HOLCIM

DUNLOE SAND QUARRY

Soil and Water Management Plan

Current Revision

Revision	Date issued	Reviewed by	Approved by	Date approved	Rev Type
9	30/03/2026	Ramboll	Holcim	30/03/2026	Final

Organisation	Holcim (Australia) Pty Ltd
Project	Dunloe Sand Quarry
Document Title	Soil and Water Management Plan
Document Revision	9
Author	Holcim (Australia) Pty Ltd
Project Identifier	06_0030

Revision History

Revision	Date issued	Reason for update
0	July 2018	Original Environmental Management Plan (EMP) prepared by for the site by Planit.
1	October 2020	Revision and consolidation completed by GHD.
2	March 2022	Updated to Holcim format by Ramboll. Update SSTVs and requirement for monitoring of major anions and cations in groundwater consistent and relocate SW3 to accurately reflect background conditions consistent with Ramboll recommendations. Updated acid sulfate soil treatment methodology for silt fines in the silt trap area.
3	April 2023	Formatting changes, including to contents page, table numbers and list of tables, figure numbers and list of figures, and appendix titles.
4	November 2023	Updated in response to comments from DPE.
5	March 2024	Updated in response to comments from DCCEEW and DPE.

6	November 2024	Updated to new Holcim template. Updated in response to comments from DCCEEW and DPHI (20 May 2024, ref OUT24/7057).
7	July 2025	Updated to address DCCEEW Comments.
8	March 2026	Updated in response to comments from DPHI and DCCEEW (4 November 2025, ref OUT25/12924)
9	March 2026	Updated in response to RFI from DPHI of 24 March 2026

Contents

Figures

Tables

Appendices

Appendix 1 – Proposed Approach to Address Groundwater Take and Licencing

Appendix 2 – Erosion and Sediment Control Plans

Appendix 3 – Acid Sulfate Soil Management Plan

Appendix 4 – Acid Sulfate Soil Reuse Assessment

Appendix 5 – Blue-green Algae Monitoring and Management Plan

Appendix 6 – Dunloe Sands SSTV Update (Ramboll, 2021b)

Appendix 7 – NSW EPA, DPHI and DCCEEW Water Consultation

1. Background

1.1 Purpose

This Soil and Water Management Plan (SWMP) forms part of the Environmental Management Strategy (EMS) for Dunloe Sand Quarry. This SWMP has been prepared to meet the requirements of the Minister's Conditions of Approval (CoA) outlined in Development Consent No. 06_0030, the mitigation measures outlined in MOD2 (GHD, 2017), the Environmental Impact Statement (EIS) (Planit, 2007), the Environment Protection Licence 13077 (EPL) and relevant legislation.

The plan incorporates the following:

- Erosion and Sediment Control Plan – relating to the monitoring and maintenance of sediment controls implemented to restrict runoff.
- Acid Sulfate Soil Management Plan – relating to the assessment and treatment of potential acid sulfate soils.
- Blue Green Algae Management Plan – relating to the management of potential algal blooms in surface water.
- Surface Water and Groundwater Management Plan – relating to the monitoring of surface water and groundwater and a contingency plan to mitigate any identified impacts.

1.2 Objectives

This SWMP details monitoring, maintenance, and management activities applicable to the Dunloe Sand Quarry. Specifically, this includes:

- Environmental inspection procedures.
- Management procedures.
- Site-specific trigger values (SSTVs) relevant to surface water and groundwater.
- Trigger events that would initiate corrective action.
- Contingency actions.

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

1.3 Targets

The following targets have been established for the management of soil and water impacts:

- Ensure full compliance with the relevant legislative requirements and CoA.
- Meet EPL water quality discharge parameters for all planned discharges.

- Ensure training on soil and water management is provided to all relevant personnel through site inductions.

1.4 Review and Improvement

This SWMP will be implemented throughout the operational lifetime of Dunloe Sand Quarry. Continuous improvement will be achieved in accordance with the EMS, through the ongoing evaluation of environmental management performance against environmental policies, objectives, and targets.

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 a comparison with objectives and targets.

2. Site Details

2.1 Operation

The Dunloe Sand Quarry is located on the New South Wales North Coast, approximately 4 km south of Pottsville. It produces fine concrete sand and other sand products through a suction dredge extraction process.

The current operational area of the site (Stage 1) comprises an extraction pond (Dredge Pond), a settlement pond (Silt Pond) and a stockpiling/processing area, as well as various site buildings, sheds, access tracks and haul roads.

The EIS (Planit Consulting, 2007) identified no previous uses which may have contaminated the site and no visual signs of contamination.

2.2 Regional Geology

The Tweed 1:250,000 Geological Series Sheet identifies the topographically elevated ridgeline to the west and north of the site as outcrops of greywacke, slate, phyllite and quartzite (part of the regionally extensive Neranleigh Fernvale Group). The low-lying floodplain sections of the site generally consisted of unconsolidated deposits of river gravels, alluvium, sand and clay of Holocene age.

2.3 Hydrology and Hydrogeology

Groundwater at the site is shallow, with several existing groundwater fed seepage dams, historically used for watering livestock. Low lying areas of the site are known to become boggy following rainfall, despite the sandy nature of the underlying geology. As such, there is likely to be a degree of groundwater-surface water interaction (Ramboll, 2021a).

Hydraulic connection between groundwater in the bedrock geology west of the site and the sand aquifer at the site is considered to be minimal due to discontinuity between the aquifer systems. The observed response to rainfall indicates that groundwater recharge is likely through direct precipitation and infiltration of overland flow from upstream or upgradient of the site and flowing through the site in creeks and drainage lines.

The site is located within the Mooball Creek catchment and Sheens Creek sub catchment area, and approximately 4 km upstream from the mouth of Mooball Creek. The site has catch drains which merge into the main agricultural drains onsite. These drainage lines were historically fitted with flood gates to control inundation of tidal water from Mooball Creek; however it is understood the NSW Department of Primary Industries (DPI) Fisheries has requested that these gates be left open to allow passage of fish. Due to the nature of the site geology, groundwater and surface water are closely related. The degree of interaction between groundwater and surface water would be influenced by pressure head differentials developed by rainfall, tidal fluctuations and the quarry operations (Ramboll, 2021a).

2.4 Acid Sulfate Soils

An acid sulfate soils assessment encountered negligible to low acid producing potential within the sandy materials proposed for excavation. Generally, the potential acid sulfate soils were associated with the grey – dark grey fine to medium grained sands encountered at variable depths throughout the profile (but generally above 5.5 m below ground level) and the basal mineral clay material. The clay is not proposed for extraction.

2.5 Baseline Data

Preliminary assessment of the site during 2004 determined baseline groundwater levels and groundwater quality as detailed in Table 2-1 and Table 2-3. Of note from the groundwater quality findings is the concentration of dissolved iron, which is elevated relative to most natural water. As a result, some iron flocs and staining may occur around the perimeter of the excavation area during operational works at the site.

The results in Table 2-3 outline the baseline water quality conditions for surface water. The electrical conductivity results support observations that the site is at least partially tidal up to the flood gates on the main agricultural drains traversing the site. Dissolved oxygen was recorded as being slightly low, with the slight depression most likely reflecting base flow from groundwater which is typically very low in dissolved oxygen. Nutrients were slightly elevated in some locations as expected due to the surrounding agricultural activities. In general, the site's surface water quality was relatively good and reflects conditions characteristic of agricultural drains in low lying floodplain environments.

Table 2-1: Baseline groundwater levels (2004)

Well ID		30/08/2004 (m AHD)	06/09/2004 (m AHD)	13/09/2004 (m AHD)	17/12/2004 (m AHD)
DLP1		0.30	0.25	0.28	0.83
DLP1A		0.26	0.25	0.23	0.99
DLP2		0.23	0.20	0.18	1.25
DLP3		0.31	0.25	0.13	0.45
DLP3A		0.21	0.30	0.30	0.72
DLP4		0.29	0.29	0.28	13.7
DLP5		0.33	0.29	0.21	0.75
DLP6		0.33	0.33	0.34	1.19
DLP7		0.29	0.27	0.25	1.09
DLP7A		0.23	0.23	0.21	0.79
DLP8		0.43	0.42	0.38	1.16
DLP8A		0.41	0.40	0.37	1.28
DLP9		0.31	0.29	-	0.53
DLP10		0.42	0.38	0.37	1.31
DLP10A		0.24	0.25	0.24	1.36
DLP11		0.24	0.23	0.21	0.80

Table 2-2: Baseline groundwater quality (2004)

	DLP1	DLP1A	DLP2	DLP3	DLP3A	DLP4	DLP5	DLP6	DLP7	DLP7A	DLP8	DLP8A	DLP9	DLP10	DLP10A	DLP11
pH	5.12	7.78	6.82	5.14	6.36	5.45	5.64	4.65	5.25	7.30	5.74	8.50	5.83	5.57	7.79	6.20
EC (mS/cm)	0.198	2.260	0.253	4.770	6.550	0.339	0.189	0.122	0.250	4.420	0.135	0.538	0.099	0.122	1.615	0.747
DO (mg/L)	3.4	2.99	2.01	3.30	2.57	2.80	3.27	3.40	2.93	3.38	6.16	7.93	4.14	4.40	3.23	2.59
Temp. (C°)	19.0	21.2	19.5	25.1	24.5	19.4	20.2	18.8	20.3	19.6	18.6	22.5	21.2	18.5	18.0	19.7
Alkalinity (mg/L as $CaCO^3$)	1	520	42	3	162	3	7	<1	3	386	3	253	12	3	410	44
Chloride Sulfate Ratio ($CL:SO_4$)	0.71	1.21	3.36	5.89	12.70	8.00	1.43	2.33	1.14	3.67	2.00	3.68	0.94	0.79	1.03	1.03
Dissolved Aluminium (mg/L)	0.46	<0.01	0.09	1.18	0.06	0.30	0.49	1.39	0.20	0.22	0.13	0.06	0.08	0.14	<0.01	<0.01
Dissolved Iron (mg/L)	7.34	0.01	0.13	7.17	10.80	1.08	2.03	44.60	5.42	1.37	1.82	0.12	8.83	3.67	<0.01	20.70
Dissolved Manganese (mg/L)	0.084	0.0405	0.034	0.052	0.582	0.003	0.008	0.300	0.076	0.092	0.011	0.014	0.100	0.031	0.152	0.184
Dissolved arsenic (mg/L)	<0.001	<0.001	<0.001	0.006	<0.001	0.002	<0.001	<0.001	0.001	<0.001	0.001	0.002	<0.001	0.002	<0.001	0.009
Calcium (mg/L)	5	109	1	39	66	3	<1	12	6	36	2	13	10	3	107	17
Magnesium (mg/L)	2	55	7	86	107	4	<1	23	4	80	1	2	7	<1	42	18
Sodium (mg/L)	20	301	19	801	1190	46	33	165	20	815	20	150	17	10	162	79
Potassium (mg/L)	2	18	2	37	54	<1	2	10	1	45	1	4	2	4	15	10

Table 2-3: Baseline surface water quality (2004/2005)

Location	Date	Tide	Water level (m AHD)	Redox (mV)	E.C. (mS/cm)	Turbidity (NTU)	pH	Temp. (C°)	DO (mg/L)	TSS (mg/L)	N (mg/L)	P (mg/L)
SW1	17/12/04	Incoming Mid tide	NA	NA	2.85	NA	NA	24.1	4.55	NA	NA	NA
SW2	17/12/04	Incoming Mid tide	NA	NA	4.19	NA	NA	23.0	6.49	NA	NA	NA
SW3	17/12/04	Incoming Mid tide	NA	NA	1.73	NA	NA	24.3	5.79	NA	NA	NA
SW4	17/12/04	Incoming Mid tide	NA	NA	5.95	NA	NA	23.3	9.22	NA	NA	NA
SW5	24/01/05	Outgoing High tide	0.566	244	39.5	5	8.07	28.9	6.23	24	0.3	0.11
SW6	24/01/05	Outgoing High tide	0.636	254	24.3	19	7.53	30.2	6.06	NA	NA	NA
SW7	24/01/05	Outgoing High tide	0.507	221	9.32	11	7.44	29.7	4.76	NA	NA	NA
SW8	24/01/05	Outgoing High tide	0.076	194	0.73	10	7.30	34.8	6.90	8	1.5	0.05
SW9	24/01/05	Outgoing High tide	0.354	240	18.8	15	7.50	31.6	5.47	22	0.4	0.04
SW10	24/01/05	Outgoing High tide	0.433	207	3.19	8	7.17	32.8	5.12	2	0.8	0.02
SW11	24/01/05	Outgoing High tide	NA	212	27.8	1	7.81	30.8	6.04	NA	NA	NA
SW12	24/01/05	Outgoing High tide	0.497	189	8.50	10	7.42	31.7	5.60	NA	NA	NA

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).
- *Water Act 1912* (Water Act).

Further discussion of the above legislation is provided in the EMS, the EIS and MOD2 Approval.

3.2 Guidelines

The following guidelines have been considered during development of this SWMP:

- *Acid Sulfate Soils Manual (ASSMAC, 1998).*
- *Soils and Construction, Managing Urban Stormwater, Volume 2E Mines and Quarries, 4th Edition (Blue Book) (Landcom, 2004).*
- *NSW Aquifer Interference Policy (DPI Office of Water, 2012).*
- *Guidelines for Managing Risks in Recreational Water (NHMRC, 2008).*
- *Code of Practice for Soil and Water Management on Construction Sites.*
- *Development Design Specification D7 – Stormwater Quality and Tweed Urban Stormwater Quality Management Plan.*
- *Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG, 2018).*
- *Water Quality Australia (2018), National Acid Sulfate Soils Guidance.*

3.3 Conditions of Approval

The CoA relevant to this SWMP are listed below in Table 3-1. A cross reference is also included to indicate where the condition is addressed in this SWMP or other environmental management documents.

Table 3-1: Conditions of Approval relevant to this SWMP

Condition No.	Requirement	Reference / Addressed in
Schedule 3, Condition 8	Except as may be expressly provided for by an EPL, the Proponent must not discharge any water from the project or ancillary operational areas. The Proponent must ensure that the extraction pit subject to dredging is maintained and operated to prevent discharges of any surface water from these ponds.	Table 5-1
Schedule 3, Condition 9	The Proponent must aim to meet the water quality objectives for water in the dredge ponds and in groundwater adjacent the dredge ponds, unless otherwise approved by the Secretary.	Section 6.2.6
Schedule 3, Condition 10	The Proponent must ensure that all excavated potential acid sulfate soil fines material is returned to below the water table as soon as possible to prevent oxidation. No potential acid sulfate soil must be removed from the site, unless adequately neutralised in accordance with methods approved under the Soil and Water Management Plan.	Table 5-1
Schedule 3, Condition 11	The Proponent must ensure that all potential acid sulfate soil fines material is discharged into the pond at a depth of no less than 3 metres from the water surface, and that all fines are deposited to a final depth of at least 8 metres from the water surface, unless an alternative method(s) is approved by DoI and the Secretary[1].	Table 5-1
Schedule 3, Condition 12	The Proponent must manage on-site sewage to the satisfaction of Council and EPA. The facility must comply with the requirements of the *Environment and Health Protection Guidelines – On-site Sewage Management for Single Households (1998)*.	Table 5-1
Schedule 3, Condition 13	The Proponent must ensure that flood bunding around the Stage 1 and Stage 2 works does not exceed 300 mm in height above natural surface level, to a maximum height of 2.0 m AHD, unless otherwise approved by the Secretary.	Table 5-1
Schedule 3, Condition 14	The Proponent must ensure that perimeter drainage must be installed and operational prior to the construction of bunding or the placement of fill on site.	Table 5-1
Schedule 3, Condition 15	All earthworks, including flood and acoustic bunding works, must be contained wholly within the site.	Table 5-1
Schedule 3, Condition 16	The Proponent must cease dredging and processing activities not less than 24 hours prior to the commencement of overflow from any dredge pond. No dredging or processing must occur when the dredge ponds are overflowing.	Table 5-1
Schedule 3, Condition 17	The Proponent must ensure that the flood storage capacity of the site is no less than the pre-existing flood storage capacity at all stages of the project. Details of the available flood storage capacity must be reported in the Annual Review.	Table 5-1
Schedule 3, Condition 18	The Proponent must prepare a Soil and Water Management Plan for the project to the satisfaction of the Secretary. This plan must: (a) be prepared in consultation with DoI and EPA; (b) include a: ● Water Balance; ● Erosion and Sediment Control Plan; ● Acid Sulfate Soil Management Plan; ● Blue-Green Algae Management Plan; ● Surface Water Monitoring Program; and ● Groundwater Monitoring Program; and (c) be submitted to the Secretary prior to starting quarrying operations, and prior to carrying out any development on the site in the case of the Erosion and Sediment Control Plan. The Proponent must implement the plan as approved by the Secretary.	This plan

[1] Depositing the fines at a depth of 8 m is not practical, so the control in **Table 3-1** has been amended to reflect the fines being deposited at a minimum depth of 3 m.

Condition No.	Requirement	Reference / Addressed in
Schedule 3, Condition 19	The Water Balance must include: (a) details of all water extracted, transferred, used and/or discharged by the quarry; (b) the source of all water collected or stored on the site, including rainfall, stormwater and groundwater; and (c) measures to minimise water use by the project.	Section 4 and Appendix 1
Schedule 3, Condition 20	The Erosion and Sediment Control Plan must: (a) be consistent with the requirements of *Managing Urban Stormwater: Soils and Construction, Volume 1, 4th Edition, 2004* (Landcom), and Council's codes including its *Code of Practice for Soil and Water Management on Construction Sites, Development Design Specification D7 – Stormwater Quality and Tweed Urban Stormwater Quality Management Plan*; (b) identify activities that could cause soil erosion and generate sediment; (c) describe measures to minimise soil erosion and the potential for the transport of sediment to downstream waters; (d) describe the location, function, and capacity of erosion and sediment control structures; and (e) describe what measures would be implemented to maintain these structures over time.	Table 5-1 and Appendix 2
Schedule 3, Condition 21	The Acid Sulfate Soil Management Plan must: (a) be consistent with the *NSW Acid Sulphate Soil Advisory Committee's Acid Sulfate Soil Manual*; and (b) define procedures for managing the potential acid sulfate soils on the site, including sample testing and procedures.	Table 5-1 and Appendix 3 and 4
Schedule 3, Condition 22	The Blue-Green Algae Management Plan must: (a) be prepared by a suitably qualified blue-green algae expert, whose appointment has been approved by the Secretary; (b) be consistent with extant guidelines for blue-green algae management including the NHMRC's *Guidelines for Managing Risks in Recreational Water*; (c) describe the measures that would be implemented to prevent and control the sources of algal blooms over the short, medium and long term; and (d) define procedures for the management and notification of identified algal blooms.	Table 5-1 and Appendix 5
Schedule 3, Condition 23	The Surface Water Monitoring Program must include: (a) detailed baseline data on surface water quality; (b) surface water impact assessment criteria; (c) a program to monitor surface water flows and quality; (d) a program to manage water releases from the site; (e) a program to monitor bank and bed stability; and (f) a protocol for the investigation, notification and mitigation of identified exceedances of the surface water impact assessment criteria.	Table 6-5 and Table 6-6
Schedule 3, Condition 24	The Ground Water Monitoring Program must include: (a) detailed baseline data on groundwater levels and quality, based on statistical analysis; (b) groundwater impact assessment criteria; (c) a program to monitor ground water levels and quality; (d) a program to monitor ground water level effects on vegetation, and on ground water supply to adjoining properties; and (e) a protocol for the investigation, notification, and mitigation of identified exceedances of the groundwater impact assessment criteria.	Table 6-2, Table 6-3 and Table 6-4
Schedule 5, Condition 1A	The Proponent must ensure that the management plans required under this approval are prepared in accordance with any relevant guidelines, and include:	
	(a) a summary relevant background or baseline data;	Section 2.5
	(b) a description of:	Section 3, Section 1.3 and Section 6

Condition No.	Requirement	Reference / Addressed in
	• the relevant statutory requirements (including any relevant approval, licence or lease conditions); • any relevant limits or performance measures/criteria; and the specific performance indicators that are proposed to be used to judge the performance of, or guide the implementation of, the project or any management measures;	
	(c) a description of the measures that to be implemented to comply with the relevant statutory requirements, limits, or performance measures/criteria;	Table 5-1
	(d) a program to monitor and report on the: • impacts and environmental performance of the project; and • effectiveness of any management measures (see (c) above);	Section 6
	(e) a contingency plan to manage any unpredicted impacts and their consequences and to ensure that ongoing impacts reduce to levels below relevant impact assessment criteria as quickly as possible;	Table 6-8
	(f) a program to investigate and implement ways to improve the environmental performance of the project over time	Section 6
	(g) a protocol for managing and reporting any: • incidents; • complaints; • non-compliances with statutory requirements; and exceedances of the impact assessment criteria and/or performance criteria; and	Section 6.5
	(h) a protocol for periodic review of the plan.	Section 6.6

3.4 EIS Statement of Commitments

The EPL conditions outline the location of monitoring, the concentrations of pollutants permitted to be discharged, sampling frequency, sampling method and the rainfall events and locations when the concentration limits can be exceeded. The requirements of the EPL have been included in this plan, where relevant.

4. Water Balance

The following sections summarise the water balance, based on the information provided in the EMS (Planit, 2018) and EIS (Planit, 2007).

At the time of this update, Holcim are in the process of addressing DCCEEW and DPHI comments dated 20 May 2024 (ref OUT24/7057) by implementing the proposed groundwater investigation plan dated 2 October 2024 (Ramboll, 2024), presented as Appendix 1, to address the outstanding water take and licencing recommendations.

In addition to above, Holcim will complete a 24-month water level and groundwater quality monitoring for the newly drilled wells, which includes both the northern and southern extraction ponds to establish baseline water quality. This is to address the comments from DCCEEW dated 23 April 2025 (ref OUT25/4671) and 4 November 2025 (ref OUT25/12924).

4.1 Overview

The Dunloe Sand Quarry is situated within the Sheens Creek catchment, which is an ephemeral, stream that eventually discharges into Mooball Creek. Water is required at the quarry for use in the wash plant and for dust suppression, the majority of which will be drawn from the extraction area itself. Water is also lost through evaporation from the extraction area and within the processing of extracted sands.

