from the monitoring location figure.
GPZ03	April 2017 only
GPZ04	April 2017 – December 2018
GPZ05	April 2017 - current
GPZ06	April 2017 - current
GPZ07	April 2017 - current
GPZ08	March 2018 - current
GPZ10	March 2018 current
GPZ11	April 2017 – October 2017

## 2.1 Groundwater Levels

### MP Bores

Groundwater levels for the Lynwood pit area have been monitored since July 2004. Most bores (MP bores) have shown a fluctuation of 1 to 2 metres in water levels throughout the monitoring period. Rainfall data was recorded during monitoring for consideration during assessment of level fluctuations.

The previous Water Management Plan outlined groundwater depth results from 2005 to 2010. The water table is generally well below the ground surface. MP-5 recorded the water level furthest from the ground surface with the level measured at 33.2 metres in October 2005. MP-1 recorded the water level closest to the surface, with a depth of 2.1 metres recorded in August 2004, November 2005 and February 2008. There was a high degree of variability between groundwater locations since monitoring commenced in 2005.

Since 2010, the data indicates that the MP water level furthest from the ground was recorded at 28.05 metres (MP-5). This result was closer to the surface compared to previous 2005-2010 data.

Since 2010 the data indicates the MP water level closest to the surface was recorded at 1.64 metres (MP1). This result was closer to the surface compared to previous 2005-2010 data.

### GPZ Bores

The 2015 Environmental Assessment for MOD 4 outlines potential groundwater impacts and interactions.

Pit staging was provided by Holcim and various stages of the Granite Pit were modelled throughout the 25 year Project life. An indicative pit shell was also modelled for the Approved Pit which is representative of the proposed operations. The focus of this assessment is on the potential impacts of the Granite Pit. The assessment also considers the interaction with the Approved Pit and existing approved groundwater impacts.

Potential exists for relatively minor inflows to both pits once quarrying extends below the water table. Inflows could increase should a hydraulically conductive structural fault be intersected. The Granite Pit would likely encounter the groundwater table from Year 2 of its life (nominally 2018 for modelling purposes) and the Approved Pit from 2016. At the end of their operational lives, the Granite Pit and Approved Pit floors will be approximately 135 metres and 15 metres respectively below the pre quarrying groundwater level.

It will therefore be necessary to control groundwater inflows to the pits and there is potential to impact the groundwater system, at least locally. Therefore, an assessment of the potential impact on groundwater levels and quality is required.

Small scale dewatering (in-pit sumps and pumps as opposed to dewatering borefields) would be required from 2016 for the Approved Pit and from Year 2 for the Granite Pit. Shallow, perched groundwater may be encountered prior to the pits extending below the water table, however resultant inflows would likely be minor and ephemeral. Since the EIS was submitted it should be noted surface water has at times been collected within the quarry floor.

Additional baseline data was obtained through the granite pit modification environmental assessment process (GPZ bores) with the data obtained in June 2014. The average depth to groundwater identified in the modification environmental assessment was approximately 12.1 metres below the ground surface. The minimum and maximum depths identified from monitoring were 2.1 metres and 28.2 metres respectively.

Since April 2017 monitoring commenced for the GPZ bores. The minimum and maximum depths since April 2017 monitoring was 2.13 metres to 23.9 metres. This was within the range of the 2014 data.

A summary of the depth to groundwater results are summarised in **Appendix A**.

## 2.2 Groundwater Flows

The groundwater contours are generally sympathetic to the topography, with levels varying from 644 mAHD in the lower areas to the east and up to 675 mAHD on the ridgelines in the highest part of Lynwood Quarry.

Groundwater generally flows away from the Lynwood pit area toward the east while the groundwater flows away from the granite pit in a west to south-westerly direction. This is confirmed in the groundwater elevation contours.

## 2.3 Groundwater Quality

Baseline groundwater quality in the area was established through the quarterly water quality sampling of the original 11 piezometers installed for the site (i.e. MP 1 to MP11). GPZ monitoring sites have also been added to the monitoring network.

Five different water quality parameters have been monitored:

- Electrical conductivity (refer to **Section 2.3.1**)
- pH (refer to **Section 2.3.2**)
- Trace elements (refer to **Section 2.3.3**)
- Nutrients (refer to **Section 2.3.4**)
- Total petroleum hydrocarbons (refer to **Section 2.3.5**).

The baseline data for each of these groundwater quality parameters is discussed in this section. The baseline monitoring has been updated to include monitoring from July 2010 until September 2019.

Prior to the 2020 update, monitoring results were compared to the ANZECC Guidelines (2000) values for slightly disturbed Freshwater Ecosystems in upland rivers in NSW to represent the moderately disturbed condition of the existing surface water system within the project area (i.e. the system into which groundwater contributes to base flows). **Section 3.1** outlines the new trigger levels developed for the 2020 GMP update.

### 2.3.1 Electrical Conductivity

The electrical conductivity ranges for the monitoring piezometers from the MP and GPZ monitoring sites are outlined in **Table 3**.

For the MP monitoring bores the measured EC ranges were from 170  $\mu\text{S}/\text{cm}$  to 11,521  $\mu\text{S}/\text{cm}$ . There was a high degree of variability between different MP sites.

For the GPZ sites which only commenced regular monitoring in April 2017, the measured EC ranges were from 604  $\mu\text{S}/\text{cm}$  to 8,020  $\mu\text{S}/\text{cm}$ .



**Table 3 Groundwater Monitoring Summary for Electrical Conductivity**

Water Quality Parameter	Minimum	Average	Maximum
<b>MP Monitoring Sites</b>			
Previous EC Baseline Data ( $\mu\text{S}/\text{cm}$ ) – July 2004 – April 2011	489	3,844	11,521
EC ( $\mu\text{S}/\text{cm}$ ) July 2011 – September 2019	170	3,590	11,279
EC Combined ( $\mu\text{S}/\text{cm}$ ) (July 2004 – September 2019)	170	3,717	11,521
<b>GPZ Monitoring Sites</b>			
EC ( $\mu\text{S}/\text{cm}$ ) Since April 2017	604	2,604	8,020

This high degree of variability in EC is considered to indicate a generally low hydraulic conductivity and poor lateral continuity within the bedrock formation.

The EC monitoring results were previously compared with ANZECC Guidelines (2000). The EC ANZECC values for upland rivers (ranging between 30 – 350  $\mu\text{S}/\text{cm}$ ) are well below natural levels, and therefore cannot be used as triggers.

### 2.3.2 pH

The pH ranges for the monitoring piezometers since monitoring commenced are outlined in the table below.

Generally the groundwater results were near a neutral pH, with values ranging from 4.2 to 9.5 for the MP sites.

There was a lower degree of variability for the GPZ sites with this ranging from 6.1 to 7.8. The reason for the lower variability may be due to the fact there have only been a few GPZ samples occur since April 2017 due to the ongoing dry conditions.

**Table 4 Groundwater Monitoring Summary for pH**

Water Quality Parameter	Minimum	Average	Maximum
<b>MP Monitoring Sites</b>			
pH Baseline Data (July 2004 – April 2011)	4.2	6.6	9.5
pH (July 2011 – September 2019)	4.7	6.3	7.3
pH Combined (July 2004 – September 2019)	4.2	6.45	9.5
<b>GP Monitoring Sites</b>			
pH Since April 2017	6.1	6.9	7.8

The pH ANZECC value for upland rivers (6.5-7.5) are generally within the range of the onsite groundwater water quality results. However a range of minimum and maximum from onsite groundwater monitoring has been used for the updated 2020 groundwater impact assessment criteria.

The ANZECC pH values are not reflective of natural levels, with new criteria developed in **Section 3**.

### **2.3.3 Trace Elements**

Baseline monitoring has also included analysis of dissolved trace element concentrations. The ranges for dissolved trace elements for the monitoring piezometers from July 2004 to April 2011.

The analysis undertaken prior to quarrying commencing indicates the majority of piezometers recorded concentrations that comply with ANZECC and NHMRC guidelines, however, some elevated concentrations were recorded as discussed below:

- Aluminum – several piezometers (MP2, MP5, MP6, MP9 and MP10) recorded aluminum concentrations in exceedance of ANZECC guidelines, but only MP9 exceeded the NHMRC Guidelines;
- Chromium and Zinc - all piezometer locations recorded chromium and zinc concentrations in excess of ANZECC guidelines, however all were below the NHMRC Guidelines;
- Nickel – nickel concentrations were recorded at levels in excess of NHMRC guideline concentrations in all piezometers, with some also exceeding the ANZECC guidelines (MP2, MP3, MP6, MP7, MP10 and MP11);
- Lead – lead concentrations exceeded the ANZECC guideline at MP5, MP6 and MP9. MP5 and MP6 recorded lead concentrations that also exceeded the NHMRC guideline;
- Cadmium – piezometers MP5 and MP10 recorded cadmium concentrations in exceedance of both the ANZECC and NHMRC guidelines;

- Manganese – manganese was recorded at levels in excess of NHMRC guidelines in all piezometers; and  
Copper - copper was recorded in excess of ANZECC guidelines in all piezometers.

### 2.3.4 Nutrients

The monitoring ranges for nutrients (including sulphate, nitrate and phosphate concentrations measured in mg/L) are outlined in **Table 5**.

The nutrients monitored prior to quarry commencement (pre 2010) were different to construction and operational groundwater monitoring. In summary:

- Monitoring was completed for nitrate prior to quarry commencement. Since quarry commencement the monitoring was completed for total nitrogen;
- Monitoring was completed for phosphate prior to quarry commencement. Since quarry commencement the monitoring was completed for total phosphorus; and
- Monitoring for sulphate occurred prior to and post operations commencing.

As this testing is different it is not possible to compare results across the entire dataset (prior to and post quarry commencement).

**Table 5 Groundwater Monitoring Summary for Nutrients (mg/L) July 2004 to September 2019**

<b>MP Monitoring Sites</b>			
<b>Parameter</b>	<b>Minimum</b>	<b>Average</b>	<b>Maximum</b>
<b>MP Monitoring Sites (July 2004 – September 2010)</b>			
<b>Sulphate</b>	<1.2	27.0	110.0
<b>Nitrate</b>	<0.01	0.15	0.30
<b>Phosphate</b>	0.01	0.09	1.23
<b>MP Monitoring Sites (September 2010 – September 2019)</b>			
<b>Sulphate</b>	0.4	22.6	152
<b>Total Nitrogen</b>	0.00	0.26	2.20
<b>Total Phosphorus</b>	0.00	0.25	3.02
<b>GPZ Monitoring Sites</b>			
<b>Sulphate</b>	0.4	22.9	76.0
<b>Total Nitrogen</b>	0.06	1.29	5.0
<b>Total Phosphorus</b>	0.40	0.47	1.20

### 2.3.5 Total Petroleum Hydrocarbons

The following Total Petroleum Hydrocarbons (TPH) have been monitored as part of the baseline groundwater monitoring and during operations:

- C6-9;
- C10-14;
- C15-28;
- C29-36;
- Benzene;
- Toluene;
- Ethyl Benzene; and
- Xylene.

The ranges for TPH for the monitoring piezometers from July 2004 to April 2011 and July 2011 to September 2019 are outlined in **Table 6**. This table summarises the statistical range of results for TPH as well as comparing these with ANZECC (2000) and NHMRC Guidelines (2004). The frequency for testing of TPH has varied across years and across monitoring locations.

**Table 6 Groundwater Monitoring Summary for Total Petroleum Hydrocarbons (µg/L)**

TPH	Minimum Concentration	Maximum Concentration	ANZECC Guideline Values	NHMRC Guideline Values
<b>MP Sites July 2004 – April 2011</b>				
C6-9	20	90	-	-
C10-14	25	5870	-	-
C15-28	25	6450	-	-
C29-36	50	3220	-	-
Benzene	1	21	950	1
Toluene	1	52	-	800
Ethyl Benzene	1	2	-	300
Xylene	1.0	2.4	o-Xylene: 350 p-Xylene: 200	600
<b>MP Sites July 2011 – September 2019</b>				
C6-9	10	25	-	
C10-14	25	710	-	
C15-28	100	100	-	
C29-36	50	100		

TPH	Minimum Concentration	Maximum Concentration	ANZECC Guideline Values	NHMRC Guideline Values
<b>Benzene</b>	1	25	950	1
<b>Toluene</b>	1	25	-	800
<b>Ethyl Benzene</b>	1	2	-	300
<b>Xylene</b>	2	2	o - Xylene: 350 p - Xylene: 200	600
<b>GPZ Monitoring Sites (April 2017 – October 2017)</b>				
<b>No monitoring of TPH since</b>				
<b>C6-9</b>	20	160	-	
<b>C10-14</b>	NS	NS	-	
<b>C15-28</b>	NS	NS	-	
<b>C29-36</b>	NS	NS		
<b>Benzene</b>	1	1	950	1
<b>Toluene</b>	2	2	-	800
<b>Ethyl Benzene</b>	2	2	-	300
<b>Xylene</b>	NS	NS	o - Xylene: 350 p - Xylene: 200	600

Source: ANZECC (2000) Australian and New Zealand Guidelines for Fresh and Marine Water Quality. NHMRC (2004) Australian Drinking Water Guidelines

TPH monitoring for the GPZ sites was completed over three monitoring events from April 2017 to October 2017.

Analysis of the TPH monitoring results indicates all piezometers recorded concentrations that comply with ANZECC and NHMRC guideline values (Note: the limit of analysis for Benzene was above the NHMRC guidelines but complied with ANZECC guidelines).

Holcim proposes to discontinue the monitoring of TPH monitoring from 2020 onwards as part of a rationalisation of the groundwater monitoring program.

### 3. Groundwater Impact Assessment Criteria – Updated for 2020

#### 3.1 Summary of Groundwater Impact Assessment Criteria

The baseline and operational groundwater monitoring program indicated the concentrations of the various water quality parameters are often exceeding the ANZECC default triggers value that were nominated in previous versions of the Water Management Plan.

Therefore data has been collected and criteria developed based on this long term monitoring data with comments to explain the rationale behind the 2020 trigger levels.

**Table 7 Groundwater Criteria 2020**

Parameter	Minimum Trigger	Maximum Trigger	General comment
<b>MP Bores</b>			
Depth to groundwater (metres)	1.64	28.05	This was the minimum and maximum levels since regular monitoring commenced in 2010
EC (µS/cm)	No minimum trigger required	11,521	This was the highest EC reading since monitoring commenced for the MP bores.
pH	4.2	9.5	These were the highest and lowest pH readings since monitoring commenced for the MP bores.
Sulphate (mg/L)	No minimum trigger required	152	This was the maximum level recorded since monitoring commenced for sulphate.
Total Nitrogen (mg/L)	No minimum trigger required	2.20	This was the maximum level recorded since monitoring commenced for total nitrogen.
Total Phosphorus(mg/L)	No minimum trigger required	3.02	This was the maximum levels recorded since monitoring commenced for total phosphorus.
<b>GPZ Bores</b>			
Depth to groundwater (metres)	2.13	23.9	This was the minimum and maximum levels since regular monitoring commenced of GPZ bores in April 2017.
EC (µS/cm)	No minimum trigger	8,020	This was the highest EC reading since monitoring commenced for the GPZ bores.
pH	6.1	7.8	These were the highest and lowest pH readings since monitoring commenced for the GPZ bores.
Sulphate (mg/L)	No minimum trigger required	76	This was the maximum level recorded since monitoring commenced for the GPZ bores.
Total Nitrogen (mg/L)	No minimum trigger required	5.0	This was the maximum level recorded since monitoring commenced for the GPZ bores.

Parameter	Minimum Trigger	Maximum Trigger	General comment
Total Phosphorus (mg/L)	No minimum trigger required	1.20	This was the maximum level recorded since monitoring commenced for the GPZ bores.

### 3.2 Response to Criteria Exceedances

The response to criteria exceedances are outlined in Section 8.1 of the Main Water Management Plan document and are summarised in the table below:

**Table 8 Response to Criteria Exceedances**

Key Element	Trigger/Response	Condition Green	Condition Amber	Condition Red
Groundwater Quality Outside Triggers	Trigger	Within Trigger Levels	One off exceedance of Trigger Levels	Two or More Exceedances of Trigger Levels (Consecutive months)
	Response	No action	Inspection of surface water monitoring location. Comparison of results against previous trends. No reporting required.	Review of trends. Reporting to DPIE and the EPA. Possible implementation of additional mitigation measures in liaison with the DPIE and EPA.

The investigation will include an analysis of the following variables to identify potential causes of adverse trends:

- Climate (including rainfall);
- Changes to project operations (e.g. quarrying areas, equipment etc.);
- Changes in geology of the area being quarried; and
- Changes in the use of groundwater from other industries, agriculture or the community.

The investigation may require more frequent monitoring to determine the cause of the adverse trend. The findings of any groundwater trigger investigations will also be reported in the Annual Review.

### 3.3 Monitoring Standards

Groundwater monitoring at Lynwood Quarry will be undertaken in accordance with relevant Australian Standards, legislation and NSW EPA approved methods for sampling. The Australian Standards and EPA approved methods relevant to the GMP are listed below:

- NSW EPA, 2004, Approved Methods for the Sampling and Analysis of Water Pollutants in New South Wales;
- AS/NZS 5667.1:1998 Water Quality – Sampling – Guidance on the Design of Sampling Programs, Sampling Techniques, and the Preservation and Handling of Samples; and
- AS/NZS 5667.11:1998 Water Quality - Sampling - Guidance on Sampling of Groundwaters.

## 4. Groundwater Management Measures

Holcim will undertake the following mitigation measures to further minimise groundwater impacts:

- Any sources of potential contamination such as fuels, lubricants, solvents, hydrocarbons and domestic and industrial waste be managed to prevent them from entering the groundwater system.
- Groundwater inflows to the pits are likely to be saline. Rather than discharging these to the natural drainage system, Holcim proposes to reuse this water in site water management system. There are very low volumes of inflow predicted as detailed in the Modification EA (Umwelt, 2015) and therefore management of groundwater in the site water management system will provide significant dilution of the groundwater inflows to the water management system and have negligible impact on the overall salinity of the water managed on site.
- The groundwater monitoring program will be reviewed and revised every year in accordance with the requirements of the Development Consent. The review will consider any adverse trends detected in either groundwater levels or quality, as well as changes to the Lynwood Quarry operations.
- Section 8 of the Water Management Plan main document outlines potential actions in the case of exceedance of triggers. These are repeated in the table below:

**Table 9 Trigger Action Response - Groundwater**

Key Element	Trigger / Response	Condition Green	Condition Amber	Condition Red
Water Quality Outside Triggers surface water and groundwater triggers in Appendix 2 and 3	Trigger	Within Trigger Levels	One off exceedance of Trigger Levels	Two or More Exceedances of Trigger Levels (Consecutive months)
	Response	No action	Inspection of surface water monitoring location. Comparison of results against previous trends. No reporting required.	Review of trends. Reporting to DPIE and the EPA. Possible implementation of additional mitigation measures in liaison with the DPIE and EPA.