There are three main sources of water for the quarry, namely: groundwater seepage into the pit; rainfall falling directly into the pit; and lastly and of least importance, off-site runoff that enters the Quarry Site.

4.2 Site Water Use

4.2.1 Sand Washing and Retention of Water in Materials

Approximately 8,000 L of process water is required to produce one tonne of sand product. A maximum of 300,000 tonnes of washed sand will be produced annually in accordance with the development consent.

With the exception of the following, the majority of this process water will be continuously recycled and available for reuse:

- The washed sand product will have a moisture content of approximately 8%. As a consequence, up to 24 ML/year will exit the Quarry Site as water retained in the sand products.
- Water used in the placement of fines within the re-internment ponds will remain within the water cycle.

4.2.2 Dust Suppression

Water is used for dust suppression on the roads, stockpiles, and other exposed surfaces around the Quarry Site. Given that all roads will be sealed, water used in dust suppression is considered likely to be

relatively low. In this regard it is estimated that the maximum rate of water application will be an average of 3 KL/day.

Based on an application time of 3 hours/day (or 1 KL per day) for 100 days/year, this equates to approximately 1 ML/year. It is pertinent to note that in the initial stages of the extraction (dry excavation), dust suppression demands are likely to be more onerous, although it is reasonable to assume that in certain conditions no suppression will be required.

4.2.3 Evaporation/Groundwater

An evaporation assessment was undertaken using rainfall and evaporation figures for typical dry (1982) and wet (1976) rainfall years. The rainfall would be variable throughout any recording period with monthly totals above or below the median value even within annual percentile bands. The total for the reporting period used in the calculation (annual values) is the critical factor. This analysis in Table 4-1 demonstrates that typically precipitation exceeds evaporation over a 12-month period.

Table 4-1: Net monthly water balance statistics

Month	Dry (mm)	Median (mm)	Wet (mm)
January	+84.2	+87.9	+24.9
February	+36.1	-29.2	+252.1
March	+7.5	+18.9	+606.7
April	+29.3	+293.4	+45.0
May	+39.9	+22.7	+158.1
June	-34.0	+82.8	+55.8
July	-7.1	+79.0	+34.7
August	-30.3	+71.1	-77.5
September	+145.8	+17.9	-31.0
October	+8.9	-57.7	-29.9
November	-108.4	+18.0	+67.1
December	-83.9	91.8	-31.6
Balance	+87.8	+554.4	+1074.3

Table 4-1 shows that on average there is a 554.4 mm excess of water when cross referencing purely evaporation and precipitation. Given a surface area of 56.7 ha, this equates to a surplus of 314.18 ML. Given that rainfall distribution is largely variable, and precipitation generally exceeds evaporation for most months of the year, it is unlikely that excavation will result in the formation of any significant cone of depression around the extraction areas. However, it is possible during extended dry periods, some localised drawdown may occur on a temporary basis.

4.2.4 Total Water Use

Based on the calculations above, the estimated water use for the quarry is as follows:

- A maximum of 24 ML/year of water lost through the retention of water in exported sand.

- 1 ML/year of water used for dust suppression.

Potable water and water utilised in on site amenities will be harvested on site by way of rainwater tank.

4.2.5 Total Water Availability/Usage

Given an extraction area of 56.7 ha and an annual rainfall of 1720.10 mm, a total precipitation input of 975.24 ML can be demonstrated. Evaporation accounts for 661.06 ML, leaving a surplus of 314.18 ML. Given water usage associated with sand production and export loss (24 ML) and dust suppression (1 ML), total net surplus of water is in the order of 289.18 ML. All surface water runoff will be diverted to existing drains in the vicinity and therefore no surface water inflows are likely or necessary.
In the event that the amount of on-site water storage declines over time, Holcim will need to take action to increase the available water or reduce the water consumption. The following options will be considered:

- Sourcing water from existing dams on adjoining lands, which is normally close to or at capacity. This will include the Maximum Harvestable Right Dam Capacity (max. 10% runoff) for the site.
- Modify the clean water diversion channel to discharge 100% of this flow into the quarry.
- Increase the proportion of sand that is sold unwashed to reduce the amount consumed in the washing process.
- Decrease the rate sand production to reduce the amount consumed in the washing process.

5. Environmental Control Measures

Environmental requirements and control measures are identified in the Conditions of Approval and the EIS. Specific measures and requirements to address soil and water quality impacts are outlined in Table 5-1, and blue-green algae alerts from the BGA monitoring and management plan (Appendix 5) are outlined in Table 5-2.

Table 5-1 Environmental control measures

Reference	Environmental Management Measure	Timing	Responsibility
Soil			
SW01	Induct all site staff so they are aware of their responsibilities in relation to soil and water management, in particular: • Sediment and erosion control • Blue Green Algae management • Acid sulfate soil management • Use of spill kits • Flooding Quarrying activities that have the potential to cause soil erosion or generate sediment and impact the surrounding catchment areas are: • Continued quarrying operations and construction activities, • Clearing or disturbance of land for quarrying or other activities, • Construction of operational sediment control measures, • Construction of overburden and emplacement areas and haul routes, • Placement of overburden and topsoil, • Vehicle and equipment movements, and • Sand and overburden stockpiles and material handling equipment areas.	Operation	Quarry Manager
SW02	Erosion and sediment control devices will be installed prior to the commencement of extraction works in accordance with Drawing Nos GJ05554.ESCP.1 and GJ0554.ESCP.2 as presented in Appendix 2 .	Pre-operation	Quarry Manager
SW03	The perimeter bund/catch drain will be seeded (consistent with visual buffering) upon completion of its construction. This will ensure the integrity of the catch drain is maintained and will avoid potential slips and sediment run-off post construction of the perimeter bund.	Pre-operation	Quarry Manager
SW04	Additional erosion and sediment control devices including silt fences, catch drains, perimeter banks and diversion channels will be installed on an 'as required' basis. Such measures will be installed in accordance with the "Soils and Construction guidelines – Managing Urban Stormwater" (Landcom, 2004).	Operation	Quarry Manager
SW05	Erosion and sediment control devices will be installed onsite prior to extraction if potential for sheet and/or gully erosion exists.	Pre-operation and operation	Quarry Manager
SW06	Stormwater runoff will be directed away from disturbed areas.	Pre-operation and operation	Quarry Manager

Reference	Environmental Management Measure	Timing	Responsibility
SW07	Discharge velocity and configuration will be controlled to ensure erosive flows do not occur	Operation	Quarry Manager
SW08	Grass cover will be maintained around the perimeter of the extraction areas and adjacent to the haul roads.	Operation	Quarry Manager
SW09	Where practicable, surface waters from undisturbed areas will be diverted away from extraction/work areas.	Operation	Quarry Manager
Acid sulfate soils			
SW10	The extraction areas will be assessed for the presence of acid sulfate soils, in accordance with the Acid Sulfate Soils Management Plan in Appendix 3 .	Pre-operation and operation	Quarry Manager
SW11	If acid sulfate soils are present, the excavated material will be treated, in accordance with the Acid Sulfate Soils Management Plan in Appendix 3 .	Operation	Quarry Manager
SW12	All extracted materials will be hydraulically separated through a cyclone (or equivalent hydraulic separation device) to remove pyretic fines from the sand. The hydraulically separated fines will be strategically reburied (re-interred) below the water surface within the nominated on-site fines internment pond(s). The fines must be deposited, as soon as possible on the same day as extracted, at a depth no less than 3 m from the water surface.	Operation	Quarry Manager
SW13	All on-site surface water from disturbed areas will drain into the pond so that any acidic reactions will be detected and the extraction process modified to avoid a continuance of the problem.	Operation	Quarry Manager
SW14	All drainage from the cyclone/wash plant will be negatively graded back to the internment pond to ensure that any leachate from the sand stockpiles, returns water or any hydraulically suspended pyritic material drains towards the on-site fines internment pond.	Operation	Quarry Manager
SW15	If the returns water is not transported in a pipeline, the velocity will be sufficient to ensure that no precipitation of pyritic fines occurs during movement of these waters towards the on-site fines internment pond.	Operation	Quarry Manager
SW16	The returns water flow path will be directed away from any stockpiled sand.	Operation	Quarry Manager
Blue Green Algae			
SW17	During the dredging phase of the operations the formed lakes will be signed to ensure it is clear to all that the waters are not for drinking or swimming.	Operation	Quarry Manager
SW18	Warning signs including current alert levels (refer to Table 5-2) will be kept within the quarry office and each likely access point to the lake indefinitely.	Operation	Quarry Manager
SW19	Vegetated visual buffers are to be planted surrounding both extraction areas (refer to Landscape Management Plan) and these will assist in reducing nutrient loads which will assist in reducing the potential for blue-green algae outbreaks.	Operation	Quarry Manager
SW20	Following the termination of dredging at the end of the lifespan of each extraction pond planting of additional appropriate wetland vegetation species will be implemented as a part of the rehabilitation of the site (refer to Landscape Management Plan). This action will further reduce the level of nutrient flow over land by being taken up by the increased level of vegetation present.	Operation	Quarry Manager

Reference	Environmental Management Measure	Timing	Responsibility
SW21	Any visiting contractors or other visitors likely to come into contact with the lake water or be exposed to aerosols, will be asked whether they have a history of allergenic dermal reaction and or asthma and if so provided information regarding the risk. An information sheet will be provided detailing the correct response if a rash or asthma attack does occur.	Operation	Quarry Manager
SW22	If any personnel are required to dip their hands into the lake for operational or sampling purposes, they will have a suitable length rubber glove to avoid skin exposure.	Operation	Quarry Manager
SW23	For people required to submerge into the water at any time (diving for equipment servicing etc.), diving suits are not recommended as they tend to trap and disrupt cells thereby gaining greater exposure to toxin. Instead, loose fitting swimwear will be worn, and any contact with the lake water is to be followed by a thorough shower from a clean water supply.	Operation	Quarry Manager
SW24	On-site sewage will be managed to comply with the requirements of the Environment and Health Protection Guidelines – On-site Sewage Management for Single Households (1998).	Operation	Quarry Manager
SW25	Potential nutrient sources will be managed to minimise the likelihood of algal blooms in the onsite lakes.	Operation	Quarry Manager
Surface water			
SW26	Surface water monitoring will be undertaken in accordance with Section 6.2.6.	Operation	Quarry Manager
SW27	Sampling locations EPA Point 1 and EPA Point 2 are provided and maintained in an appropriate condition to permit: • The clear identification of each monitoring location • The collection of representative samples • Access to the sampling points at all times by an authorised officer of the EPA	Operation	Quarry Manager
SW28	Existing surface water conditions will be maintained outside the excavation area.	Operation	Quarry Manager
SW29	Where sediment problems are identified, settling in the dredge pond will be aided by dosing with a flocculant such as gypsum or an agreed alternative.	Operation	Quarry Manager
SW30	During clearing and topsoil stripping operations, surface water flows will be directed towards the on-site lakes. Sediment and erosion control measures will be installed during this stage as per the plans in Appendix 2 .	Operation	Quarry Manager
SW31	Dewatering from on-site water bodies, excluding the extraction ponds, will not be undertaken without prior approval from D CCEEW.	Operation	Quarry Manager
SW32	No discharge will occur from the dredge ponds unless discharge criteria have been met.	Operation	Quarry Manager
SW33	Discharge velocity and configuration will be controlled to ensure erosive flows do not occur.	Operation	Quarry Manager
SW34	Existing surveyed height pegs in watercourses/drains will be inspected and replaced as required.	Operation	Quarry Manager
SW35	Streambank and bed profile and condition to be recorded at approved locations.	Operation	Quarry Manager

Reference	Environmental Management Measure	Timing	Responsibility
SW36	Designated, impervious, bunded facilities with oil and water separator system will be provided for cleaning and/or maintenance of vehicles, plant or equipment.	Operation	Quarry Manager
SW37	All chemicals, fuels and oils stored at the premises must be contained within appropriately designed bunded areas that meet the following requirements: a) comply with any relevant Australian Standards for the liquids being stored b) have impervious flooring and walls c) have a minimum capacity of 110% of the volume of the largest container stored within the bund.	Operation	Quarry Manager
SW38	Spill kits will be provided at all chemical storage facilities/compound sites and staff trained in their use	Operation	Quarry Manager
SW39	Where refuelling on site is required, the following management practices will be implemented: • Refuelling will be undertaken on level ground, within the designated refuelling areas with appropriate bunding and/or absorbent material, at least 20 metres from drainage lines, waterways and/or environmentally sensitive areas. • Spill kits will be readily available and personnel trained in their use. • Hand tools will be refuelled within lined trays of site vehicles wherever possible. Any contaminated material will be disposed at an appropriately licensed facility and used spill kit materials replaced.	Operation	Quarry Manager
SW40	Regular checks of vehicles working at the quarry will be conducted to ensure that no oils or fuels are leaking.	Operation	Quarry Manager
Groundwater			
SW41	All groundwater related site activities will be undertaken in accordance with the DPI – Office of Water groundwater licence.	Operation	Quarry Manager
SW42	Groundwater monitoring will be undertaken in accordance with Section 6.2.5.	Operation	Quarry Manager
Flooding			
SW43	The site is to be bunded to provide protection from flooding up to 300 mm in height above natural ground level, to a maximum height of 2.0 m AHD, unless otherwise approved by the Secretary. The bunding is to be contained wholly within the site.	Operation	Quarry Manager
SW44	Holcim must provide perimeter drainage prior to the construction of bunding or the placement of fill on-site.	Operation	Quarry Manager
SW45	No dredging or processing will occur when the dredge ponds are overflowing or within 24 hours prior to them overflowing.	Operation	Quarry Manager
SW46	Holcim will ensure that that the flood storage capacity of the site is no less than the pre-existing storage capacity at all stages of the operations. Details of the available flood storage capacity will be reported in the AEMR.	Operation	Quarry Manager
SW47	Plant, equipment and machinery that is at risk from flood waters to be moved to higher ground.	Operation	Quarry Manager
SW48	Evacuate staff as required.	Operation	Quarry Manager

Reference	Environmental Management Measure	Timing	Responsibility
SW49	Where flood waters overlap the bund, appropriate water testing to be carried out to measure that water quality returns to base levels.	Operation	Quarry Manager

Table 5-1: Blue green algae (Cyanobacteria) alert levels

Alert Level	Indicator Concentration	Cyanobacteria Bio-volume	Action
No Alert	<500 cells/mL of *Microcystis aeruginosa*	N/A	• Monthly samples
Green Alert	500-5000 cells/mL of *Microcystis aeruginosa*	<0.4 mm^3/L toxic Cyanobacteria or	• Monthly samples • Algal alert signage erected
Amber Alert	5000 - 50,000 cells/mL of *Microcystis aeruginosa* (Toxic)	0.4 – 4.0 mm^3/L of known, toxic Cyanobacteria	• Fortnightly samples from lake. • Screen samples for genetic capacity to produce toxin (CyanoDtec test). • If genetic testing determines not toxic; revert to monthly surveillance monitoring • Algal alert signage erected. • Notify WaterNSW and Tweed Shire Council.
Red Alert	>50,000 cells/mL cells of *Microcystis aeruginosa* (Toxic)	>4.0 mm^3/L of known, toxic Cyanobacteria, or >10 mm^3/L <u>all</u> Cyanobacteria	• Signage alerting to potential danger for staff, contractors, clients and visitors. • Use of PPE for people coming into contact with lake water if aerosols present. • Fortnightly sampling until back to surveillance levels. • Algal alert signage erected. • Notify WaterNSW and Tweed Shire Council.

6. Monitoring and Management

The monitoring and management program detailed in the sub-sections below will assist in identifying and managing:

- Erosion of soil.
- Dust generation.
- Exposure of potential acid sulfate soils.
- Changes to water quality within the ponds and surrounding creeks/drainage lines.
- Drawdown of the surrounding water table.
- Contamination.

6.1 Environmental Inspections

Routine weekly inspections by the Quarry Manager (or delegate) will occur throughout the operational lifetime of the quarry to identify any ad-hoc soil or water related issues such as erosion, oil spill, poor water quality or algae outbreak, using the Environmental Inspection Checklist in the Environmental Monitoring and Management Plan (internal Holcim documentation).

6.1.1 Weather

Weather forecasts will be monitored daily by the Quarry Manager to inform quarry operations, for example:

- If rain is forecast, sediment and erosion controls will require to be checked and maintained.
- If dry weather and winds are forecast, dust controls will require to be implemented.

Rainfall at the site must be measured and recorded in millimeters per 24-hour period, at the same time each day.

6.1.2 Erosion and Sediment

The Quarry Manager is to ensure all erosion and sediment controls are monitored and maintained as required, this includes:

- Weekly inspections.
- Inspections following rainfall (i.e., greater than 10 mm in 24 hours).

The sediment and erosion control plans are provided as Appendix 2.

6.1.3 Streambank and Bed Profile

The streambank and bed profile and conditions at surface sampling locations SW3, SW4, SW9 and SW10 are to be visually inspected during sampling events, including:

- Quarterly monitoring events (as detailed in Table 6 3).
- Following rainfall events (as detailed in Table 6 3).

Any changes due to site operations are to be reported to the Quarry Manager and repaired as required.

6.1.4 Spill Kit

The Quarry Manager is responsible for checking the spill kit and replacing any missing materials. The spill kit is to be checked:

- Monthly.
- Following use.

6.2 Routine Monitoring

Routine monitoring of surface and groundwater will be undertaken in accordance with the quality assurance and quality control measures detailed in Section 6.2.1 to Section 6.2.4.

6.2.1 Sampling Methods

Table 6-1: Sampling methods

Sampling Type	Sampling method
Groundwater	Samples will be collected using low flow sampling methods and in general accordance with Groundwater Sampling and Analysis – A Field Guide (2009:27 GeoCat#6890.1) and Australian Standard AS/NZS 5667.11:1998 Water Quality – Sampling Part 11: Guidance on sampling of groundwaters. Water levels in monitoring wells will be gauged using a water level meter. Groundwater gauging across all wells will be undertaken within the shortest possible timeframe. Water level head will be measured during sampling to ensure head values do not decline beyond 0.1 m as evidence that groundwater sampling rates are consistent with aquifer flow rates. Groundwater field parameters, including pH, temperature, EC, DO and redox, will be monitored using a calibrated water quality meter and recorded to ensure samples are representative of groundwater conditions. Final records will be taken when readings for each water quality parameter have stabilised to 10% of each other.
Surface Water	Surface water samples will be collected from 100 mm beneath the surface as far away from the embankment as is practicable. An extendable sampling arm may be used where appropriate, and every effort will be made to avoid disturbing sediments.

6.2.2 Sampling Handling and Preservation

The following sample handling and preservation procedures will be adopted:

- The use of a new pair of disposable nitrile gloves to collect and handle each sample.
- Samples to be collected in laboratory-supplied appropriately preserved sample bottles.
- Sample bottles to be completely filled so that no headspace remains.
- Sample bottles to be stored in chilled, insulated containers with ice for transportation to the laboratory.
- Samples to be submitted to a National Association of Testing Authorities (NATA) registered laboratory under chain of custody documentation.

6.2.3 Decontamination

Clean, single use sampling equipment is to be used, wherever possible, to collect each sample to minimise the opportunity for cross contamination. Multi-use sampling equipment is to be decontaminated by washing in a solution of Decon 90 and thoroughly rinsing with de-ionised or potable water.

6.2.4 Calibration

Calibration of the water quality meter is to be undertaken following the manufacturer's instructions, and calibration details are to be retained by the field team.

6.2.5 Groundwater

The monitoring frequency includes monthly and quarterly sampling requirements as detailed in Table 6-2, with monitoring well details provided in Table 6-3. Responses to groundwater trigger exceedances are shown in Table 6-4. Consistent with recommendations provided in Ramboll (2021b), trigger values for electrical conductivity and dissolved iron in groundwater have increased from the previous SWMP (GHD 2020). The SSTV for dissolved oxygen has also been removed for groundwater (Ramboll 2021b). Ramboll (2021b) is provided as Appendix 6.

Table 6-2: Groundwater monitoring program

Monitoring Location	Frequency	Analysis	Trigger value
Stage 1 wells[1] DLP1, DLP3, DLP5, DLP6 DLP7	Monthly	pH EC Dissolved oxygen Standing water level	4.2 – 6.75 pH units <7022 µS/cm no limit 20% change from historical levels
Stage 2 wells[2]	Quarterly	As monthly monitoring, plus:	

Monitoring Location	Frequency	Analysis	Trigger value
DLP5, DLP6, DLP7, DLP8, and DLP10[2]		Ammonia Calcium Magnesium Sodium Potassium Bicarbonate Sulfate Chloride Dissolved iron Dissolved aluminium Dissolved arsenic Oil and grease Faecal coliform Enteroccocci	NA 55 mg/L 0.40 mg/L 280 mg/L 17.5 mg/L 400 mg/L 175 mg/L 285 mg/L 9.92 mg/L 0.75 mg/L 0.005 mg/L NA 1000 median no. colony forming units (cfu)/100 ml 230 median no. cfu/100ml

[1] Groundwater monitoring locations during Stage 1 of the extraction
[2] Groundwater monitoring locations during Stage 2 of the extraction

Table 6-3: Groundwater monitoring well data[a]

Monitoring Location	Well depth (mbgl)	Screen interval (mbgl)	Screened geology
DLP1	4.0	2.5 – 4.0	Sand (dark grey)
DLP3	4.0	2.5- 4.0	Silty sand (dark greyish yellow)
DLP5	5.5	4.0 – 5.5	Sand (grey)
DLP6	5.5	4.0 – 5.5	Sand (brownish grey-black)
DLP7	4.0	2.5 – 4.0	Sand (yellowish grey)
DLP8	4.0	2.5 – 4.0	Sand (yellowish grey)
DLP10	15.0	13.5 – 15.0	Silty clay (grey)

[a] Sourced from Planit (2007).
mbgl = metres below ground level

Table 6-4: Response to groundwater trigger exceedances

	Green Alert	Amber Alert	Red Alert
Trigger	Results within trigger levels	One off exceedance of trigger levels	Two or more consecutive exceedances of trigger levels
Response	No action	Reporting to DPHI, DCCEEW and EPA within one week of receiving results. Inspection of monitoring location and nearby surface waters. Comparison of results against previous trends.	Review of trends. Reporting to DPHI, DCCEEW and EPA within one week of receiving results. Implementation of additional mitigation measures in liaison with the DPHI, DCCEEW and EPA.