## Appendix A – Depth to Groundwater

2004 to 2010 Data

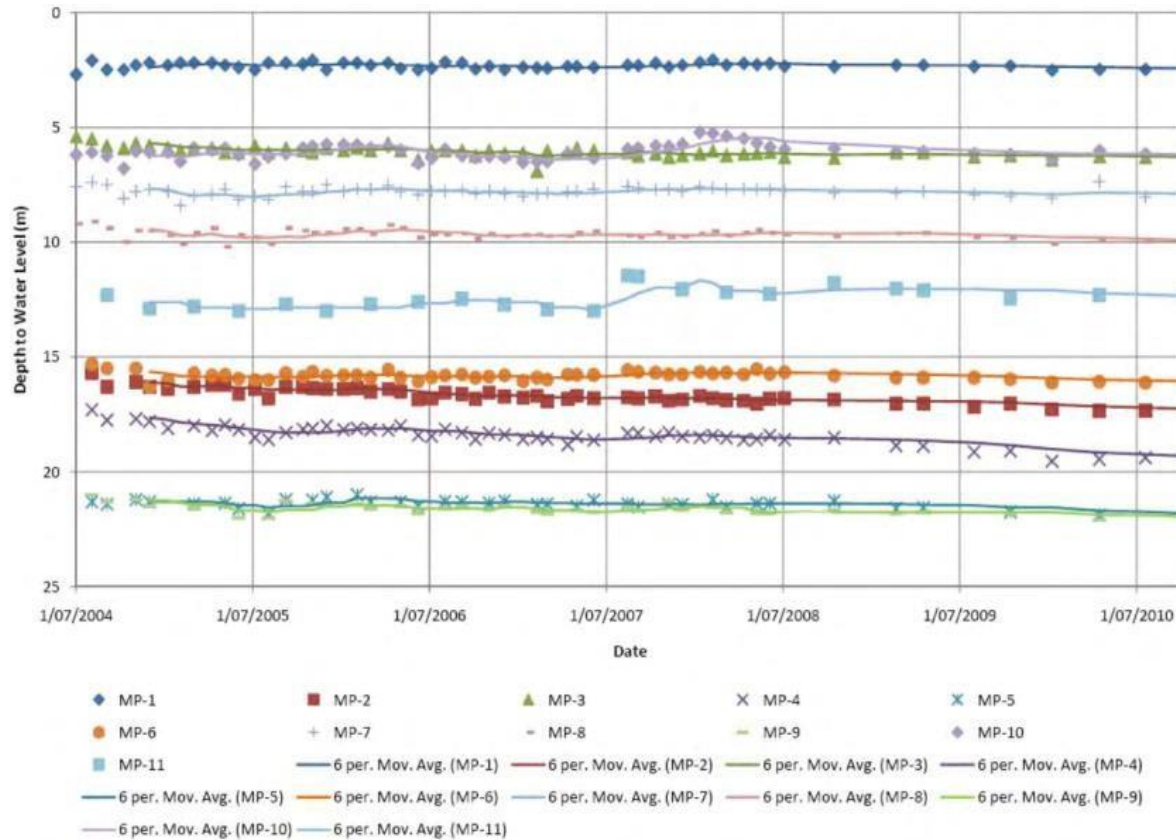


Figure A1 - Groundwater Hydrographs for the Sampling Period

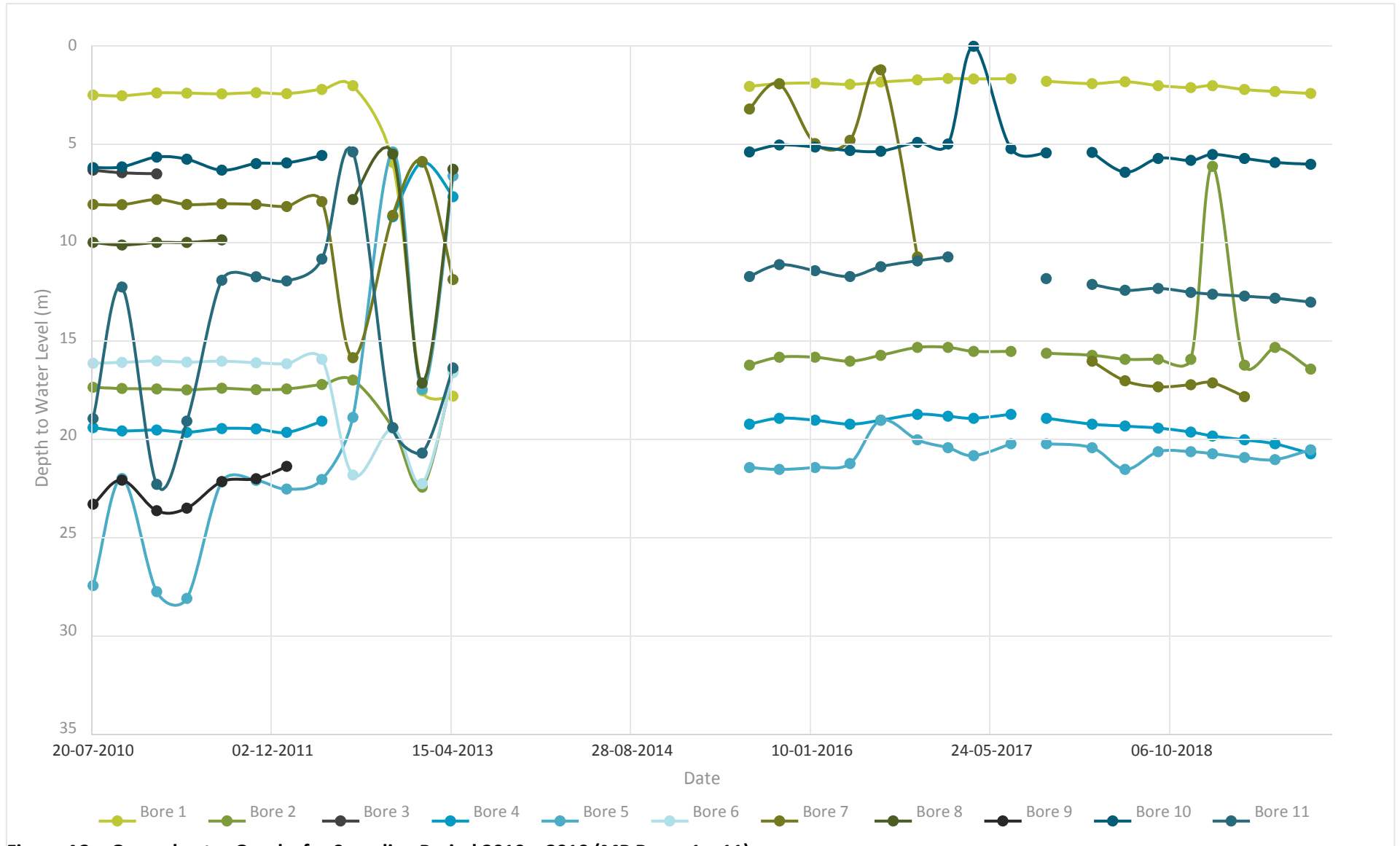


Figure A2 – Groundwater Graphs for Sampling Period 2010 – 2019 (MP Bores 1 – 11)

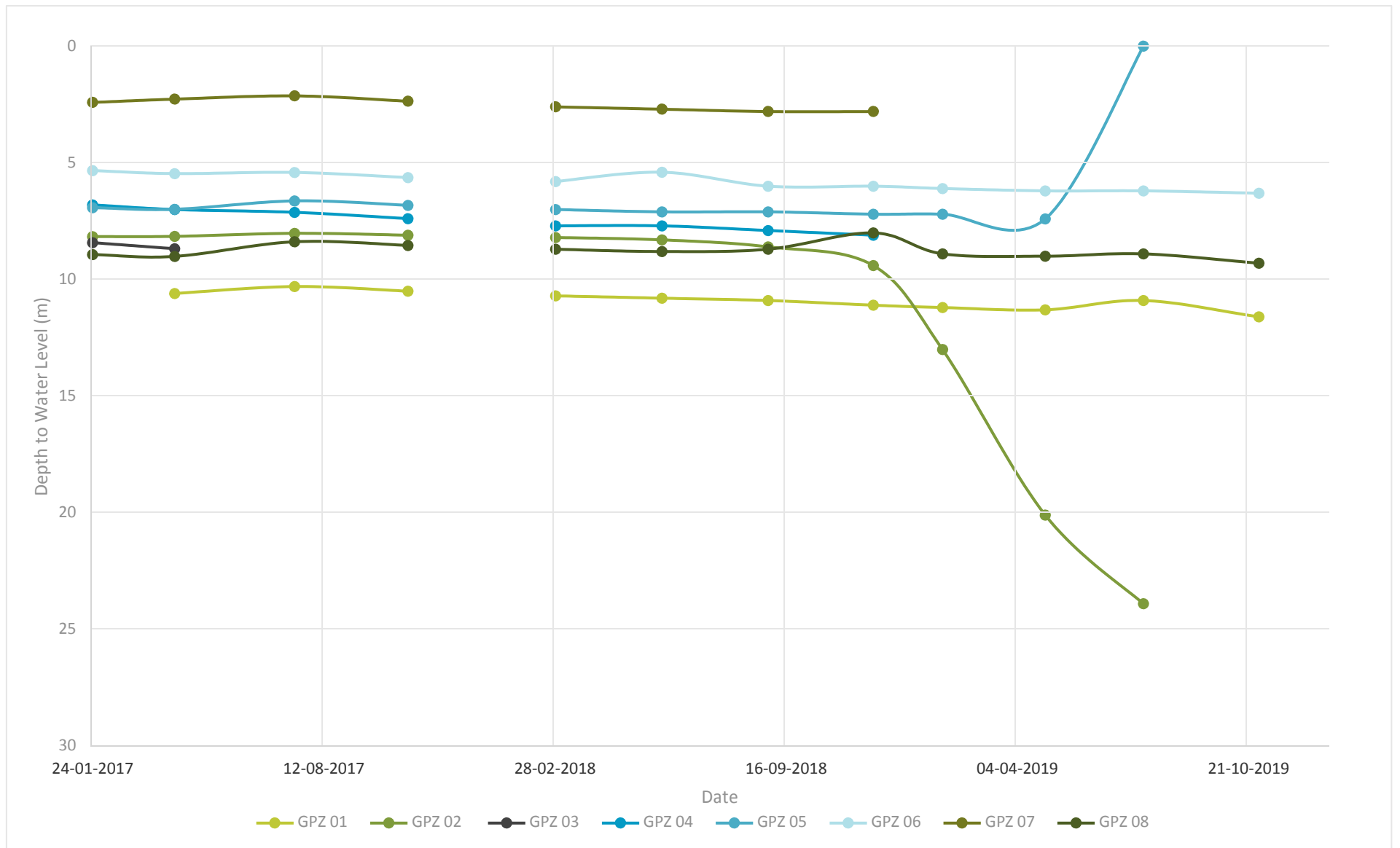


Figure A3 – Groundwater Graphs for Sampling Period 2017 – 2019 (GPZ Bores 1 - 8)



Date	Bore 1	Bore 2	Bore 3	Bore 4	Bore 5	Bore 6	Bore 7	Bore 8	Bore 9	Bore 10	Bore 11	GPZ 01	GPZ* 02	GPZ 03	GPZ 04	GPZ 05	GPZ 06	GPZ 07	GPZ 08
01-03-2018	1.9	15.7	NS	19.2	20.4	NS	16	NS	NS	5.4	12.1	10.7	8.2	NS	7.7	7	5.8	2.6	8.7
01-06-2018	1.8	15.9	NS	19.3	21.5	NS	17	NS	NS	6.4	12.4	10.8	8.3	NS	7.7	7.1	5.4	2.7	8.8
01-09-2018	2	15.9	NS	19.4	20.6	NS	17.3	NS	NS	5.7	12.3	10.9	8.6	NS	7.9	7.1	6	2.8	8.7
01-12-2018	2.1	15.9	NS	19.6	20.6	NS	17.2	NS	NS	5.8	12.5	11.1	9.4	NS	8.1	7.2	6	2.8	8
30-01-2019	2	6.1	NS	19.8	20.7	NS	17.1	NS	NS	5.5	12.6	11.2	13	NS	NS	7.2	6.1	NS	8.9
29-04-2019	2.2	16.2	NS	20	20.9	NS	17.8	NS	NS	5.7	12.7	11.3	20.1	NS	NS	7.4	6.2	NS	9
23-07-2019	2.3	15.3	NS	20.2	21	NS	NS	NS	NS	5.9	12.8	10.9	23.9	NS	NS	NS	6.2	NS	8.9
31-10-2019	2.4	16.4	NS	20.7	20.5	NS	NS	NS	NS	6	13	11.6	NS	NS	NS	NS	6.3	NS	9.3

<b>Average (m)</b>	<b>3.23</b>	<b>16.28</b>	<b>6.4</b>	<b>18.11</b>	<b>20.48</b>	<b>17.36</b>	<b>9.8</b>	<b>9.61</b>	<b>22.55</b>	<b>5.62</b>	<b>13.27</b>	<b>10.9</b>	<b>11.27</b>	<b>8.55</b>	<b>7.46</b>	<b>7.04</b>	<b>5.82</b>	<b>2.51</b>	<b>8.76</b>
<b>Minimum (m)</b>	<b>1.64</b>	<b>6.1</b>	<b>6.3</b>	<b>5.89</b>	<b>5.37</b>	<b>15.9</b>	<b>1.2</b>	<b>5.48</b>	<b>21.35</b>	<b>4.89</b>	<b>5.37</b>	<b>10.3</b>	<b>8.02</b>	<b>8.42</b>	<b>6.8</b>	<b>6.63</b>	<b>5.33</b>	<b>2.13</b>	<b>8</b>
<b>Maximum (m)</b>	<b>17.78</b>	<b>22.4</b>	<b>6.48</b>	<b>20.7</b>	<b>28.05</b>	<b>22.22</b>	<b>17.8</b>	<b>17.11</b>	<b>23.6</b>	<b>6.4</b>	<b>22.26</b>	<b>11.6</b>	<b>23.9</b>	<b>8.68</b>	<b>8.1</b>	<b>7.4</b>	<b>6.3</b>	<b>2.8</b>	<b>9.3</b>

\*Monitoring will no longer occur at GPZ02 as it will be removed due to the pit expansion.

## **APPENDIX B – Lynwood Groundwater Summary (Key Parameters)**

### **1. Prior to July 2011**

The tables in **Section 1** summarise the data from the 2018 version of the Water Management Plan. This is data from July 2004 to April 2011. It should be noted that the data in Section 1 was for pre quarrying baseline with the frequency and monitoring parameters changing since quarrying commenced.

### Ranges for Selected Water Quality Parameters

Monitoring Piezometer	pH	Conductivity μS/cm	Iron mg/L	Sulphate mg/L	Nitrate mg/L	Total Phosphate mg/L
MP-1	6.4 - 7.2	1057 - 10930	0.09 - 5.3	18 - 29	<0.01 - <0.2	0.07 - 0.29
MP-2	5.8 - 6.5	1008 - 10780	1.6 - 26	11 - 40	<0.01 - <0.2	0.02 - 0.33
MP-3	6.3 - 7.2	10388 - 11521	0.13 - 3.5	50 - 110	<0.01 - <0.3	0.02 - 0.08
MP-4	6.4 - 7.2	496 - 561	0.15 - 1.1	5.9 - 17	<0.01 - <0.2	0.04 - 0.17
MP-5	6.9 - 7.9	601 - 11410	0.65 - 5.1	4 - 4	<0.01 - <0.2	0.15 - 0.66
MP-6	6.9 - 7.8	2499 - 4670	0.33 - 2.45	1.6 - 24	<0.01 - <0.2	0.02 - 0.11
MP-7	6.5 - 7.3	5560 - 6320	0.37 - 11	19 - 31	<0.01 - <0.2	0.01 - 0.07
MP-8	6.3 - 7.0	2900 - 4471	0.93 - 11.2	14 - 38	<0.01 - <0.2	0.03 - 0.08
MP-9	6.8 - 7.8	742 - 3653	0.27 - 9.2	3 - 13	<0.01 - <0.2	0.05 - 0.49
MP-10	6.4 - 9.5	6120 - 7210	0.04 - 2.4	22 - 68	<0.01 - <0.2	0.02 - 1.23
MP-11	7.1 - 7.8	610 - 766	0.02 - 2.4	1.2 - 35	0.04 - <0.2	0.03 - 0.13



**Ranges for Total Petroleum Hydrocarbons (µg/L)**

<b>Monitoring Piezometer</b>	<b>C6-C9</b>	<b>C10-C14</b>	<b>C15-C28</b>	<b>C29-C36</b>	<b>Benzene</b>	<b>Toluene</b>	<b>Ethyl Benzer</b>	<b>Xylene</b>
<b>MP-1</b>	<20 - <25	<25 - 38	<100 - 350	<50 - 400	<1 - <1	<1 - 2	<1 - <2	<1 - <2
<b>MP-2</b>	<25 - 26	<25 - 34	<100 - 130	<50 - 100	<1 - <1	<1 - 12	<1 - <2	<2 - <2
<b>MP-3</b>	<21 - <25	<25 - 140	<100 - 640	<50 - 2600	<1 - <1	<1 - 11	<1 - <2	<2 - <2
<b>MP-4</b>	<25 - <25	<25 - 53	<100 - 300	<50 - 100	<1 - <2	<1 - 10	<1 - <2	<2 - <2
<b>MP-5</b>	<25 - 70	<25 - 180	<100 - 1550	<100 - 100	<1 - <1	<1 - 45	<1 - <2	<2 - <2
<b>MP-6</b>	<20 - 60	<25 - 568	<100 - 1300	<100 - 294	<1 - 21	<1 - 3	<1 - <2	<2 - <2
<b>MP-7</b>	<20 - <25	<25 - 63	<100 - 330	<50 - 100	<1 - <1	<1 - <2	<1 - <2	<2 - <2
<b>MP-8</b>	<20 - <25	<25 - 280	<25 - 170	<50 - 100	<1 - <1	<1 - 4	<1 - <2	<2 - <2
<b>MP-9</b>	<25 - 90	<25 - 5870	<100 - 6450	<100 - 3220	<1 - <1	<1 - 52	<1 - <2	<1 - 2.4
<b>MP-10</b>	<25 - 51	<25 - 114	<100 - 532	<100 - 206	<1 - <1	<1 - 28	<1 - <2	<2 - <2
<b>MP-11</b>	<25 - 33	<25 - 360	<100 - 1430	<100 - 420	<1 - <1	<1 - 22	<1 - <2	<2 - <2

## 2. July 2011 to now

### MP1

Monitoring Period	July 2011 - Current					
	EC (µS/cm)	pH	Sulphate (mg/L)	Total Dissolved Solids (mg/L)	Total Phosphorus (mg/L)	Total Nitrogen (mg/L)
<b>Average</b>	1051	6.2	24.6	583	0.56	0.28
<b>Minimum</b>	350	5.6	18.0	280	0.02	0.00
<b>Maximum</b>	1180	6.8	31.0	679	3.02	2.20

### MP2

Monitoring Period	July 2011 - Current					
	EC (µS/cm)	pH	Sulphate (mg/L)	Total Dissolved Solids (mg/L)	Total Phosphorus (mg/L)	Total Nitrogen (mg/L)
<b>Average</b>	365	5.5	11.4	259	0.18	0.30
<b>Minimum</b>	170	4.7	5.8	62	0.02	0.00
<b>Maximum</b>	907	6.2	18.0	560	0.40	0.98

### MP3

Monitoring Period	July 2011 – April 2015					
	EC (µS/cm)	pH	Sulphate (mg/L)	Total Dissolved Solids (mg/L)	Total Phosphorus (mg/L)	Total Nitrogen (mg/L)
<b>Average</b>	10202	6.6	84.5	7050	0.07	0.52
<b>Minimum</b>	9000	6.1	48.0	6100	0.02	0.46
<b>Maximum</b>	11279	7.2	120.0	8600	0.10	0.57

**MP4**

Monitoring Period	July 2011 – Current					
	EC (µS/cm)	pH	Sulphate (mg/L)	Total Dissolved Solids (mg/L)	Total Phosphorus (mg/L)	Total Nitrogen (mg/L)
<b>Average</b>	473	6.3	9.3	294	0.16	0.10
<b>Minimum</b>	436	5.9	4.4	220	0.03	0.00
<b>Maximum</b>	542	6.8	17.0	340	0.40	0.19

**MP5**

Monitoring Period	July 2011 – Current					
	EC (µS/cm)	pH	Sulphate (mg/L)	Total Dissolved Solids (mg/L)	Total Phosphorus (mg/L)	Total Nitrogen (mg/L)
<b>Average</b>	961	6.4	3.8	722	0.23	0.66
<b>Minimum</b>	830	6.0	0.4	498	0.02	0.00
<b>Maximum</b>	1300	6.8	13.0	1700	0.40	1.20

**MP6**

Monitoring Period	July 2011 – April 2015					
	EC (µS/cm)	pH	Sulphate (mg/L)	Total Dissolved Solids (mg/L)	Total Phosphorus (mg/L)	Total Nitrogen (mg/L)
<b>Average</b>	4611	6.7	22.0	3283	0.05	0.11
<b>Minimum</b>	4446	6.0	19.0	2700	0.02	0.00
<b>Maximum</b>	4800	7.1	24.0	4000	0.11	0.42

**MP7**

Monitoring Period	July 2011 – Current					
	EC (µS/cm)	pH	Sulphate (mg/L)	Total Dissolved Solids (mg/L)	Total Phosphorus (mg/L)	Total Nitrogen (mg/L)
<b>Average</b>	6374	6.4	45.1	4428	0.15	0.13
<b>Minimum</b>	4740	5.8	19.0	3500	0.00	0.00
<b>Maximum</b>	8090	7.2	108.0	5000	0.40	0.43

**MP8**

Monitoring Period	July 2011 – January 2011					
	EC (µS/cm)	pH	Sulphate (mg/L)	Total Dissolved Solids (mg/L)	Total Phosphorus (mg/L)	Total Nitrogen (mg/L)
<b>Average</b>	4547	6.4	32.5	2950	0.05	0.19
<b>Minimum</b>	4455	6.2	32.0	2500	0.03	0.19
<b>Maximum</b>	4639	6.6	33.0	3400	0.06	0.19

\*Note there was only two samples from this location, hence limited data variability.