6.2.6 Surface Water

The monitoring frequency and analytical requirements for surface water are detailed in Table 6-5.

Consistent with recommendations made in Ramboll (2021a) the position of surface water monitoring location SW3 has been moved further upgradient (west), as illustrated in Figure 6-1.

Updated trigger values could not be determined for surface water (Ramboll 2021b) due to insufficient background surface water data. Monitoring of surface water, particularly at location SW10, is to continue until at least 20 data points for each of the SSTV parameters have been completed before re-evaluation of the surface water SSTVs can be undertaken. Concentration limits are to be established from calculating the 80th and/or 20th percentile values for each parameter sampled at each monitoring location. Outliers will be statistically removed for accuracy. Responses to surface water trigger exceedances are shown in Table 6-6.

Table 6-5: Surface water monitoring program

Monitoring Location	Frequency	Analysis	Trigger Value
Pond 1 and Pond 2	Fortnightly (October to April)	Blue green algae (refer to **Appendix 5**)	
	Monthly (May to September)		
	Monthly	pH	5.0 – 8.5 pH units
		Electrical conductivity	<5.50 mS/cm
		Dissolved oxygen	>4.00 mg/L
		Turbidity	<20 NTU
		Oil and grease	<10 mg/L
		Water Level	NA
	Quarterly	As above monthly monitoring, plus:	
		Manganese	<0.15 mg/L
		Magnesium	<40 mg/L
		Sodium	<280 mg/L
		Potassium	<17.5 mg/L
		Bicarbonate	<400 mg/CaCO3
		Chloride	<285 mg/L
		Sulfate	<175 mg/L
		Aluminium	<0.75 mg/L
		Arsenic	<0.005 mg/L
		Iron	<7.5 mg/L
		Chlorophyll a	2-10 µg/L
		Ammonium ion	<20 mg/L
		Faecal coliform	1000 median no.cfu/100 ml
		Enteroccocci	230 median no.cfu/100ml
Active extraction area[1]		pH	5.0 – 8.5
		Electrical conductivity	<5.50 mS/cm
		Dissolved oxygen	>4.00 mg/L
		Turbidity	<20 NTU
SW3, SW4, SW9 and SW10	Quarterly and following heavy rainfall events (i.e., >82.5 mm rainfall over a consecutive 5-day period)	pH	5.5-7.5 pH units
		EC	1800-2400 µS/cm
		Suspended solids	<25 mg/L
		Dissolved oxygen	>6 mg/L
		Total nitrogen	<1 mg/L
		Total phosphorus	<0.08 mg/L
		Visual inspection of streambank and bed profile[2]	NA

[1] Vertical profile monitoring of pH, EC, DO and turbidity at 1 m intervals in the active extraction area
[2] Refer to Section 6.1.3

Table 6-6: Response to surface water trigger exceedances

	Green Alert	Amber Alert	Red Alert
Trigger	Results within trigger levels	One off exceedance of trigger levels	Two or more consecutive exceedances of trigger levels
Response	No action	Reporting to DPHI, DCCEEW and EPA within one week of receiving results. Inspection of monitoring surface water location and surrounding land. Comparison of results against previous trends.	Review of trends. Reporting to DPHI, DCCEEW and EPA within one week of receiving results. Implementation of additional mitigation measures in liaison with the DPHI, DCCEEW and EPA.

6.3 Blue Green Algae (Cyanobacteria)

The blue green algae monitoring program forms part of surface water monitoring requirements and is to be undertaken at various frequencies throughout the year, as detailed in Appendix 5.

6.3.1 Discharge

Discharge monitoring requirements are detailed in Table 6-7. If trigger values are not achieved, the water will need to be treated and resampled prior to discharge.

Table 6-7: Discharge monitoring program

Monitoring Location	Frequency	Analysis	Trigger value[2]
Point 1 and Point 2	Once within 24 hours prior to each discharge event and then daily during each discharge event[1]	Oil and grease	Nil visible
		pH	6.5 – 8.5 pH units
		TSS	50 mg/L

[1] When discharging either naturally (i.e., solely as a result of rainfall at the premises less than 82.5 mm over any consecutive five-day period or manually (i.e., pumped) but not if reused on site (i.e., dust suppression, wash plant).

[2] Exceedances of the trigger values or volume limit for discharge from Point 1 or Point 2 is permitted under the EPL if the discharge occurs solely as a result of rainfall exceeding a total of 82.5 mm over any consecutive 5-day period.

Figure 6-1: Site Layout and Sample Locations

6.4 Contingency Plan

If the monitoring detailed in Section 6.2 detects an impact, a contingency plan or trigger and response plan is to be implemented, as shown in Table 6-8.

Table 6-8: Contingency plan

Trigger	Response
Soils	
Erosion, sedimentation, damaged controls or turbid water observed	• Identify the source of the problem and take the necessary steps required to prevent a recurrence.
Acid sulfate soils	
Signs acid sulfate soil and water management has not been effective: • Yellow efflorescence on soil surface • Iron staining of soils or water • Sulphurous odour • Low pH soils or water	• Contain the material and runoff. • Sample and treat the material in accordance with the procedure in Appendix 3. • Review procedures to ensure management is effective.
Fish kills associated with acid sulfate soil impacts	• Stop works immediately and implement the EMS incident procedure.
Blue Green Algae	
Algal blooms observed / detected	• Increase inspections of the extraction pond to twice daily and water monitoring to weekly. • Ensure no public access to water body and erect signs on site informing people to avoid contact with water. • Should phosphorous levels be recorded higher than the criteria, dosing of the ponds will be undertaken. A mixture of alum and gypsum is to be used. The quantity of each will be determined by the volume of water in the lakes. This action is more appropriate and successful at the beginning of summer and prior to a bloom developing. • Engage consultant to advise on the appropriate mitigation.
Surface water	
Water quality results exceed the relevant trigger value	• Undertake a detailed inspection of all controls and address any issue identified. • For any exceedance of the trigger value in lake water pH or EC occurs as a result of on-site activities, investigate the cause of the problem and identify measures to resolve. • Review procedures to avoid the issue in future. • If the issue persists, engage a consultant to advise on the appropriate mitigation.
Fuel/chemical spill on land	• Identify and stop the source of the leak or spill. • Apply the spill kit to clean up the spill. • Dispose of the used material at a licensed landfill. • Replace the materials used in the spill kit.
Fuel/chemical spill on water	• Dredging to cease and all equipment in vicinity turned off. • All ignition sources to be removed from the vicinity of the spill.

Trigger	Response
	● Fuel/oil absorbing products to be used to contain and soak up contaminants from the pond and contaminated sand from the edge of the pond to be removed. ● Site manager to identify source of contamination and rectify problem.
Groundwater	
Monitoring results exceed the relevant trigger value	● Undertake a detailed inspection of all controls and address any issue identified. ● For any exceedance of the trigger value in groundwater pH, EC or level occurs as a result of on-site activities, investigate the cause of the problem and identify measures to resolve. ● Assess vegetation health and impact of groundwater supply on adjoining properties. ● Review procedures to avoid the issue in future. ● If problem persists, engage a consultant to advise on the appropriate mitigation.
Flooding	
Flooding damages equipment	● Review controls to avoid damage during floods in the future.
Flooding exceeds perimeter bunds	● Review the height of bunds to ensure they are the design height ● Investigate increasing the height of the bund, in consultation with DCCEEW and DPHI .

6.5 Reporting

The general reporting requirements are described in Section 8.4 of the EMS. In relation to routine monitoring this will be recorded on the Environmental Inspection Checklist in the Environmental Monitoring and Management Plan.

In relation to water samples, the following is to be recorded, as a minimum:

- The date(s) on which the sample was taken.
- The time(s) at which the sample was collected.
- The point at which the sample was taken.
- The name of the person who collected the sample.
- The activities occurring during the monitoring.
- A comparison of the results with the adopted criteria.

A report will be prepared by the Quarry Manager following every 12 months of monitoring and a summary of the monitoring results will be presented in the Annual Report (refer to the EMS).

If an exceedance of the criteria is recorded, the affected landowners and DCCEEW and DPHI will be notified in writing, as described in Section 6 of the EMS, and provided with quarterly monitoring results until the results show that the project is complying with the relevant criteria.

All records will be:

- Maintained in a legible form.
- Kept for at least 4 years.
- Produced to any authorised officer of the EPA and/or DCCEEW and DPHI upon request.

6.6 NSW EPA and DCCEEW and DPHI Consultation

The SWMP was provided to NSW EPA and DCCEEW and DPHI for review and consultation. EPA indicated that they do not intend to review and provide comment upon the updated SWMP management plan (but will undertake compliance reviewed against the requirements of EPL 13077 and the implementation of the management plans at their discretion) and the SWMP is still with DPE Water for review. Copies of email correspondence with EPA and DCCEEW and DPHI is provided as Appendix 6. Actions in response to DCCEEW advice are provided in Table 6-9. Table 6-10 presents the actions in response to recent DPHI comments.

Table 6-9: DCCEEW Advice

DCCEEW Recommendation	Holcim Action
OUT25/12924, dated 4 November 2025	
1.1 DPHI should request the proponent to quantify maximum annual water take due to aquifer interference activities.	• An investigation is currently underway to determine the maximum annual water take (refer to Appendix 1). Additional groundwater monitoring wells were installed in October 2025. The wells will be monitored for 24 months, and following assessment of the data Holcim will update the SWMP with quantified annual water take and submit to DPHI for approval.
1.2 DPHI should request the proponent demonstrate sufficient groundwater entitlement can be acquired in the relevant water sources unless an exemption applies.	• This will be addressed as part of the investigation currently underway (refer to Appendix 1). Following completion of 24 months of monitoring in October 2027, Holcim will assess its water take and ascertain its groundwater entitlement status.
1.3 DPHI should request the proponent provide an assessment of the surface water licensing requirements prior to implementation if contingency water supply options are needed	• This will be addressed as part of the investigation currently underway (refer to Appendix 1), with monitoring expected to be completed in October 2027.
2.1 DPHI should request the proponent to update the Soil Water Management Plan to include 24 months of groundwater quality monitoring data to establish baseline water quality, once the data has been gathered.	• Section 4 updated to include this.

Table 6-10: DPHI Advice

DPHI Recommendation	Holcim Action
Tables 6-4 and 6-6 states consecutive exceedances are notified. A single exceedance must also be reported.	• Tables 6-4 and 6-6 amended
Update cross references and Table labels.	• Updated
You are required to make firm commitments	• Updated
Address comments provided by DCCEEW Water Group	• Refer to Table 6-9.

7. References

GHD (2020). Holcim (Australia) Pry Ltd, Dunloe Sand Quarry Soil and Management Plan, dated October 2020.

NSW ASSMAC (1998). Acid Sulfate Soil Manual

NSW EPA (2018). Environmental Protection Licence, Number 13077 Planit Consulting (2007).

Environmental Impact Statement Planit Consulting (2018).

Environmental Management Plan (EMP) and Environmental Management Strategy for Dunloe Sands (Holcim Australia Pty Ltd), dated July 2018

Ramboll (2021a). Dunloe Sand Quarry Data Review, dated September 2021. Prepared by Ramboll Australia Pty Ltd, reference 318000911.

Ramboll (2021b). Report, Dunloe Sands SSTV Update, dated November 2021. Prepared by Ramboll Australia Pty Ltd, reference 318000911.

Ramboll (2024). Dunloe Sand Quarry SWMP – Memo 001, dated 2 October 2024. Prepared by by Ramboll Australia Pty Ltd, reference 318001800.

Water Quality Australia (2018). National Acid Sulfate Soils Guidance.

Appendix 1 – Proposed Approach to Address Groundwater Take and Licensing

RAMBOLL

ENVIRONMENT
& HEALTH

MEMO

Project name	**Holcim NSW Environmental Monitoring Program**
Project no.	**318001800**
Client	**Holcim (Australia) Pty Ltd**
Memo no.	**Dunloe Sand Quarry SWMP – 001**
Version	**1**
To	**Dozie Egeonu**
From	**Rachel Condon**
Copy to	**Matt Kelly**
Prepared by	**Rachel Condon**
Checked by	**Gavan Butterfield**
Approved by	**Gavan Butterfield**

Date 02/10/2024

1 Introduction

This memorandum provides a summary of background documentation relating to water extraction at the Holcim Dunloe Sand Quarry that was prepared in response to planning approvals.

It also presents a proposed approach to address more recent review comments issued by the Department of Planning, Housing and Infrastructure (DPHI) and Department of Climate Change, Energy, Environment and Water (DCCEEW) in November 2023 and March 2024 respectively for the soil and water management plan (SWMP).

Ramboll
The Arc, 45a Watt St
Newcastle, NSW 2300
Australia

T+61 2 4962 5444
https://www.ramboll.com/

2 Background

Holcim (Australia) Pty Ltd (Holcim) operates a sand quarry on the New South Wales North Coast, approximately 4 km south of Pottsville (the site). Dunloe Sand Quarry produces fine concrete sand and other sand products including plasterer sand, bunker sand and fill sand through a suction dredge extraction process. The quarry includes two sand extraction areas for water-based extraction (i.e. suction dredge) with adjacent work areas containing work plant and machinery for crushing, grinding and separating (i.e. sand separator and screening plant). The site also includes material stockpiles for loading and unloading operations (i.e. excavator, two front end loaders and 25 T dump truck), buildings to accommodate workers with amenities and administrative areas and parking facilities. The quarry is limited to a maximum extraction rate of 300,000 tonnes per annum.

In accordance with Planning Approval 06_0030, a soil and water management plan (SWMP) was prepared by Planit Consulting Pty Ltd (Planit, 2018) to meet the requirements of the mitigation measures outlined in the various planning documents including MOD2 (GHD, 2017), the Environmental Impact Statement (EIS) (Planit, 2007), the Environment Protection Licence 13077 (EPL) and relevant legislation.

Ramboll Australia Pty Ltd.
ACN 095 437 442
ABN 49 095 437 442

It is noted that the 2008 Director-General's Environmental Assessment Report under Section 75I of the *Environmental Planning and Assessment Act 1979* was "*satisfied that the project is able to be managed such that it would not have a significant impact on groundwater resources in the area*" but recommended conditions that would require the development of a detailed Groundwater Monitoring Program (GMP) for the project, as part of the SWMP.

The SWMP has had a number of updates and revisions since originally prepared in 2018 by Planit Consulting Pty Ltd (Planit) prior to the recent comments from the DPHI and DCCEEW in November 2023 and March 2024 respectively.

Ramboll has reviewed the requirements and discussed them in a workshop on 11 September 2024. In that meeting it was agreed, given the number of stakeholders involved, that Ramboll should prepare a brief document to describe an approach to satisfy the requirements ahead of developing a more formal scope.

3 Proposed approach to address DCCEEW's recommendations

1.1 The Department of Planning, Housing and Infrastructure request the proponent to quantify the maximum annual volume of water take due to aquifer interference activities as required by the NSW Aquifer Interference Policy (2012) (AIP).

To address this recommendation, Ramboll proposes to consider groundwater take from the dredge pond under two main headings:

1. The annual ('on-going') volume of groundwater removed with the quarried product (i.e. during the dredging activities); and
2. The annual volume of groundwater potentially flowing into the dredge pond during, for example, periods of drought when the water level in the pond may be depressed, causing inflow from the surrounding aquifer.

The overall approach comprises establishment of a groundwater level monitoring network, using existing and new wells, to measure the deflection of the water table in the vicinity of the pond as an indicator or water take. Whilst some existing groundwater level data is available, this is limited to wells that are relatively far from the pond, and as such, it is unlikely such an assessment of water take can be applied retrospectively, other than at a highly qualitative level. Nonetheless, the scope would comprise the following elements:

- It is proposed to review the existing groundwater level dataset recorded at the site to establish the useability and appropriateness of the available data for the assessment.
- Based on the outcome of this assessment, additional groundwater monitoring wells will be proposed, most likely comprising two to three wells in close proximity to the edge of the pond.
- Using the combined well set, monitoring duration and frequency will be designed, most likely employing data loggers to measure water levels at ongoing intervals with periodic download.
- This data set will be the primary mean of assessing deflection(s) in water table over time as an indicator or aquifer disturbance during mining activities.
    - If the defection is minimal, it may be concluded that interference is negligible, however, if an indication of disturbance is apparent, additional works (most likely computer modelling) would be required to quantify the volume.
- In parallel, some approximate 'direct' estimations of water take during typical operations will be made. This information may be useful in a comparative assessment with the logger outputs.

- Historical rainfall data and historical aerial imagery will also be reviewed to determine if and when drought conditions have prevailed. It may be possible to correlate these events to the historical groundwater levels record as a means to commenting in retrospect on historical water take, however, as stated above the efficacy of achieving a meaningful outcome is probably low.

1.2 The Department of Planning, Housing and Infrastructure request the proponent to quantify the demonstrate sufficient entitlement can be acquired in the relevant water source/s to account for the predicted water take unless an exemption applies.

The results of the review of historical data and the groundwater study for item 1.1 would assist in determining the entitlement requirement, to be able to demonstrate there is sufficient entitlement in the relevant water sources and/or make recommendations for entitlements.

1.3 The Department of Planning, Housing and Infrastructure advise the proponent that should contingency water supply options be required that further assessment of the impacts and viability of these would be required prior to implementation.

To be determined following the outcomes of items 1.1 and 1.2.

2.1 The Department of Planning, Housing and Infrastructure request the proponent to document the rational for defining trigger exceedances.

The 2021 report that completed a review of the groundwater dataset for the site and reviewed the groundwater trigger values will be appended to the SWMP.

2.2 The Department of Planning, Housing and Infrastructure request the proponent to provide additional detail in the contingency response plan to clarify:

- *the process to respond to single and/or persistent trigger value exceedances*,
- *the timeframes to investigate, document and notify agencies,*
- *viable mitigation actions should the quarry related activities result in exceedances of minimal environmental impact.*

The contingency response plan will be reviewed and revised to clarify the process for responding to single v persistent trigger value exceedances, outline a timeframe to investigate, document and notify relevant agencies and any mitigation actions.

Ramboll's services are not intended as legal advice, nor an exhaustive review of site conditions and/or compliance. This report and accompanying documents are initial and intended solely for the use and benefit of the client for this purpose only and may not be used by or disclosed to, in whole or in part, any other person without the express written consent of Ramboll. Ramboll neither owes nor accepts any duty to any third party, unless formally agreed by Ramboll through that party entering into, at Ramboll's sole discretion, a written reliance agreement.

Unless otherwise stated in this report, the scope of services, assessment and conclusions made assume that the site will continue to be used for its current purpose and end-use without significant changes either on-site or off-site.

Appendix 2 – Erosion and Sediment Control Plans

Site Layout/Clearing Limits

No site disturbance shall occur until appropriate approvals are obtained.
The area of disturbance shall be clearly identified.
Vegetation buffer zones shall be maintained where possible especially around high erosion risk areas.
No onsite maintenance of earthmoving equipment shall occur unless appropriate controls are in place.

Dust Management

Ground surfaces will be kept damp (not wet). An on-site water cart will be available at all times.
Surfaces shall be left in a rough cloddy condition to increase roughness and slow surface wind speed.
Temporary access roads and parking areas shall be sealed with a gravel layer.

Erosion Controls

Works programme shall be scheduled to minimise the potential for soil loss.
Sediment and erosion controls shall be installed prior to clearing and include:
* Diversion of stormwater around disturbed areas.
* Sediment control fences at the downslope perimeter of cleared and/or disturbed areas. These controls shall be functional prior to commencing upslope work.
* A negative grade towards the dredge ponds should be maintained for the area within the perimeter bund.
Stormwater runoff shall be directed away from construction entry/exit points.
Temporary erosion measures (silt fences, catch drains, perimeter banks and diversion channels) are to be employed onsite where reasonably deemed necessary.
Access is to be provided for maintenance and sediment removal works.
Perimeter bund is to be constructed prior to the commencement of resource extraction.
Upon its completion the perimeter bund is to be vegetated/seeded.

Surface water monitoring

All surface water tested to conform with the following criteria:

Parameter	Release Criteria	Criteria Type
pH	6. 0 - 8.5	Range
Dissolved Oxygen (field measured)	>6.5 mg/L	Minimum
Oil and Grease	No visible film, No detectable odour	

Sampling and analysis of dredge pond surface water should be undertaken monthly.

Acid sulfate soil identification

Soils recovered using dry excavation are to be tested in accordance with the ASSMAC guidelines.
A minimum of 10 samples per quarter are to be collected for CRS/TAA analysis from the resource recovered by dredging.

Acid sulfate soil treatment

Soils requiring lime treatment will be treated to neutralise their equivalent TPA or equivalent oxidisable sulfur, incorporating a mixing factor of safety of 1.5.
Materials used to construct the bunds will be free from acid sulfate soils or suitably treated.
Exposed sides of open drains are to be treated with lime immediately after excavation.

Pollution control

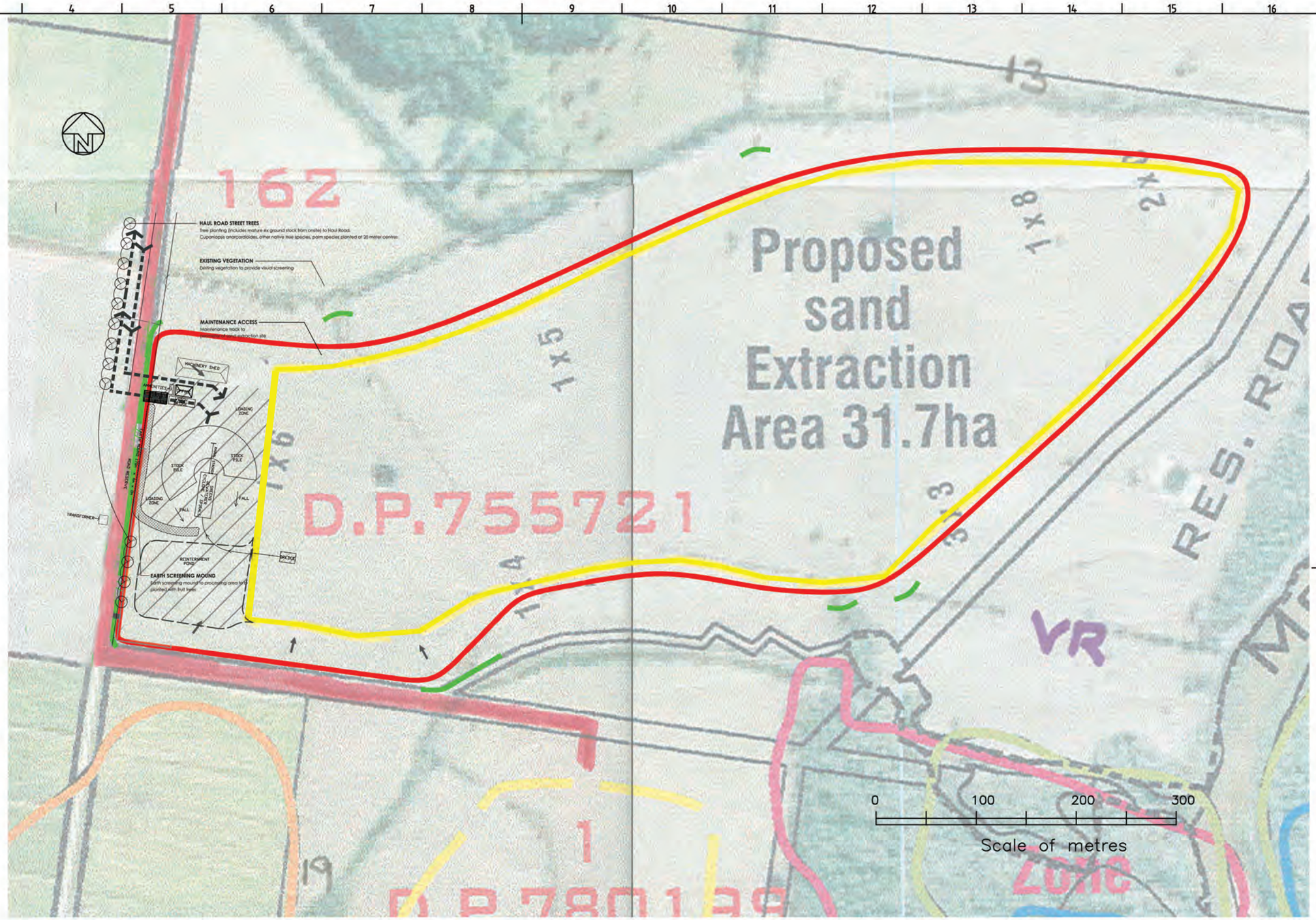
Petroleum and other chemical products shall be prevented from containing surface water and soil.
Any onsite fuel storage areas shall comply with Australian Standards.
Adequate trade waste and litter bins shall be provided onsite and service d regularly.
Concrete wastes and washouts shall not be deposited in any location where the wastes or washings can flow, or can be washed into any areas of retained vegetation or receiving waters.

Rehabilitation and landscaping

Progressive stabilisation of areas where construction delays occur and revegetation of completed areas.
All landscaping and rehabilitation shall be completed so that a duration of less than 60 working days will elapse from final land shaping to permanent rehabilitation.
All temporary erosion and sediment control works are to be removed once works are complete and revegetation is successfully established in for merly disturbed areas.
Drainage channels are to be rehabilitated immediately after completion.

Contractor Management

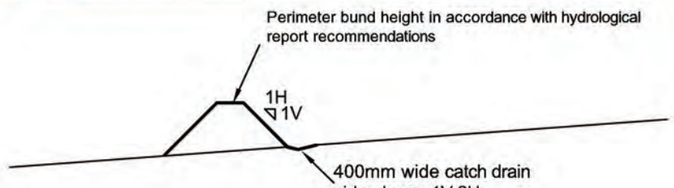
Review of the ESCP and the works contracts by the proponent.
Periodic checks to be made by an independent Environmental Consultant.
Training for construction staff in implementation of ESCP provisions.
Staff to be trained to implement dust minimisation measures.



Legend

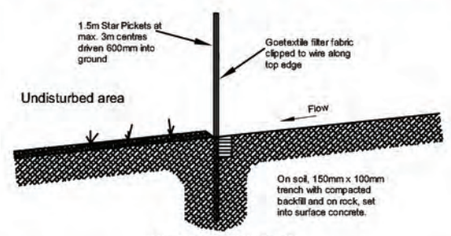
- Site office
- Perimeter bund
- Processing area
- Vehicular Shakedown
- Haul route
- Silt Fence
- Negative grade

Image source: N.C. White & Associates



PERIMETER BUND DETAIL

Not to Scale



SILT FENCE SECTION

Not to Scale

PO Box 1623, Kingscliff NSW 2487
88 Marine Pde, Kingscliff
Telephone: (02) 6674 5001
Fax: (02) 6674 5003
Email: info@planitconsulting.com.au
PLANIT CONSULTING

PROJECT

RAMTECH PTY LTD

DUNLOE PARK, MOOBALL

NORTHERN LAKE EROSION AND SEDIMENT CONTROLS

FIGURED DIMENSIONS TO BE READ IN PREFERENCE TO SCALING	APPROVED	SCALE AS SHOWN	DRAWN C.M.A	DRAWING No.
		DATE 9/1/08	CHECKED	GJ05554.ESCP.1.

Site Layout/Clearing Limits

No site disturbance shall occur until appropriate approvals are obtained.
The area of disturbance shall be clearly identified.
Vegetation buffer zones shall be maintained where possible especially around high erosion risk areas.
No onsite maintenance of earthmoving equipment shall occur unless appropriate controls are in place.

Dust Management

Ground surfaces will be kept damp (not wet). An on-site water cart will be available at all times.
Surfaces shall be left in a rough cloddy condition to increase roughness and slow surface wind speed.
Temporary access roads and parking areas shall be sealed with a gravel layer.

Erosion Controls

Works programme shall be scheduled to minimise the potential for soil loss.
Sediment and erosion controls shall be installed prior to clearing and include:
* Diversion of stormwater around disturbed areas.
* Sediment control fences at the downslope perimeter of cleared and/or disturbed areas. These controls shall be functional prior to commencing upslope work.
* A negative grade towards the dredge ponds should be maintained for the area within the perimeter bund.
Stormwater runoff shall be directed away from construction entry/exit points.
Temporary erosion measures (silt fences, catch drains, perimeter banks and diversion channels) are to be employed onsite where reasonably deemed necessary.
Access is to be provided for maintenance and sediment removal works.
Perimeter bund is to be constructed prior to the commencement of resource extraction.
Upon its completion the perimeter bund is to be vegetated/seeded.

Surface water monitoring

All surface water tested to conform with the following criteria:

Parameter	Release Criteria	Criteria Type
pH	6.5 - 8.5	Range
Dissolved Oxygen (field measured)	>6.5 mg/L	Minimum
Oil and Grease	No visible film, No detectable odour	

Sampling and analysis of dredge pond surface water should be undertaken monthly.

Acid sulfate soil identification

Soils recovered using dry excavation are to be tested in accordance with the ASSMAC guidelines.
A minimum of 10 samples per quarter are to be collected for CRS/TAA analysis from the resource recovered by dredging.

Acid sulfate soil treatment

Soils requiring lime treatment will be treated to neutralise their equivalent TPA or equivalent oxidisable sulfur, incorporating a mixing factor of safety of 1.5.
Materials used to construct the bunds will be free from acid sulfate soils or suitably treated.
Exposed sides of open drains are to be treated with lime immediately after excavation.

Pollution control

Petroleum and other chemical products shall be prevented from containing surface water and soil.
Any onsite fuel storage areas shall comply with Australian Standards.
Adequate trade waste and litter bins shall be provided onsite and service d regularly.
Concrete wastes and washouts shall not be deposited in any location where the wastes or washings can flow, or can be washed into any areas of retained vegetation or receiving waters.

Rehabilitation and landscaping

Progressive stabilisation of areas where construction delays occur and revegetation of completed areas.
All landscaping and rehabilitation shall be completed so that a duration of less than 60 working days will elapse from final land shaping to permanent rehabilitation.
All temporary erosion and sediment control works are to be removed once works are complete and revegetation is successfully established in for merly disturbed areas.
Drainage channels are to be rehabilitated immediately after completion.

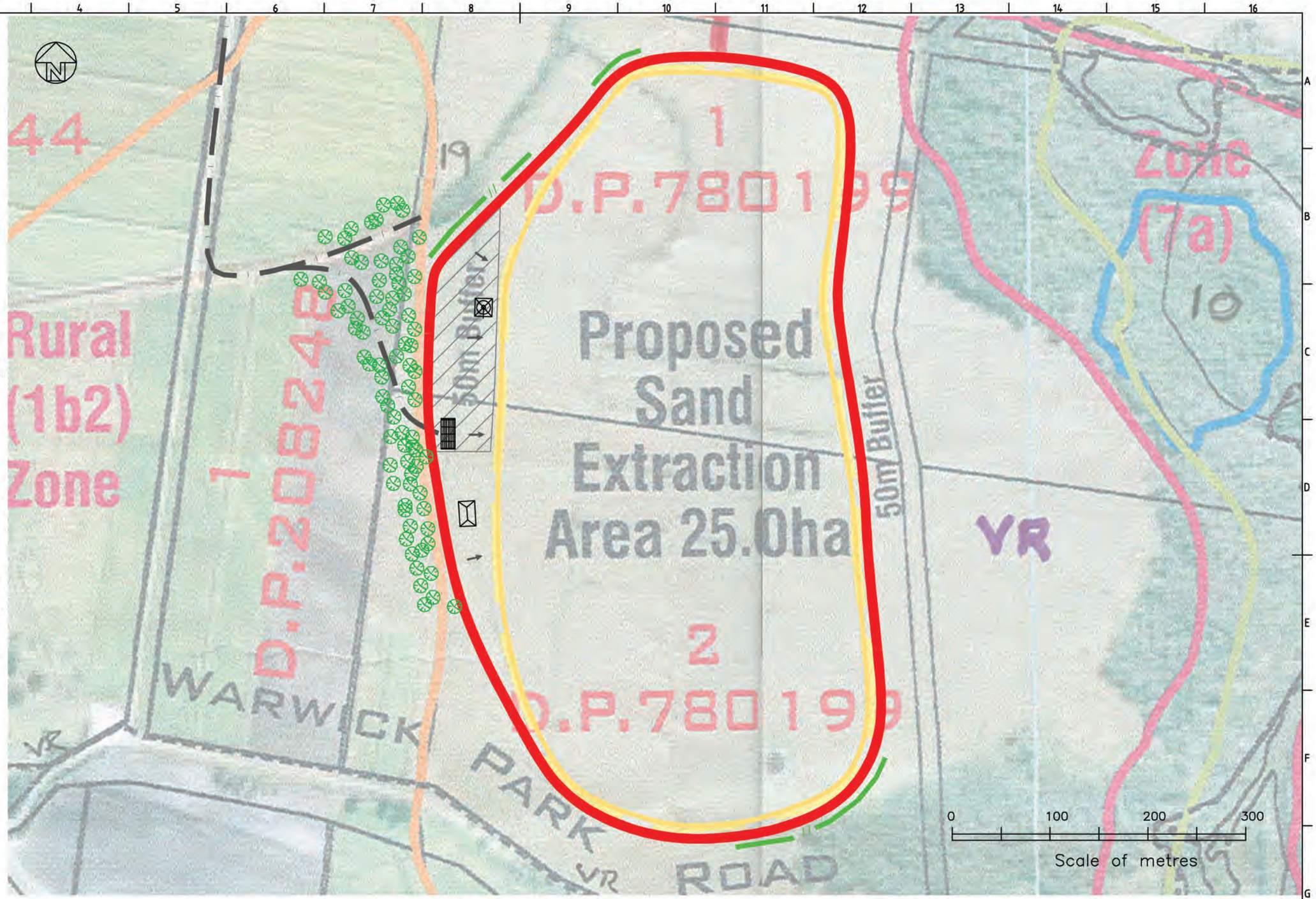
Contractor Management

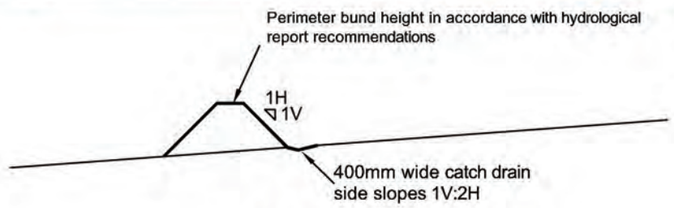
Review of the ESCP and the works contracts by the proponent.
Periodic checks to be made by an independent Environmental Consultant.
Training for construction staff in implementation of ESCP provisions.
Staff to be trained to implement dust minimisation measures.

Legend

- Site office
- Washplant
- Perimeter bund
- Processing area
- Vehicular Shakedown
- Haul route
- Silt Fence
- Negative grade

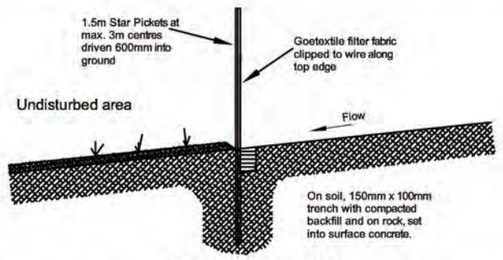
Image source: N.C. White & Associates





PERIMETER BUND DETAIL

Not to Scale



SILT FENCE SECTION

PO Box 1423,
Kingscliff NSW 2487
86 Marine Pde, Kingscliff
Telephone: (02) 6674 5001
Fax: (02) 6674 5003
Email: info@planitconsulting.com.au
PLANIT CONSULTING

PROJECT
RAMTECH PTY LTD
DUNLOE PARK, MOOBALL
SOUTHERN LAKE EROSION AND SEDIMENT CONTROLS

FIGURED DIMENSIONS TO BE READ IN PREFERENCE TO SCALING	APPROVED	SCALE AS SHOWN	DRAWN C.M.A.	DRAWING No.
		DATE 9/11/06	CHECKED	GJ0554.ESCP.2.

Appendix 3 – Acid Sulfate Soil Management Plan

Acid Sulfate Soil Identification and Treatment

The Acid Sulfate Soil Management Plan has been separated into the following parts:

- Acid Sulfate Soil Identification
- Acid Sulfate Soil Treatment

Acid Sulfate Soil Identification

Dry excavated materials

All surface materials to be dry excavated will be sampled according to the following protocol on a staged basis prior to commencement of the excavation works in the following protocol:

- Frequency – In accordance with the NSW ASSMAC (1998) guidelines sampling frequency will be 2 boreholes per hectare over the excavation area with holes extending to the maximum depth of the builder's loam material.
- Sampling – Soil samples approximately 0.3 kg each to be collected from each soil horizon or at least 0.5 m intervals down the soil profile. The soil profile description and depth of each sample is to be recorded. Soil samples to be collected in sealed containers or geological sampling bags that exclude air and chilled immediately. Samples are to be sent to the laboratory or frozen within 24 hours.
- Analysis – Samples are to be screened for acid sulfate soil potential and undergo Chromium Reducible Sulphur (CRS) and Total Actual Acidity (TAA) analyses at an appropriate laboratory. If the ASSMAC (1998) action criteria of 0.03%S equivalent sulfur or 18 mol H+/tonne of the equivalent acidity are exceeded, the material will require treatment as described below.

Hydraulically excavated material

Material extracted by hydraulic dredge will be sampled according to the following protocol:

- Frequency – Ten samples per quarter.
- Sampling – Samples will be collected following the washing process. Soil samples to be collected in sealed containers or geological sampling bags that exclude air and chilled immediately. Samples are to be sent to the laboratory or frozen within 24 hours.
- Analysis - Samples are to be screened for acid sulfate soil potential and undergo CRS and TAA analyses at an appropriate laboratory. If the ASSMAC (1998) action criteria of 0.03%S equivalent sulfur or 18 mol H+/tonne of the equivalent acidity are exceeded, the material will require treatment as described below.

Silt fines within the silt trap area

Silt fines extracted to the silt trap area will be sampled according to the following protocol:

- Frequency – In accordance with the National Acid Sulfate Soils Guidance (Water Quality Australia, 2018) stockpiles in the silt trap area will be tested at the following frequencies:
  - For stockpiles < 250 m^3 – two samples
  - For stockpiles 251 m^3 – 500 m^3 – three samples
  - For stockpiles 501 m^3 – 1,000 m^3 – four samples
  - For stockpiles >1,000 m^3 – four samples plus one additional sample per 500 m^3
- Sampling – Samples will be collected from the stockpiled silt in the silt trap area. Soil samples to be collected in sealed containers or geological sampling bags that exclude air and chilled immediately. Samples are to be sent to the laboratory or frozen within 24 hours.

- Analysis - Samples are to be screened for acid sulfate soil potential and undergo CRS and TAA analyses at an appropriate laboratory. If the ASSMAC (1998) action criteria of 0.03%S equivalent sulfur or 18 mol H+/tonne of the equivalent acidity are exceeded, the material will require treatment as described below.

Acid Sulfate Soil Treatment

Dry excavated materials

Dry excavation of soils exhibiting acid sulfate potential, based on the laboratory results, is to be treated in accordance with the following procedures:

- Soils requiring treatment will be treated with lime or a suitable neutralising agent to neutralise their equivalent TPA or equivalent oxidisable sulfur. In calculating the amount of lime or neutralising agent to be added, a mixing factor of safety of 1.5 will be used. If it can be demonstrated that this safety factor is not needed, a 1:1 ratio will be implemented.
- The calculated amount of lime or neutralising agent is to be spread over the extraction prior to commencement of excavation. Mixing of the materials will occur as the soils are excavated.
- All treated materials will be placed in spatially tracked areas within the perimeter bund and undergo verification testing at a rate of a minimum of 10 samples of the processed sand over a quarterly period for analysis by the CRS/TAA method. One sample should be collected from each on-site processing unit.
- Soils will not be transported off site until verification testing indicates acceptable oxidisable sulphur concentrations in accordance with the ASSMAC guidelines i.e., the equivalent sulphur is less than 0.03%S and the equivalent acidity 18 mol H+/tonne.
- If verification testing indicates continual failure to meet specified oxidisable sulfur concentrations additional lime and more thorough mixing of materials may be required. In this case, additional lime will be spread across the excavation area and mixed into the soil using a rotary hoe or disc plough prior to excavation.

Hydraulically excavated material

Hydraulically excavation material exhibiting acid sulfate potential, based on the laboratory results, is to be treated in accordance with the following procedure:

- Lime is to be mixed with water at the rate indicated by the laboratory results. In calculating the amount of lime or neutralising agent to be added, a mixing factor of safety of 1.5 will be used. If it can be demonstrated that this safety factor is not needed, a 1:1 ratio will be implemented.
- The lime and water mixture is to be sprayed onto the washed sand.
- All treated materials will be placed in spatially tracked areas within the perimeter bund and undergo verification testing at a rate of a minimum of 10 samples of the processed sand over a quarterly period for analysis by the CRS/TAA method. One sample will be collected from each on-site processing unit.
- The sand will not be transported off site until verification testing indicates acceptable oxidisable sulphur concentrations in accordance with the ASSMAC guidelines i.e., the equivalent sulphur is less than 0.03%S and the equivalent acidity is less than 18 mol H+/tonne.
- If verification testing indicates continual failure to meet specified oxidisable sulfur concentrations additional lime and more thorough mixing of materials may be required.

Silt fines within the silt trap area

Silt fines may be treated either by wet treatment (lime and water) following settlement or by dry treatment with lime when material is drained and amenable to dry mixing. Silt fencing is to be set up around the silt trap area to minimize sedimentation to the pond.

Dry treatment of silt from the silt trap area is to be undertaken in accordance with the following procedures:

- Silt materials requiring treatment will be treated with lime or a suitable neutralising agent to neutralise their equivalent TPA or equivalent oxidisable sulfur. In calculating the amount of lime or neutralising agent to be added, a mixing factor of safety of 1.5 will be used. If it can be demonstrated that this safety factor is not needed, a 1:1 ratio will be implemented.
- The calculated amount of lime or neutralising agent is to be spread over the silt stockpile prior to mixing with an excavator.
- All treated materials will be placed in spatially tracked areas within the silt trap area and undergo verification testing at the following frequencies for analysis by the CRS/TAA method:
  - For stockpiles < 250 m^3 – two samples
  - For stockpiles 251 m^3 – 500 m^3 – three samples
  - For stockpiles 501 m^3 – 1,000 m^3 – four samples
  - For stockpiles >1,000 m^3 – four samples plus one additional sample per 500 m^3
- The silt will not be removed from the stockpile until verification testing indicates acceptable oxidisable sulfur concentrations in accordance with the ASSMAC guidelines i.e., the equivalent sulphur is less than 0.03%S and the equivalent acidity is less than 18 mol H+/tonne.
- If verification testing indicates continual failure to meet specified oxidisable sulfur concentrations additional lime and more thorough mixing of materials may be required. In this case, additional lime will be spread across the excavation area and mixed into the soil using an excavator.
- Wet treatment of silt from the silt trap area is to be undertaken in accordance with the following procedures:
  - Lime is to be mixed with water at the rate indicated by the laboratory results. In calculating the amount of lime or neutralising agent to be added, a mixing factor of safety of 1.5 will be used. If it can be demonstrated that this safety factor is not needed, a 1:1 ratio will be implemented.
  - The lime and water mixture is to be sprayed onto the silt stockpile.
- All treated materials will be placed in spatially tracked areas within the silt trap area and undergo verification testing at the following frequencies for analysis by the CRS/TAA method:
  - For stockpiles < 250 m^3 – two samples
  - For stockpiles 251 m^3 – 500 m^3 – three samples
  - For stockpiles 501 m^3 – 1,000 m^3 – four samples
  - For stockpiles >1,000 m^3 – four samples plus one additional sample per 500 m^3
- The silt will not be removed from the stockpile until verification testing indicates acceptable oxidisable sulfur concentrations in accordance with the ASSMAC guidelines i.e., the equivalent sulphur is less than 0.03%S and the equivalent acidity is less than 18 mol H+/tonne.
- If verification testing indicates continual failure to meet specified oxidisable sulfur concentrations additional lime and more thorough mixing of materials may be required.