**MP9**

Monitoring Period	July 2011 – October 2011					
	EC (µS/cm)	pH	Sulphate (mg/L)	Total Dissolved Solids (mg/L)	Total Phosphorus (mg/L)	Total Nitrogen (mg/L)
<b>Average</b>	3063	6.4	8.0	1933	0.09	0.59
<b>Minimum</b>	3018	6.0	7.0	1700	0.05	0.59
<b>Maximum</b>	3120	6.6	8.9	2100	0.16	0.59

\*Note there was only three samples from this location, hence limited data variability.

**MP10**

<b>Monitoring Period</b>	<b>July 2011 – Current</b>					
	EC ( $\mu$ S/cm)	pH	Sulphate (mg/L)	Total Dissolved Solids (mg/L)	Total Phosphorus (mg/L)	Total Nitrogen (mg/L)
<b>Average</b>	6793	6.5	51.9	4777	0.24	0.11
<b>Minimum</b>	737	5.8	15.0	4000	0.02	0.00
<b>Maximum</b>	7580	7.3	152.0	5400	0.40	0.24

**MP11**

<b>Monitoring Period</b>	<b>July 2011 – Current</b>					
	EC ( $\mu$ S/cm)	pH	Sulphate (mg/L)	Total Dissolved Solids (mg/L)	Total Phosphorus (mg/L)	Total Nitrogen (mg/L)
<b>Average</b>	987	6.8	10.5	422	0.25	0.17
<b>Minimum</b>	610	6.2	3.2	340	0.03	0.00
<b>Maximum</b>	6780	7.3	22.0	449	0.40	0.32

**MP Summary:**

Summary Across All MP's						
	EC ( $\mu$ S/cm)	pH	Sulphate (mg/L)	Total Dissolved Solids (mg/L)	Total Phosphorus (mg/L)	Total Nitrogen (mg/L)
<b>Average</b>	3,590	6.3	22.6	1916	0.25	0.26
<b>Minimum</b>	170	4.7	0.4	62	0.00	0.00
<b>Maximum</b>	11279	7.3	152.0	8600	3.02	2.20

**GP01**

Monitoring Period	April 2017 – Current					
	EC (µS/cm)	pH	Sulphate (mg/L)	Total Dissolved Solids (mg/L)	Total Phosphorus (mg/L)	Total Nitrogen (mg/L)
<b>Average</b>	3536	6.8	33.4	2547	0.40	0.09
<b>Minimum</b>	2970	6.4	17.0	2420	0.40	0.06
<b>Maximum</b>	4470	7.2	76.0	2670	0.40	0.14

**GP02**

Monitoring Period	April 2017 – Current*					
	EC (µS/cm)	pH	Sulphate (mg/L)	Total Dissolved Solids (mg/L)	Total Phosphorus (mg/L)	Total Nitrogen (mg/L)
<b>Average</b>	3536	6.8	33.4	2547	0.40	0.09
<b>Minimum</b>	2970	6.4	17.0	2420	0.40	0.06
<b>Maximum</b>	4470	7.2	76.0	2670	0.40	0.14

\*GPZ02 will be removed as part of the pit expansion.

**GP03**

Monitoring Period	April 2017 only					
	EC (µS/cm)	pH	Sulphate (mg/L)	Total Dissolved Solids (mg/L)	Total Phosphorus (mg/L)	Total Nitrogen (mg/L)
<b>Average</b>	4130	6.7	1.7	NS	NS	NS
<b>Minimum</b>	4130	6.7	1.7	NS	NS	NS
<b>Maximum</b>	4130	6.7	1.7	NS	NS	NS

\*one sample only

**GP04**

Monitoring Period	April 2017 – December 2018					
	EC (µS/cm)	pH	Sulphate (mg/L)	Total Dissolved Solids (mg/L)	Total Phosphorus (mg/L)	Total Nitrogen (mg/L)
<b>Average</b>	2377	6.7	17.1	NS	0.40	2.75
<b>Minimum</b>	1970	6.3	4.9	NS	0.40	2.22
<b>Maximum</b>	2950	7.3	23.7	NS	0.40	3.17

**GP05**

Monitoring Period	April 2017 – Current					
	EC (µS/cm)	pH	Sulphate (mg/L)	Total Dissolved Solids (mg/L)	Total Phosphorus (mg/L)	Total Nitrogen (mg/L)
<b>Average</b>	3845	7.5	26.9	2045	0.40	0.87
<b>Minimum</b>	3680	7.1	11.8	2020	0.40	0.41
<b>Maximum</b>	4100	7.8	73.0	2070	0.40	1.04

**GP06**

Monitoring Period	April 2017 – Current					
	EC (µS/cm)	pH	Sulphate (mg/L)	Total Dissolved Solids (mg/L)	Total Phosphorus (mg/L)	Total Nitrogen (mg/L)
<b>Average</b>	1873	6.7	31.9	1047	0.40	2.78
<b>Minimum</b>	1710	6.2	25.3	1000	0.40	0.23
<b>Maximum</b>	1980	7.0	40.0	1080	0.40	5.00



**GP07**

Monitoring Period	April 2017 – December 2018					
	EC (µS/cm)	pH	Sulphate (mg/L)	Total Dissolved Solids (mg/L)	Total Phosphorus (mg/L)	Total Nitrogen (mg/L)
<b>Average</b>	1740	7.0	2.0	NS	0.40	0.51
<b>Minimum</b>	604	6.2	0.8	NS	0.40	0.26
<b>Maximum</b>	8020	7.5	3.1	NS	0.40	0.92

**GP08**

Monitoring Period	March 2018 - Current					
	EC (µS/cm)	pH	Sulphate (mg/L)	Total Dissolved Solids (mg/L)	Total Phosphorus (mg/L)	Total Nitrogen (mg/L)
<b>Average</b>	2434	6.7	5.9	1513	0.40	1.85
<b>Minimum</b>	2200	6.3	0.4	1330	0.40	1.67
<b>Maximum</b>	2520	7.1	14.0	1720	0.40	2.29

**GP10**

Monitoring Period	April 2017 – October 2017					
	EC (µS/cm)	pH	Sulphate (mg/L)	Total Dissolved Solids (mg/L)	Total Phosphorus (mg/L)	Total Nitrogen (mg/L)
<b>Average</b>	7047	6.1	29.1	NS	NS	NS
<b>Minimum</b>	6930	6.1	27.8	NS	NS	NS
<b>Maximum</b>	7180	6.2	30.7	NS	NS	NS

**GP11**

Monitoring Period		October 2017 only				
	EC (µS/cm)	pH	Sulphate (mg/L)	Total Dissolved Solids (mg/L)	Total Phosphorus (mg/L)	Total Nitrogen (mg/L)
<b>Average</b>	639	6.5	7.3	NS	NS	NS
<b>Minimum</b>	639	6.5	7.3	NS	NS	NS
<b>Maximum</b>	639	6.5	7.3	NS	NS	NS

\*one sample only

**GP Summary:**

Summary Across All GP's						
	EC (µS/cm)	pH	Sulphate (mg/L)	Total Dissolved Solids (mg/L)	Total Phosphorus (mg/L)	Total Nitrogen (mg/L)
<b>Average</b>	2604	6.9	22.9	1504	0.47	1.29
<b>Minimum</b>	604	6.1	0.4	542	0.40	0.06
<b>Maximum</b>	8020	7.8	76.0	2670	1.20	5.00

## Appendix C – Groundwater Monitoring Program

Holcim are proposing a streamlined groundwater monitoring program for the 2020 management plan update. This would involve continuing to monitor three monthly for key parameters (**Table 1**) and then monitoring annually (**Table 2**) for other parameters.

**Table 1 Three monthly Testing**

Parameter	Units
pH Value	
Conductivity @ 25'C	µS/cm
Total Dissolved Solids (TDS)	mg/L
Hardness as CaCO <sub>3</sub>	mg/L
Sodium - Filtered	mg/L
Potassium - Filtered	mg/L
Carbonate as CaCO <sub>3</sub>	mg/L
Sulphate - Filtered	mg/L
Chloride	mg/L

**Table 2 Annual Testing**

<b>DISSOLVED METALS</b>	
Iron - Filtered	µg/L
Silver - Filtered	µg/L
Aluminium - Filtered	µg/L
Antimony - Filtered	µg/L
Barium - Filtered	µg/L
Beryllium - Filtered	µg/L
Boron - Filtered	µg/L
Cadmium - Filtered	µg/L
Chromium - Filtered	µg/L
Cobalt - Filtered	µg/L
Copper - Filtered	µg/L
Manganese - Filtered	µg/L
Molybdenum - Filtered	µg/L
Nickel - Filtered	µg/L
Lead - Filtered	µg/L
Selenium - Filtered	µg/L
Zinc - Filtered	µg/L
Mercury - Filtered	µg/L

<b>Parameter</b>	<b>Units</b>
WAD Cyanide	µg/L
Calcium - Filtered	mg/L
Magnesium - Filtered	mg/L
Bicarbonate as CaCO <sub>3</sub>	mg/L
Ammonia as N	mg/L
Nitrate as N	mg/L
Total Kjeldahl Nitrogen as N	mg/L
Total Phosphorus as P	mg/L
Reactive Phosphorus as P	mg/L
Total Cations	me/L
Total Anions	me/L
Actual (Anion / Cation) Difference	me/L
Allowed (Anion / Cation) Difference	me/L
<b>TOTAL PETROLEUM HYDROCARBONS</b>	
C6-C9 Fraction	µg/L
C10-C14 Fraction	µg/L
C15-C28 Fraction	µg/L
C29-C36 Fraction	µg/L
Total C10 - C36	µg/L
<b>BTEX</b>	
Benzene	µg/L
Toluene	µg/L
Chlorobenzene	µg/L
Ethylbenzene	µg/L
meta- & para-Xylene	µg/L
ortho-Xylene	µg/L

## APPENDIX 4 CONSULTATION FOR THE MANAGEMENT PLAN

The table below outlined 2018 consultation for the Water Management Plan. There were no comments received for the Water management plan during 2020 consultant.