Appendix 4 – Acid Sulfate Soil Reuse Assessment

ENVIRONMENT
& HEALTH

Holcim Australia Pty Ltd
Dunloe Sand Quarry
Pottsville Road,
Pottsville NSW 2485
Attention: Matt Kelly

Date 01/03/2022

Acid Sulfate Soil Reuse Assessment

Dear Matt,

Ramboll has prepared this letter to inform Holcim on the approval process for the reuse of treated acid sulfate soil fines from the sand quarry operations at Dunloe Sand Quarry, Pottsville, NSW.

Holcim propose to blend silt produced from the sand quarrying process with existing topsoil onsite and apply the soil blend to the neighbouring agricultural land. Currently, the consent conditions for the Quarry (Modification 2, November 2018) states that:

Condition 10
"The Proponent must ensure that all excavated potential acid sulfate soil fines material is returned back to below the watertable as soon as possible to prevent oxidation. No potential acid sulfate soil must be removed from the site, unless adequately neutralised in accordance with methods approved under the Soil and Water Management Plan."

Condition 11
"The Proponent must ensure that all potential acid sulfate soil fines material is discharged into the pond at a depth of no less than 3 metres from the water surface, and that all fines are deposited to a final depth of at least 8 metres from the water surface[1], unless an alternative method(s) is approved by DoI and the Secretary."

Ramboll considers that Holcim should discuss alternative treatment options with DPIE (formerly DoI) and the Secretary to facilitate a sustainable onsite reuse option for the silt fines.

Holcim is proposing the following process (with diagram copied below):

1. *Water pumped from wash plant into a silt trap*

[1] It's understood depositing the fines at a depth of 8 m is not practical at the site, so the fines are being deposited at a minimum depth of 3 m.

Ramboll
Level 2, Suite 18 Eastpoint
50 Glebe Road
PO Box 435
The Junction
NSW 2291
Australia

T +61 2 4962 5444
https://ramboll.com

Ramboll Australia Pty Ltd.
ACN 095 437 442
ABN 49 095 437 442

2. *When filled with silt, remove silt with excavator as it fills. Runoff water from the silt trap to feed into silt pond through gravity.*
3. *Mix with topsoil stockpiles on site which are spread out over the site owners neighbouring paddocks (still retained within the boundaries of the site)*

Ramboll suggests treatment with agricultural lime (aglime) to neutralise acid sulfate soils in the silt trap if the fines are not treated prior to this step. It's understood that the topsoil material is also treated with lime and therefore the treatment of silt will need to be balanced to ensure the blended material is not over limed and the pH of the blended material is appropriate for the proposed use.

Ramboll has consulted with NSW EPA on a previous iteration of the proposal by Holcim to transport the silt material off-site, without specifying the end-use. We have considered the current proposal against relevant legislation and approval processes and consider that the main approval pathway should be through consultation with DPIE and amendment of the Acid Sulfate Soil Management Plan (ASSMP) and Soil and Water Management Plan (SWMP) to allow reuse of treated acid sulfate soil fines onsite. On that basis we do not propose any further consultation on the application with NSW EPA at this stage.

As Ramboll are currently revising the SWMP and ASSMP, the revision should consider the alternative approach to reusing the silt fines. The following additional information should be included in the ASSMP:

- Updated information on the testing methodology and frequency for the silt pumped from the wash station.
- Updated information on the treatment of hydraulically excavated silt fines in the silt trap area.
- Updated information on the verification testing methodology and testing frequency of the silt fines.

The following additional information should be included in the SWMP:

- Include provision of sediment control around the proposed silt fines stockpile.

Ramboll considers the proposal provides a sustainable solution through reuse of a valuable soil resource, negating the need to retain the silt within the pond which causes water quality issues. We appreciate the opportunity to support Holcim with this initiative.

Yours sincerely

Nathan McGuire
Environmental Engineer
Environment and Health

D 02 4962 5444
M +61 422 937 410
nmcguire@ramboll.com

Fiona Robinson
Principal, Manager Australia and New Zealand
Environment and Health

D 02 4962 5444
M +61 421 311 066
frobinson@ramboll.com

Figure: Diagram of proposed process (Holcim, 2022)

Figure: Map of the Quarry Site including the Stage 1 and Stage 2 extraction areas (GHD, 2019).

Appendix 5 – Blue-green Algae Monitoring and Management Plan

Dunloe Sand Quarry

Pottsville-Mooball Road, Mooball, NSW

Blue-green Algae Monitoring and Management Plan

October 2023

Prepared By:
Dr. Nimal Chandrasena
Principal Ecologist and Director, *Nature Consulting Australia*
Principal Ecologist and Partner - *Bettersafe Environmental Services* (https://www.bettersafe.com.au/),

Contents

Figures

Tables

1 Background

1.1 Purpose

This **Blue-green Algae Monitoring Plan (BGMP)** forms part of the Environmental Management Strategy (EMS) for Dunloe Sand Quarry and has been prepared to meet the requirements of the Minister's Conditions of Approval (CoA) outlined in Development Consent No. 06_0030, the mitigation measures outlined in MOD2 (GHD, 2017), the Environmental Impact Statement (EIS) (Planit, 2007), the Environment Protection Licence 13077 (EPL) and relevant legislation.

The BGMP is focused on the surveillance, monitoring and management of water quality parameters, related to algal blooms in surface water of the two ponds at the site.

Implementation of the BGMP is to be integrated with the associated Surface Water and Groundwater Monitoring and Management Plans, as well as environmental contingency plans to mitigate any identified adverse impacts.

1.2 Objectives

This BGMP details monitoring, maintenance, management and reporting activities applicable to water quality management in the two ponds at the Dunloe Sand Quarry. Specifically, this includes:

- Environmental and water quality monitoring procedures using best practices.
- Trigger levels related to guidelines that would initiate management action.
- Mitigative and/or Contingency actions.

The key objective of this BGMP are to:

- Ensure that impacts on water quality during operations at the site are minimised.
- Manage any public health risks within the scope approved by the development consent.
- Ensure full compliance with the relevant legislative requirements and CoA.

1.3 Review and Improvement

This BGMP will be implemented throughout the operational lifetime of Dunloe Sand Quarry. Continuous improvement will be achieved in accordance with the EMS, through the ongoing evaluation of environmental management performance against environmental objectives and targets by:

- Identifying areas of opportunity for improvement of environmental management and performance.
- Determining the cause(s) of non-conformances and deficiencies.
- Implementing a plan of corrective and preventative action to address any non-conformances.
- Verify the effectiveness of the corrective and preventative actions.
- Document any changes in procedures resulting from process improvement.

2 Site Details

The Dunloe Sand Quarry is located on the New South Wales North Coast, approximately 4 km south of Pottsville. It produces fine concrete sand and other sand products through a suction dredge extraction process. The current operational area of the site (Stage 1) comprises an extraction pond (Dredge Pond), a settlement pond (Silt Pond) and a stockpiling/processing area, as well as various site buildings, sheds, access tracks and haul roads.

Figure 1 shows the site and the two ponds in question. The Silt Pond (Pond 1) is approximately 25,000 m^2 and typically 5-6 m but can be up to about 7 m deep. The larger Dredge Pond (Pond 2) is about 12 ha (120,000 m^2) and could be 10-12 m deep.

Groundwater at the site is shallow, with several existing groundwater fed seepage dams, historically used for watering livestock. Low lying areas of the site are known to become boggy following rainfall, despite the sandy nature of the site. As such, there is likely to be a degree of groundwater-surface water interaction (Ramboll, 2021a).

Observed responses to rainfall also indicates that in addition to direct precipitation, the ponds receive water through groundwater recharge and infiltration of overland flow from upstream or upgradient of the site and flowing through the site in creeks and drainage lines.

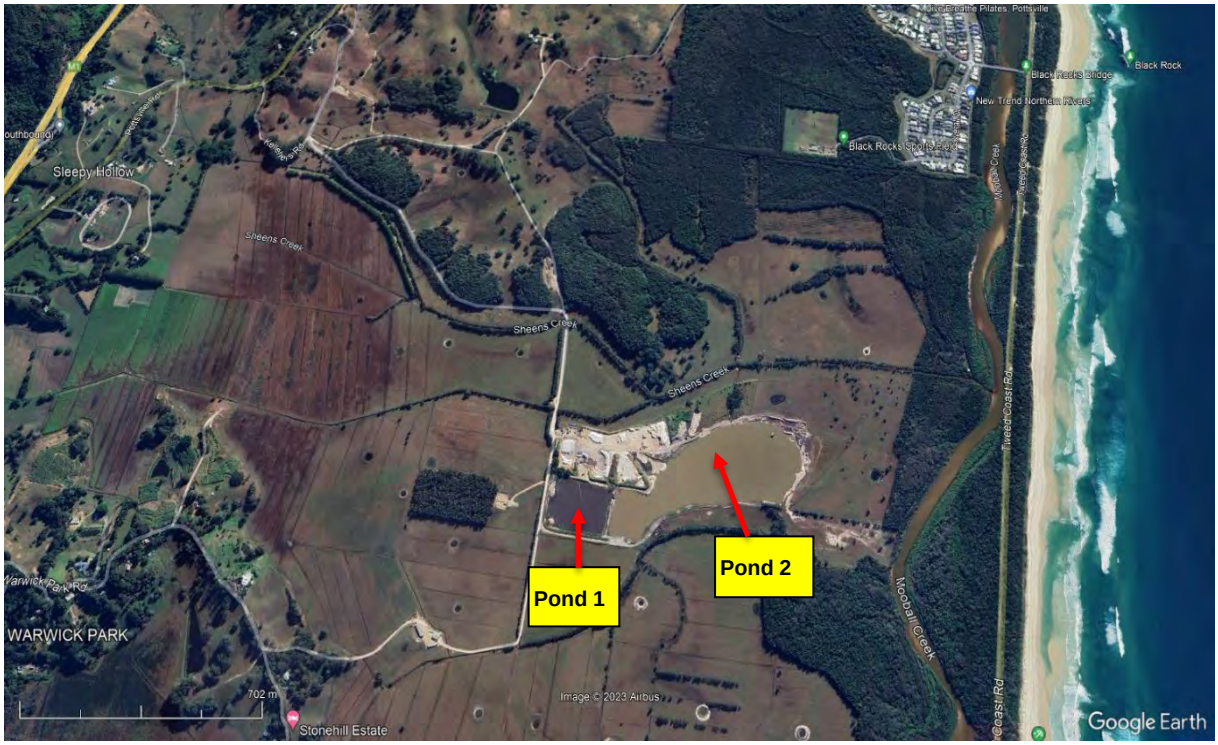


Figure 1 Site Layout and Sample Locations

The site is located within the Mooball Creek catchment and Sheens Creek sub catchment area, and approximately 4 km upstream from the mouth of Mooball Creek. The site has catch drains which merge into the main agricultural drains onsite.

These drainage lines were historically fitted with flood gates to control inundation of tidal water from Mooball Creek; however it is understood the NSW Department of Primary Industries (DPI) Fisheries has requested that these gates be left open to allow passage of fish.

2.1 Rationale for water Quality Monitoring

Monitoring of water quality parameters of flowing rivers and streams, and stagnant water bodies, such as lakes, ponds, basins, wetlands and estuaries, provides information on the aquatic health of the water.

The parameters allow for decisions to ensure the preservation of the health of the aquatic ecosystem in those environments. As explained in the ANZECC Water Quality Guidelines (2000), outside certain ranges, the parameters indicate “stressful” conditions in the waterbodies for aquatic life.

Sampling and measurement of the concentration of defined water quality parameters allows for comparison with baseline data and assessment of compliance with water quality guideline values. They allow management decisions to be taken to mitigate any adverse effects arising from catchment sources and also for managing public health risks.

2.2 Baseline Data

Table 1 provides a snapshot of historical (2004-05) baseline water quality conditions for surface water at the Holcim site. The electrical conductivity (EC) results showed that the site is partially tidal, at least up to the flood gates on the main agricultural drains, which traverse the site.

- Dissolved oxygen (DO) levels were slightly lower than ANZECC Guidelines, which was most likely due to base flow from groundwater, which is typically very low in DO.
- Nutrients were elevated, above the relevant ANZECC Guidelines, at some locations and can be attributed to the surrounding agricultural landscapes.

- In general, the sites surface water quality was relatively good and reflected conditions characteristic of agricultural drains in low lying floodplains.

Table 1 Baseline surface water quality (2004-2005)

Location	Date	E.C. (mS/cm)	Turbidity (NTU)	pH	Temp. (C°)	DO (mg/L)	TSS (mg/L)	N (mg/L)	P (mg/L)
SW1	17/12/04	2.85	NA	NA	24.1	4.55	NA	NA	NA
SW2	17/12/04	4.19	NA	NA	23.0	6.49	NA	NA	NA
SW3	17/12/04	1.73	NA	NA	24.3	5.79	NA	NA	NA
SW4	17/12/04	5.95	NA	NA	23.3	9.22	NA	NA	NA
SW5	24/01/05	39.5	5	8.07	28.9	6.23	24	0.3	0.11
SW6	24/01/05	24.3	19	7.53	30.2	6.06	NA	NA	NA
SW7	24/01/05	9.32	11	7.44	29.7	4.76	NA	NA	NA
SW8	24/01/05	0.73	10	7.30	34.8	6.90	8	1.5	0.05
SW9	24/01/05	18.8	15	7.50	31.6	5.47	22	0.4	0.04
SW10	24/01/05	3.19	8	7.17	32.8	5.12	2	0.8	0.02
SW11	24/01/05	27.8	1	7.81	30.8	6.04	NA	NA	NA
SW12	24/01/05	8.50	10	7.42	31.7	5.60	NA	NA	NA

2.3 Current data

The current water quality monitoring program undertakes monthly surface water and groundwater monitoring at the nominated sites, given in the EPL, along with monthly other environmental monitoring (i.e. air quality with dust gauges).

Monthly surface water monitoring with ‘grab’ samples taken from the ponds is done from the banks with an extendable pole. However, once a quarter the depth profiles are taken from a boat at a location in the middle of the ponds.

Table 2 presents a set of data from the Quarter 2 (April 2023) sampling. Both waterbodies, with high salinity levels, are not freshwater.

The standout parameter is pH in both ponds, which are in the acidic range and well below the ANZECC guidelines for pH in freshwater lakes or lowland rivers and streams.

Dissolved oxygen levels are mostly satisfactory in the Dredge Pond (range of 80%-82%). But in the Silt Pond, DO levels are lower than ANZECC Guidelines (in the range of 65-72% down to 6 m depth and much low at the bottom (about 50% DO).

Table 2 Baseline water quality (11 April 2023) Quarter 2 Monitoring – Depth Profiles

Location	Depth (m)	pH	Temp. (C°)	DO (mg/L)	EC (µS/cm)	Turbidity (NTU)
Dredge Pond	1.0	5.1	23.6	7.8	95	0.9
	2.0	4.3	23.4	7.6	95	1.0
	3.0	4.2	23.4	7.6	95	1.0
	4.0	4.2	23.4	7.7	96	1.0
	5.0	4.1	23.4	7.5	96	0.9
	6.0	3.9	23.3	7.5	96	1.4
	7.0	3.8	23.3	7.4	96	1.0
Silt Pond	1.0	4.9	22.61	7.2	107	177
	2.0	4.6	22.27	6.7	107	218
	3.0	4.4	22.26	6.6	107	232
	4.0	4.2	22.12	6.5	108	210
	5.0	4.3	22.1	6.4	108	195
	6.0	4.3	22.13	6.2	108	202
	7.0	4.3	22.24	4.8	108	1000

2.4 Environment Protection Licence (EPL) Requirements

The minimal surface water requirements for the two ponds are contained in Environment Protection Licence 13077 (EPL), which has been issued under the following, relevant legislation:

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

The reporting requirements for surface water quality in the EPL are presently for three parameters: (1) pH, (2) Oil & Grease, and (3) Total Suspended Solids (TSS).

The EPL requires the samples to be taken from two defined locations (i.e. Southern most point of the Dredge Pond and the South-West corner of Silt Pond.

3 Blue-green Algal Monitoring and Management

Stagnant waterbodies with little water exchanges or flows through them tend to become enriched with nutrients. This is especially true if the waterbodies are located in agricultural environments (such as this site). Nutrient enrichment (Nitrogen and Phosphorus), combined with other factors (such as warm temperatures and high sunlight) can produce conditions conducive to algal growth.

Not all forms of algal growth poses public health and environmental risks as algae are a natural component (producers) of aquatic ecosystems. However, one group, blue-green algae (Cyanobacteria) poses public health risks due to their excessive growth and the potential to produce harmful toxins.

Condition 22 of Schedule 3 requires that a Blue-green Algae Management Plan be developed and implemented with appropriate levels of surveillance, monitoring with sampling, analyses and reporting.

The conditions also imply suitable action be implemented to reduce cyanobacterial bloom formation in the waterbodies and mitigate any associated environmental risks to the public.

3.1 Guidelines

Following best practice, the following guidelines were considered during development of this Blue-green Algae Management Plan (BGMP):

- *Guidelines for Managing Risks in Recreational Water (NHMRC, 2008).*
- *Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC, 2000).*

These documents provide specific algal alert guidelines to manage the risks posed by excessive cyanobacterial growth. The Monitoring guidelines are given below in **Table 3**:

3.2 Water Quality Monitoring Plan for Blue-green Algae

3.2.1 'Composite' Water Samples

- Routine monitoring of the surface water samples will be collected from 100 mm beneath the surface as far away from the embankment as is practicable.
- An extendable sampling arm (pole) may be used where appropriate, and every effort should be made to avoid disturbing sediments.
- Because of the uneven distribution of cyanobacteria, several water samples (grab samples) will be taken from around each pond into a bucket.
- These samples will then be made into a single 'composite' water sample, representative of conditions in those waterbodies, at the time of sampling.
- The composite sample will be submitted to the laboratory for analysis.

3.2.2 Water Quality Parameters

In-situ measurements of water quality parameters at the specified locations (see **Figure 2**) and depth profiling are essential to determine site conditions that can vary dramatically, or frequently, and also the stratification of the waterbodies during summer months.

Table 3 Blue green algae (Cyanobacteria) Alert Levels

Alert Level	Indicator Concentration	Cyanobacteria Bio-volume	Action
No Alert	<500 cells/mL of *Microcystis aeruginosa*	N/A	• Monthly samples
Green Alert	500-5000 cells/mL of *Microcystis aeruginosa*	<0.4 mm^3/L toxic Cyanobacteria or	• Monthly samples • Algal alert signage erected
Amber Alert	5000 - 50,000 cells/mL of *Microcystis aeruginosa* (Toxic)	0.4 – 4.0 mm^3/L of known, toxic Cyanobacteria	• Fortnightly samples from lake. • Screen samples for genetic capacity to produce toxin (CyanoDtec test). • If genetic testing determines not toxic; revert to monthly surveillance monitoring • Algal alert signage erected.
Red Alert	>50,000 cells/mL cells of *Microcystis aeruginosa* (Toxic)	>4.0 mm^3/L of known, toxic Cyanobacteria, or >10 mm^3/L <u>all</u> Cyanobacteria	• Signage alerting to potential danger for staff, contractors, clients and visitors. • Use of PPE for people coming into contact with lake water if aerosols present. • Fortnightly sampling until back to surveillance levels. • Algal alert signage erected

Where possible, *in-situ* monitoring will be from locations away from the water's edge and in areas where water is deep. *In-situ* measurements will be made at the same locations as water sample collection.

In-situ monitoring will be conducted using a calibrated, multi-parameter water quality probe, collecting data from a fully submerged probe (i.e. 200-500 mm) at each location.

Parameters measured will be:

- Temperature (°C);
- pH;
- Electrical Conductivity (µS/cm);
- Dissolved Oxygen (mg/L and % saturation), and
- Turbidity (NTU).

All measurements will be recorded on appropriate field sheets, or electronically captured on a Tablet

3.2.3 Visual Assessments

Visual assessment of the two ponds will be performed opportunistically during the monitoring events. The assessments involve checking the components of the whole system, including inflows/outflows. Observations will be recorded on a customized field sheet and include observations on:

- Water clarity
- Aquatic flora and fauna (desirable and undesirable)
- Algae and floating scums
- Water levels and influential weather

Figure 2 Sampling locations for blue-green algae and surface water quality monitoring

Note: These sampling locations are provisional suggestions only and should be verified (depending on access) and recorded as such by the sampling team. If these locations are unsuitable due to access, they team should select the most appropriate sampling locations.

- Surrounding landform, and bank erosion
- Spills/rubbish, damage or vandalism of the system components; and
- Any other significant site issues.

3.2.4 Sample Handling and Preservation

- Samples for blue-green algal analysis will be collected in appropriate bottles and preserved with a drop of iodine (2%). The collected samples will be transported on ice, in an esky, to the NATA accredited laboratory as soon as possible, accompanied by a Chain-of-Custody Form.
- All sampling and preservation techniques will be in accordance with the Australian Standards for water quality sampling (AS/NZS 5667.1:1998).

3.2.5 Integration with Surface Water Quality Monitoring

The blue-green algae monitoring program forms part of surface water monitoring requirements and is to be undertaken at various frequencies throughout the year, as detailed in **Table 4**.

Table 4 Blue-green algae monitoring integrated with Surface water monitoring program

Monitoring Location	Frequency	Analysis	Trigger Value
Dredge Pond and Silt Pond	Fortnightly (October to April) Monthly (May to September)	• Blue green algae total count • Total Biovolumes • Toxic and potentially Toxic Cyanobacteria – full count and biovolumes	As given in Table 3

- For surface water quality, the frequencies of monitoring, specific parameters and indicators for measurements are outlined in **Section 6** and **Table 6-3** of the Dunloe Sands Quarry Soil and water Management Plan (SWMP).
- In implementing this BGMP, the monitoring of water quality for blue-green algae will be integrated with the parameters to be measured for general surface water quality.
- The reporting (see Section 5) will also capture and combine the results of implementing the monitoring plans given in both the SWMP and the BGMP.