Copies of the Draft 2020 management plan have be sent out the required government agencies (EPA, WaterNSW, DPI Water and DPI Fisheries). This 2020 management plan has been updated to reflect the relevant feedback from these agencies..

### Response to DPE comments on Draft Lynwood Water Management Plan (2018)

DPE Comment	DPE Satisfactory Status (Yes/No)	Comment	Action Required	Update to Lynwood Quarry WMP
20. The Applicant must prepare a Water Management Plan for the development to the satisfaction of the Secretary. In addition to the standard requirements for management plans (see condition 2 of Schedule 5) this plan must: (a) be prepared in consultation with the EPA, WaterNSW, DPI Water and DPI Fisheries;	No	Agencies have provided detailed comments on the WMP, particularly with regard to water quality criteria. DPI – Fisheries has asked that it be given an opportunity to review the draft plan once amended in response to its comments	- Holcim must provide the revised WMP to agencies, as well as a table showing the consolidated agency comments and Holcim’s response to each comment. - Holcim must ask agencies whether or not they are satisfied with the revised WMP before resubmitting it to DPE.	Noted - table of Holcim responses to be provided to agencies with draft plan updates.
(b) be submitted to the Secretary for approval by 30 November 2016, unless otherwise agreed by the Secretary;	Yes	The WMP was submitted 19 Oct 2016	ND	Satisfactory - no response required
(c) include a Water Balance;	Yes, included in 3.1 to 3.4, but see comments for Condition 21 below	ND	ND	
(d) include an Erosion and Sediment Control Plan;	Yes, included in Section 4	ND	ND	
(e) include a Surface Water Monitoring Program;	Yes, included as Appendix 2, but see comments for condition 23 below	ND	ND	
(f) include a Ground Water Monitoring Program; and	Yes, included as Appendix 3	ND	ND	
(g) include a Surface and Ground Water Response Plan to address any potential adverse impacts associated with the development.	Yes, included in Section 6	ND	ND	
21. The Water Balance must: (a) include details of all water extracted (including water make), dewatered, transferred, used and/or discharged by quarry; and	No	- Please check the second dot point on page 13 as it doesn’t make sense – not sure if it is meant to be two or more dot points. - In section 3.5, please reconsider whether vague expressions such as “where practical” and “where appropriate” could be deleted.	Please consider comments and amend plan	
(b) describe measures to minimise water use by the development.	No	As Holcim do not propose to use the supernatant from the Marulan Water Treatment Plant at this time, please consider whether references to this can be deleted.	Please consider comments and amend plan	DPE comments considered. As this is a potential future water source it has been retained within the text of the WMP.

<p>22. The Erosion and Sediment Control Plan must:</p> <p>(a) be consistent with the requirements of the Landcom's Managing Urban Stormwater: Soils and Construction manual;</p> <p>(b) identify activities that could cause soil erosion and generate sediment;</p> <p>(c) describe measures to minimise soil erosion and the potential for the transport of sediment to downstream waters;</p> <p>(d) describe the location, function, and capacity of erosion and sediment control structures; and</p> <p>(e) describe what measures would be implemented to maintain (and if necessary decommission) the structures over time.</p>	<p>Yes</p>	<p>ND</p>	<p>ND</p>	<p>Satisfactory - no response required</p>
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<p>23. The Surface Water Monitoring Program must include:                  (a) detailed baseline data on surface water flows and quality in Joarimin Creek, Lockyersleigh Creek, and Marulan Creek;                  (b) surface water impact assessment criteria;</p>	<p>No</p>	<p>- Section 4 of this document needs to be carefully reconsidered against the water discharge limits in the consent and the comments provided by agencies.                  - This section seems to include “trigger values” developed from ANZECC Guidelines.                  - Please note that the condition 17 of Schedule 3 states that “except as may be expressly provided by a Licence,” the water discharge limits in condition 17 must be complied with.</p>	<p>Please consider comments and amend plan</p>	<p>- Section 4.2.2 updated to reflect this requirement.                  - SWMP table 4.1 updated to include an additional column specifying trigger limits as per Condition 17 of schedule 3 of the Consent</p>
<p>(c) a program to monitor surface water flows and quality;                  (d) a protocol for the investigation of identified exceedances of the surface water impact assessment criteria; and                  (e) a program to monitor the effectiveness of the Erosion and Sediment Control Plan.</p>	<p>No</p>	<p>Please also reconsider the last paragraph in Section 5.0. Once the WMP is approved by the Secretary, any amendments (such as discontinuing the monitoring of some parameters) need to be approved by the Secretary (following consultation with agencies).</p>	<p>Please consider comments and amend plan</p>	<p>Section 5.0 SWMP- Text updated to include reference to approval by DPE.</p>
<p>24. The Ground Water Monitoring Program must include:                  (a) detailed baseline data on ground water levels, flows, and quality, based on statistical analysis;                  (b) groundwater impact assessment criteria for monitoring bores;                  (c) a program to monitor regional ground water levels and quality; and                  (d) a protocol for the investigation of identified exceedances of the groundwater impact assessment criteria.                  Note: The surface and ground water monitoring programs must be consistent with the current version of Approved Methods for the Sampling and Analysis of Water Pollutants in New South Wales (OEH).</p>	<p>Yes</p>	<p>ND</p>	<p>ND</p>	<p>Satisfactory – no response required</p>
<p><b>General Comments:</b>                  Please search for and remove references to the quarry being approved for a “30 year period” .It would be clearer to state that Holcim has approval to carry out quarrying operations until 1 January 2038</p>				<p>Section 1 and Section 1.1 updated to reflect DPE comments regarding approval period.</p>
<p>Please include a document control table at the front of this document. During the drafting process, this would provide a useful record of when agencies were consulted and when the document was updated in response</p>				<p>Text updated to include disclaimer and document control table at the front of the documents.</p>
<p>Please include an Appendix detailing the agency consultation undertaken. Copies of correspondence from agencies should be included.</p>				<p>Text of the WMP updated to include Appendix for agency consultation.</p>

Note: ND= No data provided in email correspondence from DPE.

**2018 EPA Comments.** There were no comments received for the Water management plan during 2020 consultant.

EPA Comments			
Comment ID	EPA Comment	Proposed Lynwood Response (2016 Previously provided to Holcim)	Lynwood Proposed Response (updated 2018)
	<b>Lynwood Quarry Water Management Plan July 2017</b>		
1	P12: Final paragraph. Sentence starting "Any proposed coagulant..." should be split, as "constructing access road..." may be a new dot point. Otherwise, paragraph does not read properly.	Updated in text	Section 4.2 point 7 (pg. 13) has been revised and separated accordingly in the WMP.
	<b>Lynwood Quarry Surface Water Monitoring Program July 2017</b>		
2	P7: First paragraph, last sentence: "The elevation at the Lynwood Quarry is typically higher than 30mAHD." While true, perhaps this should read "typically higher than 630mAHD?"	Updated in text	Section 3.0 Paragraph 1 - this sentence has been revised to include the elevation of Lynwood Quarry is "typically higher than 630mAHD".
3	P10: First dot point should be split into two separate dot points.	Updated in text	Section 5.3 - dot points updated to read as separate points
	<b>Lynwood Quarry Groundwater Monitoring Program July 2017</b>		
4	P10: under 4.1 Monitoring Standards, references to "OEH" should be replaced by "EPA".	Updated in text	Section 4.1 - this section has been updated to Section 3.1 in the document. Reference to OEH has been removed and replaced with reference to EPA.



**2018 DPI Fisheries Comments.** There were no comments received for the Water management plan during 2020 consultant. Response attached as Appendix.

DPI Fisheries Comment			
Comment ID	Water Management Plan	Proposed Lynwood Response (2016 Previously provided to Holcim)	Lynwood Proposed Response (updated 2018)
1	Section 4.1, point 1 - The use of the word "substantial" in this paragraph makes the intent of the point unclear. A suggested amendment is 'Erosion and sediment controls should be established prior to <b>any</b> construction works commencing.'	Section 4.1 has been updated to remove " <i>substantial</i> " and replace with " <i>any</i> ".	Section 4.1 point 1 has been updated to remove " <i>substantial</i> " and replace with " <i>any</i> ".
2	point 2 - A time frame for the seeding of disturbed areas should be included. It should be conducted as soon as practically possible.	Seeding will be undertaken as soon as practically possible. An exact timeframe cannot be given for re-seeding of disturbed areas as the exact duration of construction works is unknown at this time. The text of the WMP has been updated to clarify the situation.	Section 4.1 point 2 updated to include details of seeding and expected timeframes that this activity will occur.
3	point 7 - when a storm or significant rainfall event is imminent an inspection of <b>all</b> sediment and erosion controls should be conducted to ensure that they will operate effectively during the coming rain event. Additionally, the predicted rainfall event for which this action is undertaken should be specified, this will prevent the need for unnecessary action during small (low risk) events and ensure that it is undertaken during larger (high risk) events. Our recommendation is for this to be undertaken when rainfall of 25mm or more is predicted.	As outlined in Section 7.2, all ESC will be inspected daily during construction. 25 mm rainfall trigger to be included in the text.	Section 4.1 point 7 has been updated to include details of erosion and sediment control inspection requirements.
4	A clarifying statement should be included that any construction plan to be developed will ensure that the objectives of the Water Management Plan will be met.	Agreed - this has been updated in the text.	Section 4.1 - additional details have been added to the development of construction plans to indicate that these plans will be developed in consideration of the objectives of the Water Management Plan
5	Topsoil stockpiles should be seeded or stabilised in addition to being surrounded by sediment fencing	Long-term stockpiles (greater than 6 months) will be seeded or stabilised. This information is currently in the site Rehab and Landscape Management Plan. Updated in text	Section 4.1 - details of the management of long-term stockpiles (greater than 6 months) has been included in the text
6	Section 4.2, Could you please provide us with a copy of the RAMPs for works proposed in the riparian zones.	DPI-Fisheries are not required to be consulted in the preparation of the RAMPs in accordance with Condition 45 of Schedule 3 of the Lynwood Quarry Development Consent. A link to the Lynwood Quarry website will be provided to DPI Fisheries once the documents are complete.	In accordance with Condition 45 of Schedule 3 of the Lynwood Quarry Development Consent, Lynwood Quarry has consulted with OEH, DPI Water and Goulburn Council regarding to the Riparian Area Management Plans (RAMPs). A link to the Lynwood Quarry website will be provided to DPI Fisheries once the documents approved.
7	Section 7.0, We support the daily inspection of erosion and sediment controls during construction along with weekly inspection during operation. An additional requirement for inspection prior to predicted rainfall events exceeding 25mm should be included	Construction ESC will be inspected daily operational ESC will be inspected monthly where rainfall events of greater than 25 mm in a 24 hr period are predicted, an additional inspection of operational phase ESC will be undertaken. Updated in text.	Section 7.3 - Operational inspection requirements are included in Section 7.3 of the WMP. A sentence has been included in the text to detail the inspection requirements associated with predicted rainfall of 25mm or greater.
8	A commitment to undertake annual independent auditing of water quality management and reporting should be included.	An annual review of water management and water related performance monitoring of the site will be undertaken as part of the Annual Environmental Review of operations required by DPE in accordance with Condition 10 of Schedule 5 of the Development Consent. An Independent Environmental Audit is also required to be undertaken on a 3-yearly basis in accordance with Condition 11 of Schedule 5 of the Development Consent	Section 9 of WMP - An annual review of water management and water related performance monitoring of the site will be undertaken as part of the Annual Environmental Review of operations required by DPE in accordance with Condition 10 of Schedule 5 of the Development Consent. An Independent Environmental Audit is also required to be undertaken on a 3-yearly basis in accordance with Condition 11 of Schedule 5 of the Development Consent
	<b>Surface Water Monitoring Program</b>		

<p>9</p>	<p>As was expressed in our response to the modification proposals, our key concern relates to the degradation of downstream water quality and aquatic habitats resulting from sediment and pollutants leaving the quarry workings and passing into downstream waterways including Lockyersleigh Creek, Jaorimin Creek and the Wollondilly River.</p> <p>Our previous advice was that 'a comprehensive water quality management and monitoring plan specific to the expanded proposal with a focus on the highest risk parameter (suspended sediment) needs to be developed.... . The plan should be designed to achieve and demonstrate at least a neutral outcome for receiving waters and must include details of planned sediment basins, adopted rainfall recurrence interval, monitoring and mitigation measures and standards that the proponent intends to meet. The standards should be based on a comparison of background levels before and after the development'.</p> <p>Of primary concern with the monitoring program proposed, is the baseline data that has been used and the trigger values that have been set. Baseline data is used to compare the water quality prior to construction of the quarry with water quality following construction of the quarry. This comparison enables a determination to be made as to what, if any, impact quarry operations is having on water quality. All data used to obtain baseline values has been collected from waterways impacted by current quarry operations. To obtain suitable baseline data for comparison, samples will need to be taken from equivalent waterways outside (i.e. upstream) of the quarry's area of impact. Where water quality trigger values have been determined using previous water sampling (i.e.; including current impacts from the quarry) these values are well above the ANZECC guidelines, e.g.; The value selected for total nitrogen is more than 8 times the ANZECC value for upland rivers, the value selected for phosphorus is 10 times the ANZECC value for upland rivers.</p> <p>Should adequate baseline data be unavailable then use of default ANZECC guidelines would be suitable. However the ANZECC guidelines referenced in the plan are based on lowland river values. Section 3.0 defines an upland river system as a river with an elevation &gt;150m AHD, it also states that the elevation at the Lynwood Quarry as being 'typically higher than 30m AHD'. The altitude of Marulan is 648m AHD, this is well above 150m AHD and would classify the system as an upland river system, therefore any ANZECC values used should be those of upland river systems.</p>	<p>The surface water baseline data utilised in the Surface Water Monitoring Program is data collected from monitoring within the creeks in the vicinity of the Lynwood Pit area prior to the commencement of construction of the site. The baseline data collected shows that the water quality within the creeks was in exceedance of ANZECC guideline values prior to the commencement of construction.</p> <p>As baseline data collected from creeks in the vicinity of Lynwood Quarry was in exceedance of ANZECC Trigger values for upland rivers prior to the commencement of construction, site specific trigger values utilised as criteria for Lynwood Quarry have been calculated based on an analysis of baseline information. These trigger values are utilised for monitoring locations SW5 and SW6, while monitoring of the site sediment dams and new surface water monitoring locations related to the Granite Pit area (SW8 to SW11) will be assessed against the criteria provided in Condition 17 of Schedule 3 of the Lynwood Quarry Development Consent.</p> <p>Additional monitoring points for creeks in the vicinity of the Granite Pit area were commenced post EA lodgement and any baseline information obtained from these creeks prior to the construction of the Granite Pit will be utilised to inform future updates of the Surface Water Monitoring Program.</p>	<p>The surface water baseline data utilised in the development of Version 1 of the Surface Water Monitoring Program was data collected from monitoring within the creeks in the vicinity of the Lynwood Pit area prior to the commencement of construction of the site. The baseline data collected shows that the water quality within the creeks was in exceedance of ANZECC guideline values prior to the commencement of construction.</p> <p>As baseline data collected from creeks in the vicinity of Lynwood Quarry was in exceedance of ANZECC Trigger values for upland rivers prior to the commencement of construction, site specific trigger values utilised as criteria for Lynwood Quarry have been calculated based on an analysis of baseline information. These trigger values are utilised for monitoring locations SW5 and SW6 while monitoring of the site sediment dams and new surface water monitoring locations related to the Granite Pit area (SW8 to SW11) will be assessed against the criteria provided in Condition 17 of Schedule 3 of the Lynwood Quarry Development Consent. Section 4.0 Table 4.1 of the SWMP has been updated to include trigger values for site water management dams.</p>
<p>10</p>	<p>No data regarding current levels of suspended sediments generated by operations has been provided, and no baseline has been determined. The ANZECC guidelines for turbidity in upland rivers is 2-25 ntu, however a value of 50ntu has been selected, the rationale behind this value needs to be provided.</p>	<p>All water from site disturbance areas is managed within the site dirty water management system. Water management dams have been designed and constructed in accordance with 'Bluebook' requirements (Landcom 2004 - Soils and Construction Volume 2E - Mines and Quarries).</p> <p>As detailed in Condition 17 of Schedule 3 of the Development Consent, DP&amp;E have defined a limit of 50mg/L for Total Suspended Solids for discharges from site sediment dams. It is also the standard used in Environment Protection Licences in NSW and is considered appropriate.</p>	<p>All water from site disturbance areas is managed within the site dirty water management system. Water management dams have been designed and constructed in accordance with 'Bluebook' requirements (Landcom 2004 - Soils and Construction Volume 2E - Mines and Quarries).</p> <p>As detailed in Condition 17 of Schedule 3 of the Development Consent, DP&amp;E have defined a limit of 50mg/L for Total Suspended Solids for discharges from site sediment dams. It is also the standard used in Environment Protection Licences in NSW and is considered appropriate.</p> <p>Section 4.0 of the SWMP details the requirements of Condition 17 of Schedule 3 of the Development Consent. DPE defines a limit of 50mg/L for Total Suspended Solids for discharges from site sediment dams which has been used as trigger values for the Project as this value is in line with Lynwood's approvals.</p>

11	It is noted that values of water quality emanating from the quarry exceed ANZECC trigger values for upland river systems for all water quality parameters.	Baseline data, as obtained from the creeks in the vicinity of Lynwood Quarry prior to the commencement of quarry construction, shows the creek systems to be in exceedance of ANZECC default criteria and therefore site specific triggers have been developed based on an analysis of the baseline data in accordance with the ANZECC Guidelines. Due to the baseline water quality, the use of 'upland river' ANZECC trigger values are not considered appropriate for this site.	Section 4.0 - Baseline data, as obtained from the creeks in the vicinity of Lynwood Quarry prior to the commencement of quarry construction, shows the creek systems to be in exceedance of ANZECC default criteria and therefore site specific triggers have been developed based on an analysis of the baseline data in accordance with the ANZECC Guidelines. Due to the baseline water quality, the use of 'upland river' ANZECC trigger values are not considered appropriate for this site.
12	DPI Fisheries policy is that all developments should aim to achieve no net impacts on receiving waters. Additionally the quarry is situated within the Sydney drinking water catchment so water quality management must be designed to have a neutral or beneficial impact on receiving water ways. There has been no assessment included in the plan referencing either of these objectives.	Please refer to the Environmental Assessment 'Lynwood Quarry Extraction Area Modification' (Umwelt 2015) for environmental assessment related information. The approved modification to Lynwood Quarry has been designed such that the project will have a neutral or beneficial impact on receiving waterways. The management plan will be revised to reference that the project will have a neutral and beneficial effect on receiving waterways.	Please refer to the Environmental Assessment 'Lynwood Quarry Extraction Area Modification' (Umwelt 2015) for environmental assessment related information. The approved modification to Lynwood Quarry has been designed such that the project will have a neutral or beneficial impact on receiving waterways. Section 5.0 of the AWMP has been updated to include an objective of achieving a neutral or beneficial effect on water quality.
13	Section 5.0 - In addition to scheduled monthly monitoring at all monitoring sites, sampling must be undertaken following rainfall events exceeding 25mm. This will provide an indication of the water quality performance of controls during rainfall events.	As described in Section 5.0, water quality monitoring will be undertaken during any discharge event from site sediment dams. Monitoring will also be undertaken monthly for due diligence purposes as described in the SWMP.	Section 5.0 includes details that water quality monitoring will be undertaken during any discharge event from site sediment dams. Monitoring will also be undertaken monthly for due diligence purposes as described in the SWMP.
14	A commitment to undertake annual independent auditing of water quality management and reporting should be included.	An annual review of water management and water related performance of the site will be undertaken as part of the Annual Environmental Review of operations required by DPE in accordance with Condition 10 of Schedule 5 of the Development Consent. An Independent Environmental Audit is also required to be undertaken on a 3-yearly basis in accordance with Condition 11 of Schedule 5 of the Development Consent	Section 6.0 of the SWMP - text states the requirement in accordance with Condition 10 of Schedule 5 of the Development Consent, to complete an annual review of water management and water related performance monitoring of the site will be undertaken as part of the Annual Environmental Review . An Independent Environmental Audit is also required to be undertaken on a 3-yearly basis in accordance with Condition 11 of Schedule 5 of the Development Consent
15	So in summary, the water quality monitoring plan should include - a monthly and event based sampling regime, i.e., >25mm of rainfall - in the absence of adequate baseline data, trigger values used should be those of the ANZECC guidelines for upland river systems - a commitment to undertake annual independent auditing of water quality management and reporting should be included. - Please provide a copy of the revised version to the Department for further comment.	Please see above for detailed responses. A final revised version will be provided to DPI-Fisheries upon resubmission.	Please see above for detailed responses. A final revised version will be provided to DPI-Fisheries upon resubmission.