3.3 Contingency Action Plan

If the monitoring detailed in Section 3.2 detects a cyanobacterial abundance or a bloom, a contingency plan or trigger and response plan is to be implemented, as shown in **Table 5**.

Table 5 Contingency plan for Blue-green algae

Trigger	Response
Blue Green Algae	
Algal blooms observed	• Increase inspections of the ponds to twice daily and water monitoring to weekly. • Ensure no public access to water body. Erect appropriate warning signage. • Should phosphorous levels be recorded higher than the criteria, dosing of the ponds could be undertaken. • A mixture of alum and gypsum should be used. The quantity of each will be determined by the volume of water in the lakes. This action is more appropriate and successful at the beginning of summer and prior to a bloom developing. • Engage consultant to advise on the appropriate mitigation.
Surface water	
Water quality results exceed the relevant trigger value	• Undertake a detailed inspection of all controls and address any issue identified. • If a significant variation in lake water pH or EC occurs as a result of on-site activities, investigate the cause of the problem and identify measures to resolve it. • Review procedures to avoid the issue in future. If the issue persists, engage a consultant to advise on the appropriate mitigation.

4 Reporting

The general reporting requirements are described in Section 8.4 of the EMS.

In relation to routine monitoring this will be recorded on the Environmental Inspection Checklist in the Environmental Monitoring and Management Plan.

In relation to water samples, the following would be recorded:

- The date(s) on which the sample was taken.
- The time(s) at which the sample was collected.
- The point at which the sample was taken.
- The name of the person who collected the sample.
- The activities occurring during the monitoring.
- A comparison of the results with the adopted criteria.
- A report will be prepared by the Quarry Manager following every 12 months of monitoring and a summary of the monitoring results will be presented in the Annual Report (refer to the EMS).

If an exceedance of the criteria is recorded, DPE will be notified in writing, as described in Section 6 of the EMS, and provided with quarterly monitoring results until the results show that the project is complying with the relevant criteria.

All records will be:

- Maintained in a legible form.
- Kept for at least 4 years.
- Produced to any authorized officer of the EPA and/or DPE upon request.

5 Conditions of Approval

The CoA components relevant to this BGMP are listed in **Table 7** given in the appendices. These are relevant to implementing this BGMP to ensure that issues related to managing water bodies are complied with and best management practices are followed in the management of both the waterbodies and their surrounding environments.

6 Environmental Control Measures

General Controls

Environmental requirements and control measures have already been identified in the CoA and the EIS.

Specific measures and requirements to address soil and surface water quality, including blue-green algal management are also outlined in **Section 5** and **Table 5-1** of the Dunloe Sands Quarry Soil and Water Management Plan (SWMP).

- Best management would require periodic review of all these factors and issues and making suitable adjustments and interventions.
- Expert advice should be sought if the water quality in the ponds deteriorate, and public health risks eventuate in any Blue-green algal bloom event.

Blue-green Algal Risk Management

- Managing the potential for blue-green algal blooms will involve a holistic approach addressing factors that might contribute to nutrient enrichment.
- The Environmental Control measures already in place, given in the above-mentioned SWMP (see Table 5-1), are important in managing the risks posed by algal abundance or blooms. They should also be reviewed periodically for effectiveness.

7 References

ANZECC (2000) Australian and New Zealand guidelines for fresh and marine water quality. National Water Quality Management Strategy, Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand, Canberra.

GHD (2020). Holcim (Australia) Pry Ltd, Dunloe Sand Quarry Soil and Management Plan (October 2020).

NHMRC (2008). National Health & Medical Research Council. Guidelines for managing risk in recreational waters. Australian Government Publication.

NSW EPA (2018). Environmental Protection Licence, Number 13077.

Planit Consulting (2007). Environmental Impact Statement.

Planit Consulting (2018). Environmental Management Plan (EMP) and Environmental Management Strategy for Dunloe Sands (Holcim Australia Pty Ltd), dated July 2018

Ramboll (2021a). Dunloe Sand Quarry Data Review. Dated September 2021. Prepared by Ramboll Australia Pty Ltd, Reference 318000911.

Ramboll (2021b). Report, Dunloe Sands SSTV Update, dated November 2021. Prepared by Ramboll Australia Pty Ltd, Reference 318000911.

Ramboll (2023). Dunloe Sand Quarry: Soil and Water Management Plan. Prepared by Ramboll Australia Pty Ltd.

Appendices

The ANZECC (2000) guidelines for south-east Australian aquatic ecosystems (freshwater lakes, lowland rivers and estuaries) are relevant for the monitoring program. The guidelines (Table 6) are based on toxicological studies, which define trigger values for physical and chemical stressors at which undesirable effects on aquatic ecosystems are observed.

However, given that they relate to reference conditions of aquatic systems that are minimally disturbed, these guidelines are regarded as conservative, in relation to the current condition of the pond systems.

Table 6 ANZECC (2000) Guidelines for Aquatic Ecosystem Health

Parameter	Significance of parameter	GUIDELINES		
		Lowland Rivers	Freshwater Lakes	Estuaries
pH	Extremes of pH can be directly toxic to biota, and can modify the effect of other stressors (e.g. release metals).	6.5 – 8.5 pH units	6.5 - 8.0 pH units	7.0 - 8.5 pH units
Electrical Conductivity (EC)	Levels elevate during periods of low flow and if affected by saline groundwater inputs. Changes in EC can alter the ecosystem composition and abundance of species.	125 - 2200 µS/cm	20 - 30 µS/cm	N/A
Dissolved Oxygen (DO)	Low DO stresses aquatic organisms and change redox conditions leading to the release of toxicants and nutrients from sediment.	85 - 110% saturation	90 - 110% saturation	80 - 110% saturation
Turbidity	High turbidity is typical of disturbed catchments and during high flow events. Not toxic, but can affect ecosystems and biota.	6 - 50 NTU	1 - 20 NTU	1 - 20 NTU
Ammonium Nitrogen	Indicative of wastewater or fertiliser inputs. Toxic to aquatic life; Can directly affect ecosystems and biota through algal growth and cyanobacterial blooms.	0.02 mg/L	0.01 mg/L	0.015 mg/L
Oxides of Nitrogen (NOX)	Indicative of contamination by wastewater or fertilizer, stimulates phytoplankton; can directly affect ecosystems through algal growth and cyanobacterial blooms.	0.04 mg/L	0.01 mg/L	0.015 mg/L
Total Nitrogen (TN)	Indicative of wastewater or fertiliser inputs. Includes ammonia, NOx-N and other nitrogen compounds, indicates inputs from wastewater and other diffuse sources. Can directly affect ecosystems and biota through algal growth and cyanobacterial blooms.	0.5 mg/L	0.35 mg/L	0.30 mg/L
Total Phosphorus (TP)	Indicative of wastewater or fertiliser inputs. Key nutrient determinant for growth, can stimulate growth and is frequently the limiting nutrient for algal growth.	0.05 mg/L	0.01 mg/L	0.03 mg/L
Chlorophyll *a*	A surrogate of the phytoplankton biomass, and a measure of the effect of nutrient interaction with other parameters.	5 µg/L	5 µg/L	4 µg/L
Total Suspended Solids (TSS)	Reduces light penetration of water, and can affect some forms of aquatic life. May indirectly affect the effect of stressors such as temperature and DO.	No guideline		

Table 7 Conditions of Approval relevant to this BGMP to ensure the water quality of the ponds

Condition No.	Requirement
Schedule 3, Condition 8	Except as may be expressly provided for by an EPL, the Proponent must not discharge any water from the project or ancillary operational areas. The Proponent must ensure that the extraction pit subject to dredging is maintained and operated to prevent discharges of any surface water from these ponds.
Schedule 3, Condition 9	The Proponent must aim to meet the **water quality objectives** for water in the dredge ponds and in groundwater adjacent the dredge ponds, unless otherwise approved by the Secretary.
Schedule 3, Condition 12	The Proponent must manage on-site sewage to the satisfaction of Council and EPA. The facility must comply with the requirements of the *Environment and Health Protection Guidelines – On-site Sewage Management for Single Households (1998)*.
Schedule 3, Condition 13	The Proponent must ensure that flood bunding around the Stage 1 and Stage 2 works does not exceed 300 mm in height above natural surface level, to a maximum height of 2.0 m AHD, unless otherwise approved by the Secretary.
Schedule 3, Condition 16	The Proponent must cease dredging and processing activities not less than 24 hours prior to the commencement of overflow from any dredge pond. No dredging or processing must occur when the dredge ponds are overflowing.
Schedule 3, Condition 17	The Proponent must ensure that the flood storage capacity of the site is no less than the pre-existing flood storage capacity at all stages of the project. Details of the available flood storage capacity must be reported in the Annual Review.
Schedule 3, Condition 18	The Proponent must prepare a Soil and Water Management Plan for the project to the satisfaction of the Secretary. This plan must: (a) be prepared in consultation with DoI and EPA; (b) include a: • Water Balance; • Erosion and Sediment Control Plan; • Acid Sulfate Soil Management Plan; • Blue-Green Algae Management Plan; • Surface Water Monitoring Program; and • Groundwater Monitoring Program; and (c) be submitted to the Secretary prior to starting quarrying operations, and prior to carrying out any development on the site in the case of the Erosion and Sediment Control Plan. The Proponent must implement the plan as approved by the Secretary.
Schedule 3, Condition 19	The Water Balance must include: (a) details of all water extracted, transferred, used and/or discharged by the quarry; (b) the source of all water collected or stored on the site, including rainfall, stormwater and groundwater; and (c) measures to minimise water use by the project.
Schedule 3, Condition 20	The **Erosion and Sediment Control Plan** must: (a) be consistent with the requirements of *Managing Urban Stormwater: Soils and Construction, Volume 1, 4th Edition, 2004* (Landcom), and Council's codes including its *Code of Practice for Soil and Water Management on Construction Sites, Development Design Specification D7 – Stormwater Quality and Tweed Urban Stormwater Quality Management Plan*; (b) identify activities that could cause soil erosion and generate sediment; (c) describe measures to minimise soil erosion and the potential for the transport of sediment to downstream waters; (d) describe the location, function, and capacity of erosion and sediment control structures; and (e) describe what measures would be implemented to maintain these structures over time.

Condition No.	Requirement
Schedule 3, Condition 22	The **Blue-Green Algae Management Plan** must: (a) be prepared by a suitably qualified blue-green algae expert, whose appointment has been approved by the Secretary; (b) be consistent with extant guidelines for blue-green algae management including the NHMRC's *Guidelines for Managing Risks in Recreational Water*; (c) describe the measures that would be implemented to prevent and control the sources of algal blooms over the short, medium and long term; and (d) define procedures for the management and notification of identified algal blooms.
Schedule 3, Condition 23	The **Surface Water Monitoring Program** must include: (a) detailed baseline data on surface water quality; (b) surface water impact assessment criteria; (c) a program to monitor surface water flows and quality; (d) a program to manage water releases from the site; (e) a program to monitor bank and bed stability; and (f) a protocol for the investigation, notification and mitigation of identified exceedances of the surface water impact assessment criteria.
Schedule 5, Condition 1A	The Proponent must ensure that the management plans required under this approval are prepared in accordance with any relevant guidelines, and include: (a) a summary relevant background or baseline data; (b) a description of: • the relevant statutory requirements (including any relevant approval, licence or lease conditions); • any relevant limits or performance measures/criteria; and • the specific performance indicators that are proposed to be used to judge the performance of, or guide the implementation of, the project or any management measures; (c) a description of the measures that to be implemented to comply with the relevant statutory requirements, limits, or performance measures/criteria; (d) a program to monitor and report on the: impacts and environmental performance of the project; and effectiveness of any management measures (see (c) above); (e) a contingency plan to manage any unpredicted impacts and their consequences and to ensure that ongoing impacts reduce to levels below relevant impact assessment criteria as quickly as possible; (f) a program to investigate and implement ways to improve the environmental performance of the project over time (g) a protocol for managing and reporting any: incidents; complaints; non-compliances with statutory requirements; and exceedances of the impact assessment criteria and/or performance criteria; and (h) a protocol for periodic review of the plan.

Appendix 6 – Dunloe Sands SSTV Update (Ramboll, 2021b)

Intended for
Holcim Australia Pty Ltd

Document type
Report

Date
November 2021

Project Number
318000911

REPORT

DUNLOE SANDS SSTV UPDATE

RAMBOLL

Revision	**0**
Date	**16/11/2021**
Made by	**Steve Cadman**
Checked by	**Greer Laing**
Approved by	**Fiona Robinson**
Description	**Reassessment of Site Specific Trigger Values based on Additional Monitoring Data**

CONTENTS

LIST OF FIGURES

LIST OF TABLES

APPENDICES

1. INTRODUCTION

Ramboll Australia Pty Ltd (Ramboll) presents the following report outlining the process and results for the update of selected interim site-specific trigger values (SSTVs) for groundwater monitoring of the Dunloe Sand Quarry located at Mooball Road, Pottsville NSW 2489. SSTVs for surface water were also reviewed to assess if update was possible based on the more limited surface water background data available.

Ramboll was commissioned by Holcim (Australia) Pty Ltd (Holcim), following an earlier review and assessment of groundwater and surface water, (Ramboll 2021). The Dunloe Sand Quarry produces fine concrete sand and other sand products through a suction dredge extraction process.

The review of environmental monitoring at the site (groundwater at five locations and surface water at four creek locations and two ponds), identified some parameters and analytes outside of the water quality interim trigger levels defined in the Dunloe Soil and Water Quality Management Plan (GHD, 2020). The site location, showing monitoring wells, is presented in **Figure 1-1,** and surface water monitoring locations are presented in **Figure 1-2.**

The review concluded that identified occasional exceedances, particularly in aluminium and iron, may be the result of offsite impacts rather than from quarry operations. Generally it was determined that quarry operations had likely not affected groundwater quality.

However, given identified exceedances of the interim trigger values, in some case by wells representative of background conditions, and site changes since quarry development, a review of the sites SSTVs was recommended. The existing interim trigger values were outlined in the Dunloe Sand Quarry Soil and Water Management Plan (GHD, October 2020), and were originally derived from statistical analysis of monitoring data from eight rounds of monthly baseline groundwater monitoring undertaken in the period September 2006 to August 2007, (prior to quarry operations and therefore able to serve as baseline conditions).

The following report presents the scope and results of the review of existing SSTVs.

Figure 1-1 Site Location and Location of Monitoring Points

Figure 1-2 Location of Surface Water Monitoring Points

2. BACKGROUND

2.1 Dunloe Quarry

A full description of the site and background environment is presented in Ramboll (2021). Pertinent details are summarised below.

The site is located on the NSW North Coast, approximately 4 km south of Pottsville, NSW and approximately 750m from the Pacific coastline to the east. The area is characterised by a coastal flood plain associated with Mooball Creek, located east of the site. Several small creeks and drainage channels intersect the site, mainly in a west to east direction ultimately flowing into Mooball Creek.

The current operational area of the site (Stage 1) comprises an extraction pond (Dredge Pond), a settlement pond (Silt Pond) and a stockpiling/processing area, as well as various site buildings, sheds, access tracks and haul roads.

The site has a relatively flat topography, with drainage and creek alignments indicating a slight fall to the east to Mooball Creek. A review of topographic mapping for the area indicates a slight incline to the west of the site to the Pacific Motorway, a major national route approximately 2.2 km away. West of the Pacific Motorway is characterised by an elevated ridgeline around Sleepy Hollow, extending northwest to Burringbar Mountain.

The site is generally set in and surrounded by coastal bushland, agricultural properties and infrastructure.

The site lies within a low-lying coastal floodplain consisting of unconsolidated gravels, alluvium, sand, and clay with greywacke, slate, phyllite and quartzite bedrock exposed in the elevated topography to the west.

The site geology including the target quarry materials comprise shallow topsoil overlaying fine to medium grain sand to approximately 12m underlain by marine clay of variable thickness.

Groundwater on the site is very shallow with an anticipated high likelihood of surface water and groundwater interaction. The degree of interaction between groundwater and surface water is assumed to be influenced by pressure head differentials developed by rainfall, tidal fluctuations, and the quarry operations.

The (surface) alluvial sediment aquifers are considered to have minimal interaction with the bedrock aquifers. This is considered a reasonable assumption based on the low permeability of the underlying marine clays which would limit groundwater flow.

2.2 Interim Site-Specific Trigger Values

As part of the approvals process for the quarry, compounds of concern were identified, in terms of impact on the groundwater environment and as defined in Schedule 3 of the Approval (2018 Consolidated Approval 06_0030 Mod 2), and a series of interim SSTVs were developed.

The SSTVs were based on groundwater monitoring conducted over a year (September 2006 to August 2007) for 15 groundwater monitoring wells installed at the site (DLP1a, DLP2, DLP3, DLP3A, DLP4, DLP5, DLP6, DLP7, DLP7A, DLP8, DLP8a, DLP9, DLP10 and DLP10a). The monitoring data from these wells was considered to represent baseline groundwater conditions at the site prior to any potential effects from operation of the quarry.

Of these wells, DLP1a, DLP5, DLP7, DLP8 and DLP10 currently remain as groundwater monitoring points.

The SSTVs were calculated from the population of concentration values for each analyte and based on the 80th percentile and 20th percentile values for upper and lower triggers, respectively.

The interim SSTVs were first presented in the original environmental management plan for the Dunloe Quarry (Planit Consulting 2018), and included the following ongoing revision condition:

- *Target criteria to be used throughout the life of the quarry shall be established upon completion of a minimum twenty rounds of monthly monitoring for the parameters presented in the following tables. Concentration limits are to be established from*

calculating the 80th and/or 20th percentile values for each parameter sampled at each monitoring location. Outliers would be statistically removed for accuracy.

The groundwater interim SSTVs for the suite of monitored parameters are presented in the latest Soil and Water Management plan (GHD 2020) and are summarised in **Table 2-1.**

Table 2-1: Interim Site-Specific Trigger Values (Groundwater)

Grouping / Analyte	Trigger Value (GHD, 2020)
Field Parameters	
pH (pH units)	Upper Limit - 7
	Lower Limit - 4.2
Electrical conductivity (EC)(µS/cm)	Upper Limit - 2,000
Dissolved Oxygen (DO) (mg/L)	Lower Limit - 1.5
Major Ions	
Bicarbonate as $CaCO_3$ (mg/L)	400
Calcium (mg/L)	55
Chloride (mg/L)	285
Potassium (mg/L)	17.5
Magnesium (mg/L)	100
Sodium (mg/L)	280
Sulfate (mg/L)	175
Metals	
Aluminium (Al) (mg/L)	0.75
Arsenic (As) (mg/L)	0.005
Iron (Fe) (mg/L)	7.5

Similarly SSTVs were assigned for surface water, based on surface water monitoring conducted in the 2007 – 2007 period.

The surface water monitoring interim SSTVs are presented in **Table 2-2.**

Table 2-2: Interim Site-Specific Trigger Values (Surface Water)

Grouping / Analyte	Trigger Value (GHD, 2020)
Field Parameters	
pH (pH units)	Upper Limit – 7.5
	Lower Limit – 5.5
Electrical conductivity (EC)(µS/cm)	Upper Limit – 2400
Dissolved Oxygen (DO) (mg/L)	Lower Limit – 6
Total Suspended Solids (mg/l)	25
Total Phosphate(mg/l)	0.08
Total Nitrogen(mg/l)	

3. UPDATE OF SITE-SPECIFIC TRIGGER VALUES

Water quality trigger values are typically numerical criteria, that if exceeded, provide an alert of a change in water quality that warrants further investigation for the contaminant of potential concern (COPC) being monitored. Trigger values should be fit for purpose and conservative enough such that, when applied, they provide an early warning of emerging potential impacts to the quality of the groundwater or surface water.

Applying trigger values that are set too high may not be sensitive enough to identify current or emerging contamination issues. Conversely, if trigger values are set too low, natural variability may be mistaken for contamination events.

Trigger values for groundwater and surface water were derived to be used as an early warning mechanism to alert of a potential or emerging change that should be investigated. Whether or not the actual change in condition at the test site has biological or ecological ramifications for the receiving environment can only be ascertained by a subsequent more comprehensive investigation and analysis (ANZG, 2018).

3.1 Groundwater

3.1.1 Trigger Value Development Methodology

The methodology for deriving and applying trigger values is described in this section.

To derive local guidelines relevant to groundwater discharging to slightly to moderately disturbed waters, the 80th percentiles (and 20th percentile for indicators such as pH and DO) of reference site values can be used. ANZG (2018) defines ideal reference sites as similar to assessment sites (e.g. similar climate, relief and geology) but are minimally impacted, have limited exposure to anthropogenic drivers, and have sufficient historical data to characterise water quality condition and variability. However, ANZG (2018) also allows for 'modified ecosystems', where the 'best available' reference site may provide the only option because truly undisturbed reference sites are sparse or absent, and even if available, they provide benchmarks that are unattainable within the foreseeable future.

Best available wells were reviewed to assess suitability for use in updating the site-specific trigger values. For the Dunloe Quarry site, reference wells were selected on a positional basis and on the data collection period.

Data were screened for outliers and trends, and where outliers or trends were identified, these were removed from the dataset before calculating the trigger values. The selected reference well data are summarized in **Table 3-1**

Table 3-1: Reference Well Sources

Well Designations	Data Period	Basis for Selection
DLP1a, DLP2, DLP3, DLP3A, DLP4, DLP5, DLP6, DLP7, DLP7A, DLP8, DLP8a, DLP9, DLP10 and DLP10a	September 2006 – August 2007	All wells are located on the actual site *prior* to any quarry activity and are installed into the shallow alluvial aquifer (wells were originally installed as part of the approvals assessment process).
DLP3 and DLP7	2017 - 2021	DLP3 and DLP7 remain on the Dunloe site as contemporary monitoring points. Their location places them either at the fringes of the monitoring network and hydraulically upgradient or cross gradient from the operation (based on interpreted groundwater contouring - Ramboll 2021). They are considered to be representative of background groundwater conditions

3.1.2 Selected Analytes for SSTV Update

The following analytes were selected for updating of their SSTVs,

- Electrical conductivity (EC)
- pH
- dissolved oxygen (DO)
- dissolved iron (Fe)
- dissolved arsenic (As)
- dissolved aluminium (Al)

The selection was based on exceedance of interim SSTVs for these analytes during the monitoring history as discussed in Ramboll (2021).

Other parameters included, common cations and anions (bicarbonate, calcium, chloride, potassium, magnesium, sodium and sulfate), which were not considered to indicate significant exceedances. The few exceeded concentrations were found in background wells only and it was considered likely these concentrations were the result of coastal saltwater intrusion, indicated by elevated EC and the that these major ions are common components of seawater.

3.1.3 Data Quality Evaluation

Monitoring was undertaken on a monthly basis with field parameters (pH, electrical conductivity, dissolved oxygen, redox potential) recorded every month and other parameters (cations/anions metals on a quarterly basis).

The monitoring data was sourced from:

- the current Holcim database which contains data from 2017 to date; and
- historical records from the original site assessment, (Planit 2018; extracts presented in **Appendix 1**)

Table 3-2 and **Table 3-3** presents a summary of the data and results of data quality evaluation.

Table 3-2: Groundwater Analytical Data Summary

Analyte	No. of Analytical Results			Mean Value[5]	Std Dev[5]
	Historical data (2006 – 2007)[1]	2017 – 2021 data[2]	Total Data Points		
Aluminum	120	26	146	0.43	0.49
Arsenic	90	26	116	0.004	0.002
Iron	120	24	144	6.19	7.20
EC[3]	90	76	166	3176	3046
pH	105	78	183	4.82	2.26
DO[4]	90	46	136	0.99	1.5

Notes
1. Wells DLP1a, DLP2, DLP3, DLP3A, DLP4, DLP5, DLP6, DLP7, DLP7A, DLP8, DLP8a, DLP9, DLP10 and DLP10a
2. Wells DLP3 and DLP7
3. EC is electrical conductivity
4. DO is dissolved oxygen
5. Values are in mg/L except for pH which are in pH units and EC which is in µS/cm

Table 3-3: Data Quality Evaluation

Data Source	Analyte	Time Period	Comment	Conclusion
Historical Sampling Records	pH, EC, Aluminium, Arsenic, Iron	Sep 2006 – Aug 2007	The historical data only available from graphed data images (concentrations presented for each well, for each monitoring period), from the original report. It was considered that recovery of this data was important given it was the basis for the existing interim SSTVs. For each parameter, a data set was synthesized by estimating the approximate values from their relative positions on the graphs. Where individual values could not be resolved from the graphs, average values were adopted for a well for multiple monitoring periods. The resulting specific data was not as accurate as the 2017-2021 tabulated data but was considered as indicative and suitable to be included in the analyte concentration data sets. The synthesized data was validated by calculating the 80th percentile value using the generated datasets and confirming the result with the value used for the existing SSTVs. Records were not available for well construction. GHD (2020) has indicated that all wells are within the alluvial aquifer although at varying depths. There is no information concerning the sampling of the wells for this period including personnel or methodologies. It has been assumed that wells were bailed for samples.	Data is indicative only but considered adequate for inclusion as total data population in the evaluation and update of SSTVs
	DO		It is assumed that samples were collected using a bailer which can result in aeration of the water. DO can be difficult to accurately analyse in groundwater and the reliability of the baseline data cannot be verified.	Likely an overestimate of dissolved oxygen concentrations
Holcim Database records	DO	Dec 2017 – Dec 2019	Prior to 2020, sampling was undertaken using a bailer which may result in aeration of the sample indicating giving atypically high DO concentrations	Likely an overestimate of dissolved oxygen concentrations
	pH, EC DO Aluminium Arsenic Iron	Jan 2020 to date	Dissolved oxygen concentrations collected using low flow sampling methods were considered to be typical for the method and well depths in the sand aquifer, Ramboll 2021)	Adequate for SSTV update

In summary, review of the available monitoring results indicated that the data was of adequate quality to re-evaluate SSTVs for pH, EC, aluminium, arsenic and iron.

The total data set was also applied for the DO results, however it was considered that the variation in DO values and the uncertainty regarding the results, based on previous practice using a bailer for sampling, renders the data less reliable for evaluation. DO trigger values were also calculated using the 2020 – 2021 data as a comparison.

3.2 Surface Water

The methodology for deriving and applying trigger values for the surface water SSTVs is similar.

To derive local guidelines relevant to slightly to moderately disturbed waters, the 80th percentiles (and 20th percentile for indicators such as pH and DO) of reference site values can be used as discussed above.

The best available monitoring sites were selected for use in updating the site-specific trigger values, primarily based on their location relevant to the site works.

Data were screened for outliers and trends, and where outliers or trends were identified, these were removed from the dataset before calculating the trigger values.

As part of the groundwater/surface water review (Ramboll 2021), SW10, located upstream of the quarry operations on the western side of south creek was identified as the only current monitoring location representative of background conditions.

Records are available for SW10 for the period 2017 – to date.

3.2.1 Selected Analytes for Surface Water SSTV Update

The following analytes were selected for updating of their SSTVs:

- Electrical conductivity (EC)
- pH
- dissolved oxygen (DO)
- suspended solids
- Total nitrogen

The selection was based on exceedance of interim SSTVs for these analytes during the monitoring history as discussed in Ramboll (2021).

3.2.2 Data Quality Evaluation

Monitoring was undertaken on a monthly basis with field parameters (pH, electrical conductivity, dissolved oxygen, suspended solids redox potential) recorded every month and other parameters (nutrients metals on a quarterly basis).

The monitoring data was sourced from, the current Holcim database which contains data from 2017 to date. There were however gaps in the 2017 – 2019 record where some months had no data for SW10 and/or some parameters were omitted.

A summary of background surface data (SW10) is presented in **Table 3-4.** Data evaluation is presented in **Table 2-1.**

Table 3-4: Surface Water Analytical Data Summary

	Total Data Points	min	max	mean	SD
pH	16	3.78	7.8	6.01	1.13
Electrical Conductivity (EC)	16	42.32	18900	6962	6210
Dissolved Oxygen~(DO)	15	2.1	8.4	5.28	1.76
Total Suspended Solids (TSS)	15	5	46	17.69	11.16
Total Nitrogen*	15	0.2	1.48	0.68	0.37

Notes
1. Values are in mg/L except for pH which are in pH units and EC which is in µS/cm

Table 3-5: Surface Water Analytical Data Evaluation

Data Source	Analyte	Time Period	Comment	Conclusion
Holcim Database records for Monitoring Point SW10	pH, EC, DO, TSS, Total N	Dec 2017 – Dec 2019	Records were only available for SW10 (or "South Creek upstream") for the following months: 1. March, June September and December 2017 2. March, June and September 2018 3. March and June 2019	Data quality is adequate for the evaluation and update of SSTVs however there are only a maximum of 16 data points (per parameter).
		Jan 2020 to date	Records were only available for SW10 for the following months: 1. September, October and November 2020 2. February, May and August 2021	

In summary, the inconsistencies in the sampling program has resulted in only sporadic data available for the background location, SW10 on the western side of the South Creek.

The Soil and Water Management Plan (GHD 2020) specifies "*Target criteria to be used throughout the life of the quarry will be established upon completion of a minimum twenty rounds of monthly monitoring"*, (Section 6.2). This is a reference from the original Environmental Management Plan and Management Strategy, (Planit 2018), Section 7.4.8. This approach is consistent with two years of monthly sampling as per the ANZG (2018) requirement for suitable data coverage for guideline value derivation.

The number of available data points for background conditions is less than 20 (per parameter) and on this basis it is considered to be too small a data set to provide a reliable basis for update of the SSTVs at this stage.

4. RESULTS OF GROUNDWATER SSTV UPDATE EVALUATION

4.1 Calculation and Results

The final data sets for each of the evaluated analytes were tested for outliers using the ProUCL statistical tool and removed if present. The 80th percentiles were determined as an upper trigger value and, in the case of pH and DO, a lower trigger value, using the 20th percentile was also calculated.

The results are presented in **Table 4-1.**

Table 4-1: SSTV Update Results

Analyte	Outliers removed	80th percentile	20th percentile	New trigger value		*Current Trigger Value*	
				Upper	Lower	*Upper*	*Lower*
Aluminum	1	0.75	NA	0.75	NA	*0.75*	*NA*
Arsenic	1	0.005	NA	0.005	NA	*0.005*	*NA*
Iron	1	9.92	NA	9.92	NA	*7.50*	*NA*
EC	0	7022	NA	7022	NA	*2000*	*NA*
pH	0	6.75	4.20	6.75	4.20	*7.00*	*4.20*
DO (all data)	1	1.564	0.25	NA	0.25	*NA*	*<1.5*
DO 2020-2021 data only)	1	1.46	0	NA	0		

Notes
1. Values are in mg/L except for pH which are in pH units and EC which is in µS/cm
2. NA is not applicable

4.2 Discussion

The following was noted from the recalculation and update of trigger values using the total monitored data sets for the designated reference wells:

- Trigger values for aluminium, arsenic and pH have remained essentially unchanged
- The upper trigger value for iron has slightly increased
- The trigger value for EC has significantly increased (2000 to 7000 µS/cm)
- The lower value for DO has slightly increased using the total data set however using just the data from 2020 – 2021 which was considered more reliable (using low flow sampling techniques) a lower value of zero was determined i.e, 20% of the DO measurements made were below detectable concentrations. It is considered that lower values of DO including below detectable limits are more realistic indicators of DO at depth in groundwater wells

The review of groundwater and surface water conducted earlier this year and reported as Ramboll (2021) considered that influences outside of the quarry site had occasionally impacted groundwater quality.

These included:

- intrusion of salt water along the coastal strip which may have been influenced by an extended period of lower rainfall. This was considered to result elevated values for electrical conductivity and major ions typically associated with seawater. DLP3 and DLP7, used as reference wells for trigger value calculation are deeper wells, located on the eastern part of the site.
- tidal flood gates within the surface water channels that were historically used to reduce tidal inundation from Mooball Creek to the agricultural drainage channels. It is understood that the floodgates are now maintained in an open position to allow tidal inundation and the passage of fish. This is expected to have caused a change in surface water quality comparative to baseline conditions and therefore leading to exceedances in the adopted trigger value for electrical conductivity in surface water. These exceedances are not related to operational activities

- following drier periods, the initial phases of a rainfall event would result in inundation and surface water run-in from further upstream in the catchment, with resultant infiltration and recharge of the shallow unconfined aquifer, potentially causing elevated metals concentrations, due to the first flush effect

All of these off-site elements are considered likely to impact the groundwater quality and should be factored in the calculation of SSTVs. For example, the elevated EC values in the reference wells, which may be the result of coastal saltwater intrusion, should remain valid as input to the SSTVs.

5. CONCLUSIONS

The interim SSTVs for the Holcim were developed originally during the approvals process and were based on 80th/20th percentiles of monitoring results from 15 site wells carried out in September 2006 – August 2007, prior to development of the site for quarry operations.

Review of surface water and groundwater undertaken earlier this year (Ramboll 2021) identified exceedances in some monitored parameters and recommended updating the SSTVs using the results from monitoring conducted 2017 to date.

Data was collated from all sources determined to represent reference (background conditions) for both surface water and groundwater.

The data set for background surface water was considered to be insufficient (maximum of 16 data points for each parameter) to update surface water SSTVs at this time. Continued monitoring of surface water, in particular at location SW10, should continue until at least 20 data points for each of the SSTV parameters have been completed before re-evaluation of the surface water SSTVs is undertaken.

The groundwater data sets included for evaluation comprised all data from the 2006 – 2007 monitoring which was synthesized from concentration graphs presented in the original approval assessment. More recent monitoring data (2017 to date), from wells determined as representing background conditions, (DLP3 and DLP7) was added to the data sets.

SSTVs were then determined for pH, EC, DO, aluminium, iron and arsenic using 80th percentile values for upper trigger values and 20th percentile for lower trigger values (pH and DO). The results are presented in **Table 4-1.**

Trigger values for aluminium, arsenic and pH (lower trigger value) remained essentially unchanged from the existing interim values, while upper trigger values for iron and EC have increased.

The lower value for DO slightly increased using the total data set however using just the data from 2020 – 2021 which was considered more reliable, a lower value of zero was determined ie, 20% of the DO measurements made were below detectable concentrations. These values are considered more realistic for groundwater wells at depth.

Off-site influences, including coastal saltwater intrusion, upgradient surface water run-on from rainfall events and changes in surface water controls, (Mooball Creek floodgates) all potentially impact groundwater on the site and it is considered their influence should be included as part of background conditions.

The following is recommended based on the recalculation of SSTVs for the site:

- Updated trigger values for iron and EC be adopted
- Trigger values for pH arsenic and aluminium remain the same
- The evaluation has cast doubt on the usefulness of trigger values for dissolved oxygen in groundwater and should be removed the SSTVs.

Based on the previous groundwater review, Ramboll (2021) it is also recommended that the common cations and anions, (bicarbonate, calcium, chloride, potassium, magnesium, sodium and sulfate), be removed from the monitoring program, given that the few exceeded concentrations were found in background wells only and it was considered likely these concentrations were the result of coastal saltwater intrusion, indicated by elevated EC and the that these major ions are common components of seawater.

6. LIMITATIONS

Whilst reasonable attempts have been made to ensure that the contents of this report are accurate and complete at the time of writing, Ramboll Australia Pty Ltd disclaims any responsibility for loss or damage that may be occasioned directly or indirectly through the use of, or reliance on, the contents of this report.

The conclusions presented in this report represent Ramboll's professional judgment based on information made available during the course of this assignment and are true and correct to the best of Ramboll's knowledge as at the date of the assessment.

Ramboll did not independently verify all of the written or oral information provided to Ramboll during the course of this review. While Ramboll has no reason to doubt the accuracy of the information provided to it, the report is complete and accurate only to the extent that the information provided to Ramboll was itself complete and accurate.

This report does not purport to give legal advice. This advice can only be given by qualified legal advisors.

6.1 User Reliance

This report has been prepared exclusively for Holcim (Australia) Pty Ltd and may not be relied upon by any other person or entity without Ramboll's express written permission.

The report must not be reproduced in whole or in part except with the prior consent of Ramboll Australia Pty Ltd and subject to inclusion of an acknowledgement of the source. No information as to the contents or subject matter of this document or any part thereof may be communicated in any manner to any third party without the prior consent of Ramboll Australia Pty Ltd.

7. REFERENCES

GHD, 2020. Holcim (Australia) Pty Ltd Dunloe Sand Quarry Soil and Water Management Plan, document reference 2220056, GHD Group Pty Ltd, October 2020.

Ramboll, 2021. Holcim (Australia) Pty Ltd, Dunloe Sand Quarry Data Review, document reference 318000911, Ramboll Australia Pty Ltd, September 2021

Planit 2018. Environmental Management Plan (EMP), Management / Monitoring / Compliance & Programming, &, Environmental Management Strategy For Dunloe Sands (Holcim Australia Pty Ltd), document reference 0390, Planit Consulting Pty Ltd, July 2018

ANZG (2018). Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Australian and New Zealand Governments and Australian state and territory governments, Canberra ACT, Australia. Available at www.waterquality.gov.au/anz-guidelines.

National Environment Protection Council (NEPC) (2013). *National Environment Protection (Assessment of Site Contamination) Measure 1999*, as amended April 2013

ProUCL 2013. Statistical Software for Environmental Applications for Data Sets with and without Nondetect Observations, Version 5.0.00, US Environment Protection Agency, September 2013

APPENDIX 1
MONITORING DATA SETS 2006 - 2007

Appendix I

Ground Water Monitoring and Base Line Data

Legend

- Stage 01 Ground Water Monitoring Location
- Stage 02 Ground Water Monitoring Location
- Stage 01 & 02 Ground Water Monitoring Location
- Excavation Area

DUNLOE PARK - GROUNDWATER MONITORING

MOOBALL - NSW

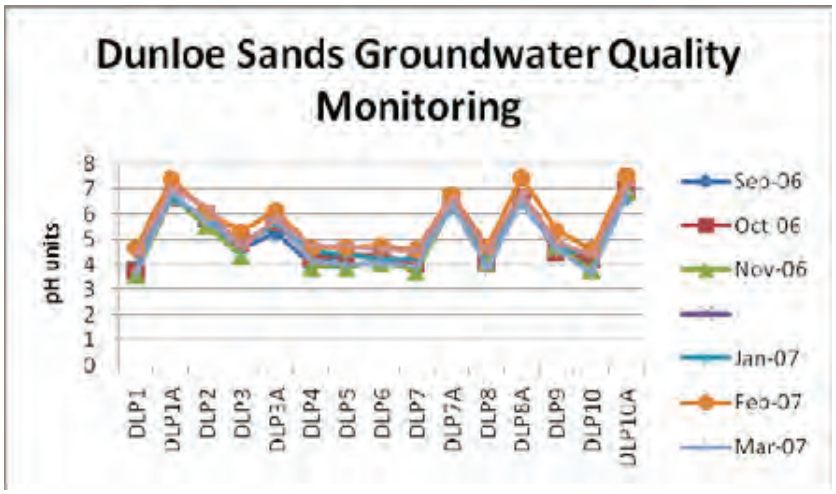
Scale: 1:8000 @ A3

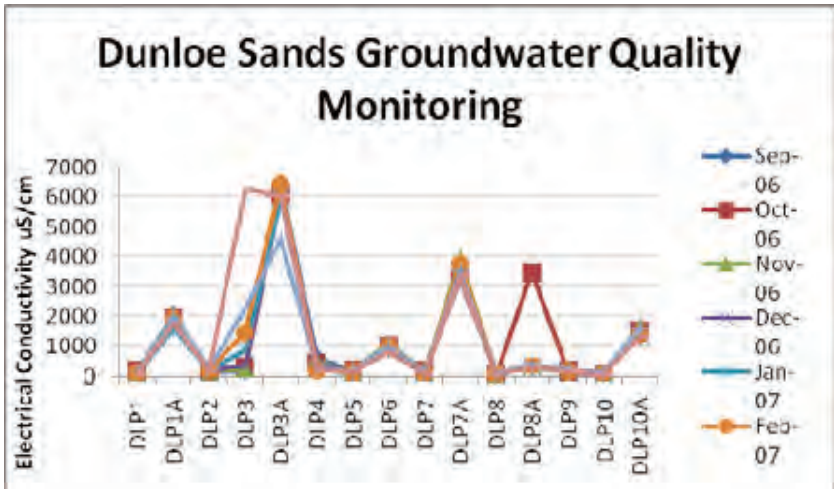
Date: MARCH 2012

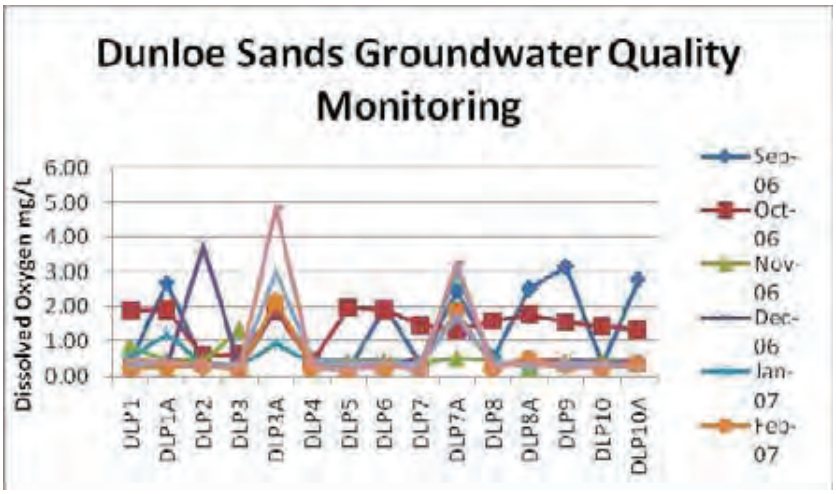
N

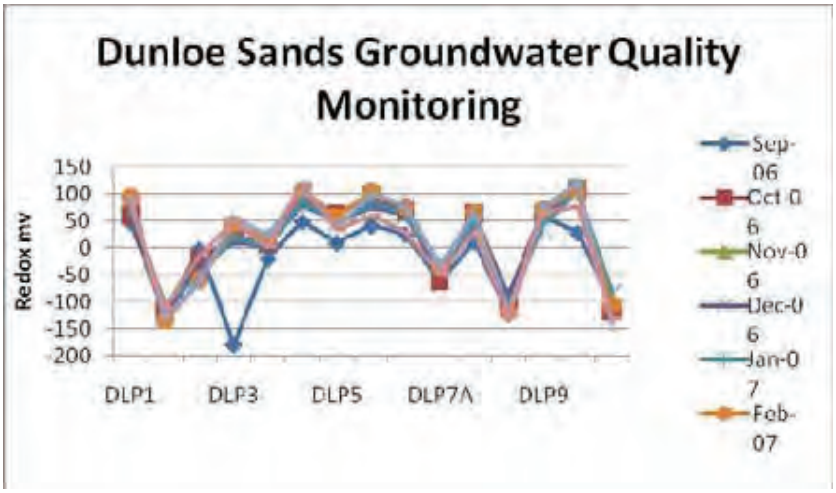
Level 1 2247 Gold Coast Hwy
Nobby Beach
PO Box 206 Nobby Beach QLD 4218
Telephone: 07 5526 1500
Fax: 07 5526 1502
admin@planitconsulting.com.au

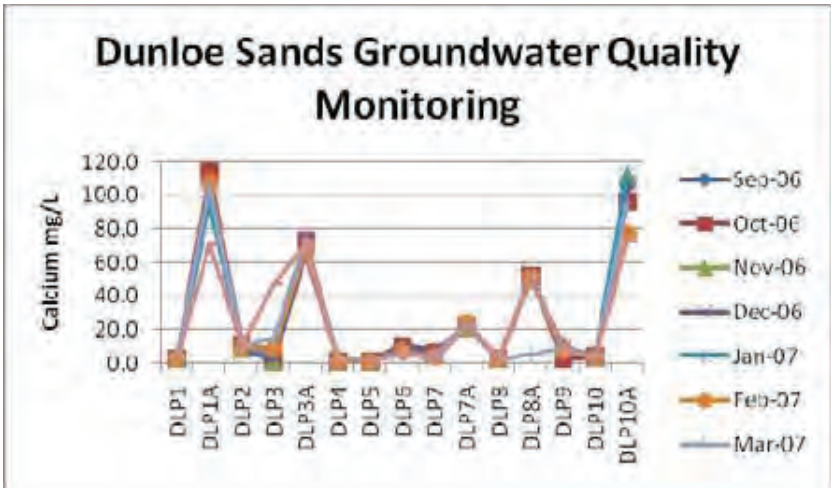
Groundwater Quality Monitoring September 2006-August 2007