**2018 Water NSW Comments.** There were no comments received for the Water management plan during 2020 consultant.

Water NSW Comments			
Comment ID	WaterNSW Comment	Proposed Lynwood Response (2016 Previously provided to Holcim)	Lynwood Proposed Response (updated 2018)
1	<p>Section 3.4.1.2 states that "Goulburn Mulwaree Council has approached Holcim regarding the potential use of the supernatant liquid from the Marulan Township water supply treatment plant. This water is suitable for industrial use and is estimated at a minimum of 3 ML/year. Holcim is continuing discussions investigating the opportunity to use this external water source."</p> <p>WaterNSW considers that this supernatant liquid is potentially high in Manganese, Aluminium and salts, although no details are presented in the plan how and where the supernatant liquid will be used. Details should be included in the WMP.</p>	<p>Holcim have no intent of taking this water at this stage. The plan has been updated to reflect this situation and commit to updating the WMP and any required controls should Holcim propose to enter an agreement with Council for this water.</p>	<p>Section 3.4.1.2 of the WMP has been updated to confirm that Holcim do not intend of taking supernatant liquid at this stage. A commitment has also been added to the text to seek approval from DPE should the use of supernatant liquid be considered as part of approved operations.</p>
2	<p>Section 4.2.1.2, Table 4.2 provides volume of new sediment dams in the Lockyersleigh catchment based on 95<sup>th</sup> percentile, 5 day rainfall event as requested by WaterNSW in its response to the EA for modification application. However the volumes in the Table 4.2 of the WMP are identical to that for the 90<sup>th</sup> percentile volume provided in the EA for modification application. This needs to be corrected.</p>	<p>The dam information provided in the WMP has been updated to include revised dam capacities from Table 2.1 of the Response to Submissions.</p>	<p>Section 4.2.1.2, Table 4.2 of the WMP has been updated to include revised dam capacities for dams yet to be constructed. This information has been obtained from Table 2.1 of the Response to Submissions.</p>
3	<p>Section 4.2.2 with regards to the proposed Water Treatment Facility (WTF) downstream of sediment and storage dam F, Holcim do not believe the WTF is now required. The WMP states that if the results of future monitoring of Dam F and the Water Management System in general identify a need for further treatment of water managed on site, Holcim will undertake additional studies to determine if the WTF is required to be constructed. WaterNSW considers that the WMP should specify what additional studies will be undertaken and be detailed in the WMP.</p>	<p>Studies to be undertaken to confirm whether the WTF is required include future assessments of water demand and future updates and refinements to the site Water Balance to determine the likelihood of spill from Dam F and the quality of this spill. If these future studies identify the need for additional storage or water treatment at the site then these studies may result in the construction of the WTF. This will be managed through the Annual Review process.</p>	<p>Section 4.2.2 of the WMP updated to include details of future studies to be considered should construction of the WTF be required. These studies include future assessments of water demand and future updates and refinements to the site Water Balance.</p>
4	<p>Surface water response plan states that dams will be monitored weekly to assist in operational water sourcing and to understand the likelihood of overflows from sediment dams. WaterNSW considers that there is also a need to monitor dam available storage levels prior to predicted high rainfall events, to ensure that past spills at volumes less than 90<sup>th</sup> percentile do not continue to occur.</p>	<p>Wording in the WMP has been updated to reflect the fact that sediment dam water level monitoring is undertaken prior to significant rainfall events</p>	<p>Section 6.0 of the WMP has been updated to include requirements to monitor sediment dam water level prior to significant rainfall events.</p>
5	<p>Section 5.0 - Surface Water Monitoring mentions faecal coliforms will be measured at Dams E &amp; F as they capture runoff from areas used for recycled water. Source of recycled water that potentially contains faecal coliforms is not specified in the WMP.</p>	<p>The WMP has been updated to confirm that this is due to the irrigation area of the office complex.</p>	<p>Section 5.0 of the WMP has been updated to confirm the source of recycled water as the office complex.</p>
6	<p>Groundwater monitoring has started two years ago in the Granite Pit area in July 2014, however the data has not been incorporated in the WMP. Similarly surface water monitoring baseline data is still based on old data. WaterNSW considers that the WMP shall include the latest ground and surface water monitoring data</p>	<p>One round of sampling was undertaken from the Granite Pit bores for Groundwater Quality monitoring prior approval which is not considered adequate for representation of baseline conditions. monitoring is now undertaken on a regular basis and, prior to the commencement of construction of the Granite pit, this additional information can be utilised as baseline information for future use in future revisions of the GWMP. The results of the additional groundwater level monitoring for the Granite Pit bores are included in the baseline summary for groundwater in Section 2.1 of the WMP. Additional groundwater quality baseline information for the groundwater bores within the Lynwood pit area has been provided</p>	

Shilpa Shashi <shilpa.shashi@lafargeholcim.com>

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## Lynwood Water Management Plan for Holcim Australia

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To: info@epa.nsw.gov.au

Tue, Jun 9, 2020 at 4:49 PM

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Many thanks,

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Planning and Environment Coordinator NSW / ACT

**Holcim (Australia) Pty Ltd**  
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		<p>in Section 2.4 of the WMP.</p> <p>For surface water baseline monitoring, the additional surface water monitoring locations for the granite pit area (SW8 to SW11) have been included as per the surface water monitoring locations figure in the WMP. The monitoring of these locations has commenced post approval for the granite pit modification, and therefore no baseline surface water information is available for these locations. Monitoring at these locations prior to the commencement of the construction of the Granite Pit will be reviewed and utilised to inform future updates of the WMP.</p> <p>For the remaining surface water monitoring locations existing prior to the modification, baseline monitoring is considered to be the results obtained prior to the commencement of construction at the site. Results obtained for the surface water monitoring undertaken post the commencement of construction could be affected by operations and are therefore not considered true indicators of 'baseline' conditions.</p>	
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Shilpa Shashi &lt;shilpa.shashi@lafargeholcim.com&gt;

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**FIN0138229 - Fwd: Lynwood Water Management Plan (Holcim)**

1 message

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**CS Connect Service Centre** <cspconnect@service-now.com>  
Reply-To: CS Connect Service Centre <cspconnect@service-now.com>  
To: shilpa.shashi@lafargeholcim.com

Tue, Jun 23, 2020 at 2:15 PM



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Thank you for contacting the **Natural Resources Access Regulator (NRAR)**.This is an automated email to advise you of the NRAR case number allocated to your enquiry:  
**FIN0138229**

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**Hyperlink reference not valid.om.au**

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\*Please note that I do not work on Fridays\*

----- Forwarded message -----

From: Shilpa Shashi <shilpa.shashi@lafargeholcim.com>  
Date: Tue, Jun 9, 2020 at 4:46 PM  
Subject: Lynwood Water Management Plan (Holcim)  
To: Shilpa Shashi <shilpa.shashi@lafargeholcim.com>

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- **NRAR compliance approach to Metering Regulations** - [https://www.industry.nsw.gov.au/\\_\\_data/assets/pdf\\_file/0005/205790/NRAR-compliance-approach-metering-regulations-fact-sheet.pdf](https://www.industry.nsw.gov.au/__data/assets/pdf_file/0005/205790/NRAR-compliance-approach-metering-regulations-fact-sheet.pdf)

Yours sincerely

**Natural Resources Access Regulator**

*Protecting lawful water users and the environment from harmful water activity.*

Email: [nrar.enquiries@nrar.nsw.gov.au](mailto:nrar.enquiries@nrar.nsw.gov.au)

Phone: 1800 633 362

Website: [www.industry.nsw.gov.au/nrar](http://www.industry.nsw.gov.au/nrar)

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Shilpa Shashi <shilpa.shashi@lafargeholcim.com>

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## Lynwood Water Management Plan for Holcim Australia

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Shilpa Shashi &lt;shilpa.shashi@lafargeholcim.com&gt;

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## Lynwood Water Management Plan (Holcim)

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**Jillian Reynolds** <jillian.reynolds@dpi.nsw.gov.au>  
To: "shilpa.shashi@lafargeholcim.com" <shilpa.shashi@lafargeholcim.com>

Mon, Jun 29, 2020 at 1:50 PM

Hi Shilpa,

Thank you for forwarding the plan to DPI Fisheries. We have no further comment to make.

Regards,

Jillian

### Jillian Reynolds | Fisheries Manager

NSW Department of Primary Industries | Coastal Systems  
4 Woollamia Road | PO Box 97 | Huskisson NSW 2540

T: 02 4428 3007 | M: 0429 918 575 | F: 02 4441 8961 | E: [jillian.reynolds@dpi.nsw.gov.au](mailto:jillian.reynolds@dpi.nsw.gov.au)

W: [www.dpi.nsw.gov.au/fisheries](http://www.dpi.nsw.gov.au/fisheries)

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**From:** Rebecca Philps <[rebecca.philps@dpi.nsw.gov.au](mailto:rebecca.philps@dpi.nsw.gov.au)>  
**Sent:** Tuesday, 23 June 2020 3:58 PM  
**To:** Jillian Reynolds <[jillian.reynolds@dpi.nsw.gov.au](mailto:jillian.reynolds@dpi.nsw.gov.au)>  
**Cc:** Dean Hayes <[dean.hayes@dpi.nsw.gov.au](mailto:dean.hayes@dpi.nsw.gov.au)>  
**Subject:** FW: Lynwood Water Management Plan (Holcim)

Hey Jill,

This one has done the rounds but I note that you provided comment back on October 2018 (C18/565) – not sure if you need to – (or have been asked) to provide feedback again.

Cheers

Rebecca Philps | Administration Officer

Coastal Systems

NSW Department of Primary Industries | Fisheries - ><(((0>`. . . `... ><(((0>

1243 Bruxner Highway WOLLONGBAR NSW 2477

T: +61 2 6626 1269 | M: 0437 703840 | E: [rebecca.philps@dpi.nsw.gov.au](mailto:rebecca.philps@dpi.nsw.gov.au)

W: [www.dpi.nsw.gov.au](http://www.dpi.nsw.gov.au)



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**FIN0138229 - Fwd: Lynwood Water Management Plan (Holcim)**

1 message

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