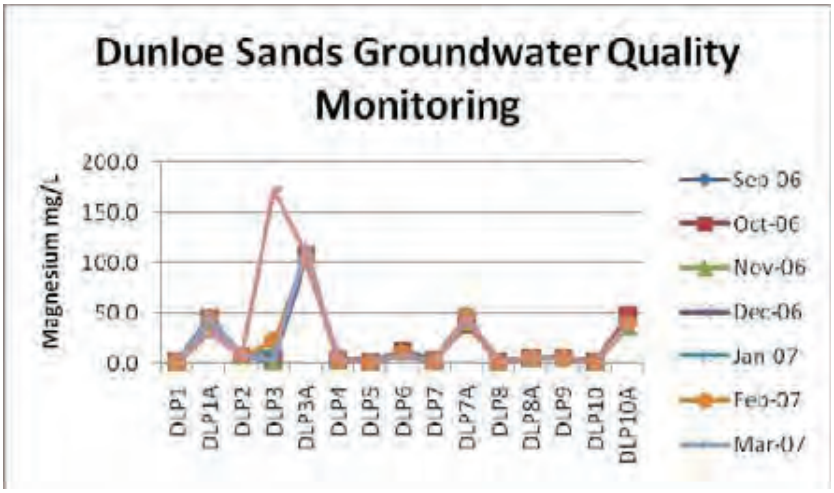


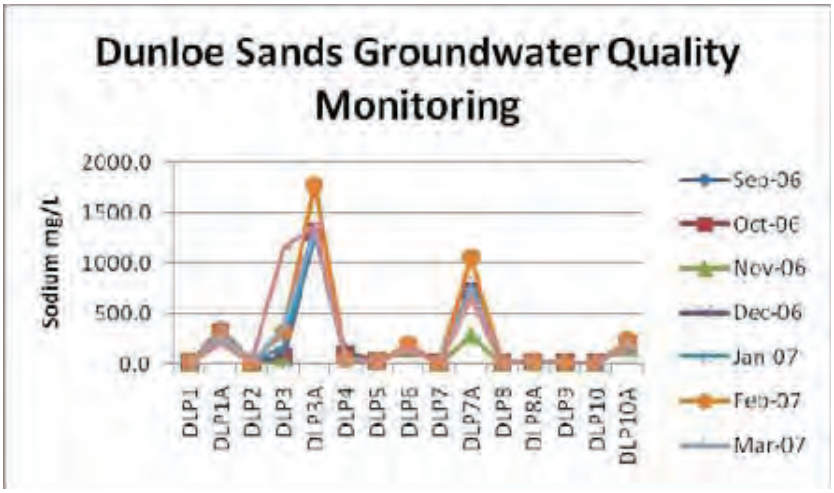


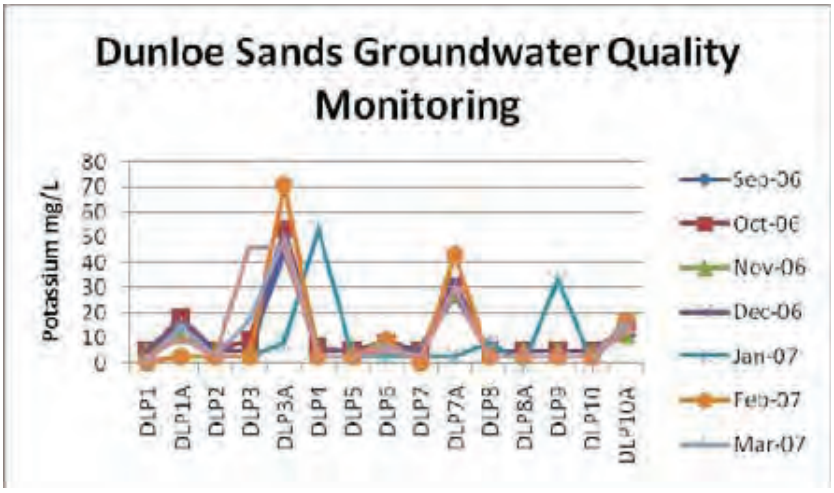

Dunloe Sands Groundwater Quality Monitoring
Dissolved Oxygen mg/L
6.00
5.00
4.00
3.00
2.00
1.00
0.00
DLP1
DLP1A
DLP2
DLP3
DLP3A
DLP4
DLP5
DLP6
DLP7
DLP7A
DLP8
DLP8A
DLP9
DLP10
DLP10A
Sep-06
Oct-06
Nov-06
Dec-06
Jan-07
Feb-07

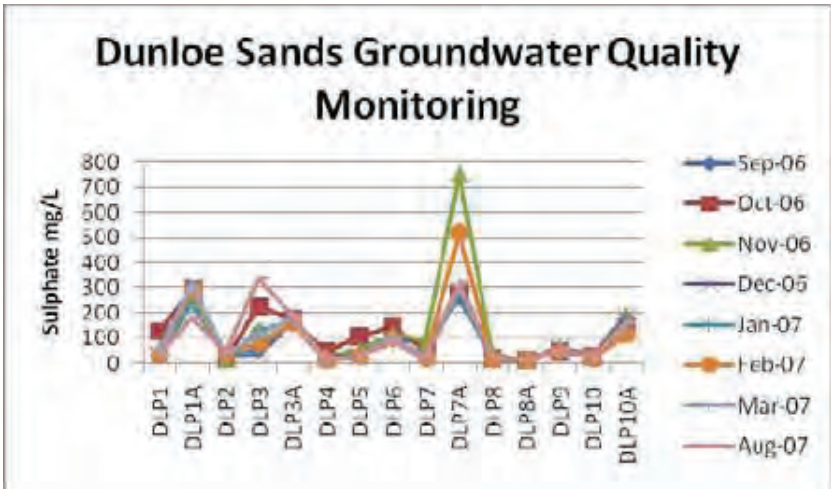

Dunloe Sands Groundwater Quality Monitoring
Redox mv
150
100
50
0
-50
-100
-150
-200
DLP1
DLP3
DLP5
DLP7A
DLP9
Sep-06
Oct-06
Nov-06
Dec-06
Jan-07
Feb-07

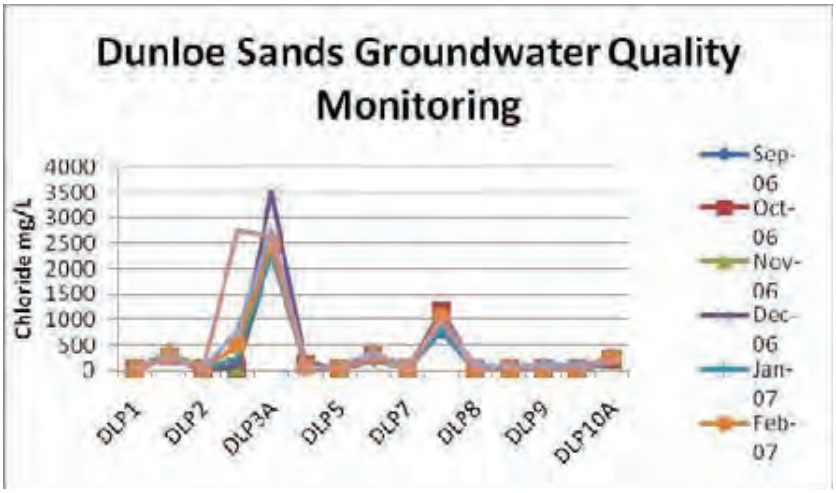

Dunloe Sands Groundwater Quality Monitoring
Calcium mg/L
120.0
100.0
80.0
60.0
40.0
20.0
0.0
DLP1
DLP1A
DLP2
DLP3
DLP3A
DLP4
DLP5
DLP6
DLP7
DLP7A
DLP8
DLP8A
DLP9
DLP10
DLP10A
Sep-06
Oct-06
Nov-06
Dec-06
Jan-07
Feb-07
Mar-07

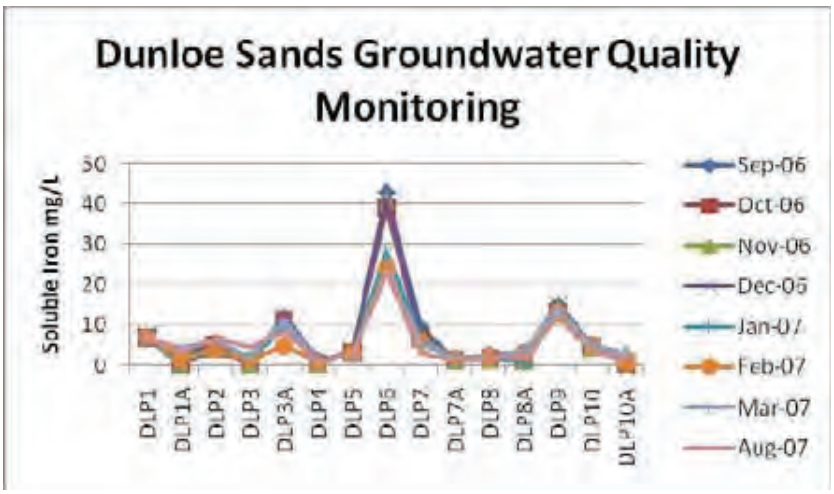

Dunloe Sands Groundwater Quality Monitoring
Magnesium mg/L
200.0
150.0
100.0
50.0
0.0
DLP1
DLP1A
DLP2
DLP3
DLP3A
DLP4
DLP5
DLP6
DLP7
DLP7A
DLP8
DLP8A
DLP9
DLP10
DLP10A
Sep-06
Oct-06
Nov-06
Dec-06
Jan-07
Feb-07
Mar-07

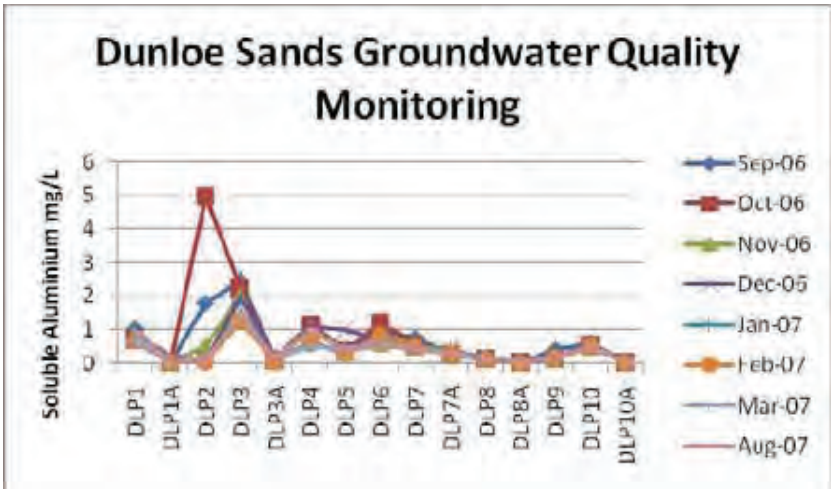

Dunloe Sands Groundwater Quality Monitoring
Sodium mg/L
2000.0
1500.0
1000.0
500.0
0.0
DLP1
DLP1A
DLP2
DLP3
DLP3A
DLP4
DLP5
DLP6
DLP7
DLP7A
DLP8
DLP8A
DLP9
DLP10
DLP10A
Sep-06
Oct-06
Nov-06
Dec-06
Jan-07
Feb-07
Mar-07

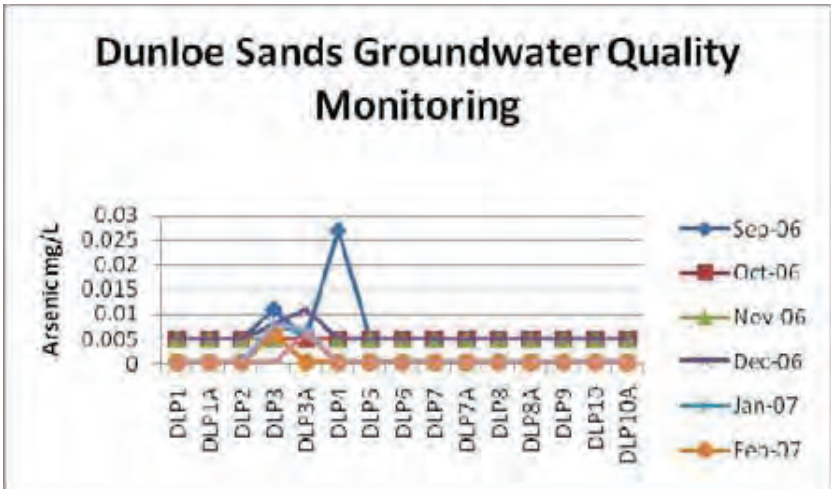

Dunloe Sands Groundwater Quality Monitoring
Potassium mg/L
80
70
60
50
40
30
20
10
0
DLP1
DLP1A
DLP2
DLP3
DLP3A
DLP4
DLP5
DLP6
DLP7
DLP7A
DLP8
DLP8A
DLP9
DLP10
DLP10A
Sep-06
Oct-06
Nov-06
Dec-06
Jan-07
Feb-07
Mar-07


Dunloe Sands Groundwater Quality Monitoring
Sulphate mg/L
800
700
600
500
400
300
200
100
0
DLP1
DLP1A
DLP2
DLP3
DLP3A
DLP4
DLP5
DLP6
DLP7
DLP7A
DLP8
DLP8A
DLP9
DLP10
DLP10A
Sep-06
Oct-06
Nov-06
Dec-06
Jan-07
Feb-07
Mar-07
Aug-07


Dunloe Sands Groundwater Quality Monitoring
Chloride mg/L
4000
3500
3000
2500
2000
1500
1000
500
0
DLP1
DLP2
DLP3A
DLP5
DLP7
DLP8
DLP9
DLP10A
Sep-06
Oct-06
Nov-06
Dec-06
Jan-07
Feb-07


Dunloe Sands Groundwater Quality Monitoring
Soluble Iron mg/L
50
40
30
20
10
0
DLP1
DLP1A
DLP2
DLP3
DLP3A
DLP4
DLP5
DLP6
DLP7
DLP7A
DLP8
DLP8A
DLP9
DLP10
DLP10A
Sep-06
Oct-06
Nov-06
Dec-06
Jan-07
Feb-07
Mar-07
Aug-07


Dunloe Sands Groundwater Quality Monitoring
Soluble Aluminium mg/L
6
5
4
3
2
1
0
DLP1
DLP1A
DLP2
DLP3
DLP3A
DLP4
DLP5
DLP6
DLP7
DLP7A
DLP8
DLP8A
DLP9
DLP10
DLP10A
Sep-06
Oct-06
Nov-06
Dec-06
Jan-07
Feb-07
Mar-07
Aug-07


Dunloe Sands Groundwater Quality Monitoring
Arsenic mg/L
0.03
0.025
0.02
0.015
0.01
0.005
0
DLP1
DLP1A
DLP2
DLP3
DLP3A
DLP4
DLP5
DLP6
DLP7
DLP7A
DLP8
DLP8A
DLP9
DLP10
DLP10A
Sep-06
Oct-06
Nov-06
Dec-06
Jan-07
Feb-07

Appendix 7 – NSW EPA DCCEEW, and DPHI Consultation

Dozie Egeonu <dozie.egeonu@holcim.com>

Dunloe Sand Quarry - Soil & Water Management Plan Review

3 messages

Dozie Egeonu <dozie.egeonu@holcim.com> Wed, Nov 8, 2023 at 2:25 PM
To: water.enquiries@dpie.nsw.gov.au
Cc: Matt Kelly <matt.kelly@holcim.com>, Rachel Condon <rcondon@ramboll.com>

Hi Fiona,

Thanks for the call back this morning.

As discussed, Holcim's Dunloe Sand Quarry has an updated Soil & Water Management Plan. To finalise the approval with the Department of Planning & Environment (DPE), the DPE requires us to consult with DPE Water.

Please see attached and provide feedback. The EPA was forwarded the Draft Plan and has confirmed they have no comments. We are waiting for yours to complete approval for the plan with the DPE.

The plan was first drafted in early 2022; however we have had some changes in key personnel and have lost any evidence of consultation between Holcim and DPE Water in regards to review of the plan, hence this email forwarding you a copy to review and provide comment where necessary.

If you have any questions, please let me know.

Regards,

Dozie Egeonu
Environment Manager - NSW & ACT
Holcim (Australia) Pty Ltd
Suite 201, Level 2, 7-9 Irvine Place
Bella Vista NSW 2153
M: 0429557493
W: www.holcim.com.au

3 attachments

SWMP.pdf
6103K

Draft BGA Monitoring_Management Plan V1_20231024_Ramboll V2.docx
2967K

2023 Dunloe Sand Quarry Soil and Water Management Plan_v4 (1).docx
1332K

Dozie Egeonu <dozie.egeonu@holcim.com> Fri, Nov 17, 2023 at 10:13 AM
To: water.enquiries@dpie.nsw.gov.au

Good morning Fiona,

Following up on my previous email regarding the review of our updated Soil & Water Management Plan. This was requested by the Department of Planning & Environment (DPE) to fulfil the consultation requirement of our Consent which includes DPE Water.

I am writing to inquire if DPE Water has completed the review of the plan and have any comments. We are required to respond to the Department of Planning & Environment on or before **24th November 2023 (in days time).**

Regards,

Dozie Egeonu
Environment Manager - NSW & ACT
Holcim (Australia) Pty Ltd
Suite 201, Level 2, 7-9 Irvine Place
Bella Vista NSW 2153

M: 0429557493
W: www.holcim.com.au

[Quoted text hidden]

DPIE Water Enquiries Mailbox <water.enquiries@dpie.nsw.gov.au> Fri, Nov 17, 2023 at 10:46 AM
To: Dozie Egeonu <dozie.egeonu@holcim.com>

Dear Dozie,

I apologize for the delay in responding to your email.

We have forwarded your inquiry to the Licensing and Approvals team, and we will follow up with them accordingly.

Additionally, their timeframe to respond to an enquiry is ten (10) working days if it is a simple enquiry and thirty (30) working days for complex enquiries.

Your reference number is IS-04863.

If you have any further questions or would like more information from us, please get in touch by reply email or phone 1300 081 047 to speak to the Water Enquiries team.

Regards,

Juliana Caixeta

Senior Customer Support Officer
Communications, Media & Engagement Team | Water Group

Department of Planning and Environment

P 1300 081 047 | **E** water.enquiries@dpie.nsw.gov.au

water.dpie.nsw.gov.au

4 Parramatta Square, 12 Darcy Street Parramatta NSW 2151

Dharug Country

DPE supports flexible working arrangements and I may be sending this message at a time that suits me. Please don't feel obliged to read, respond to or action it outside of regular working hours.

Our Vision: *Together, we create thriving environments, communities, and economies.*

The Department of Planning and Environment acknowledges that it stands on Aboriginal land. We acknowledge the traditional custodians of the land and we show our respect for elders past, present and emerging through thoughtful and collaborative approaches to our work, seeking to demonstrate our ongoing commitment to providing places in which Aboriginal people are included socially, culturally and economically.

Please view our privacy statement

[Quoted text hidden]

From: **EPA North Operations Regional Mailbox** <EPA.Northopsregional@epa.nsw.gov.au>
Date: Wed, 8 Nov 2023 at 08:08
Subject: SWMP - Dunloe Sands - EPA, EPL 13077 Dunloe Park
To: matt.kelly@holcim.com <matt.kelly@holcim.com>

Dear Matt

In relation to your email correspondence dated 27 October 2023.
Specifically providing the updates of the Holcim Dunloe Sand Quarry, Soil and Water Management Plan (SWMP) (October 2023) for Environment Protection Licence (EPL) 13077 Dunloe Park.

The Environment Protection Authority (EPA) do not intend to review and provide comment upon the updated SWMP management plan.
However, the EPA will undertake compliance reviews against the requirements of EPL 13077 and the implementation of the management plans at their discretion.

Regards

www.epa.nsw.gov.au @NSW_EPA

The EPA acknowledges the Traditional Custodians of the land, waters and sky where we work.
As part of the world's oldest surviving cultures we pay our respect to Aboriginal Elders past and present.

Department of Climate Change, Energy, the Environment and Water

Our ref: OUT24/68

Dozie Egeonu
Environmental Manager – NSW & ACT
Holcim Australia

Email: dozie.egeonu@holcim.com

15 January 2024

Subject: **Dunloe Sand Quarry – Soil and Water Management Plan Management Plan (SWMP) and Blue-green algae monitoring plan (BGAMP)**

Dear Dozie,

I refer to your request for advice sent on 8 November 2023 to the Department of Planning and Environment (DPE) Water, now the Department of Climate Change, Energy, the Environment and Water (DCCEEW) about the above matter.

The Dunloe Sand Quarry is located on the New South Wales North Coast, approximately 4 km south of Pottsville. The quarry produces fine concrete sand and other sand products through a suction dredge extraction process. Holcim Australia has prepared an updated Soil and Water Management Plan (SWMP) to meet the requirements of the Minister's Conditions of Approval (CoA) outlined in Development Consent No. 06_0030.

DCCEEW Water group has reviewed the updated SWMP and the BGAMP and notes that the current SWMP has the potential to fail the early detection of water quality impacts at the site and surrounding area. DCCEEW has provided recommendations regarding groundwater take and groundwater impacts. Please see **Attachment A** for more detail.

Should you have any further queries in relation to this submission please do not hesitate to contact DCCEEW Water Assessments water.assessments@dpie.nsw.gov.au.

Yours sincerely

Rob Brownbill,
Manager, Water Assessments, Knowledge Division
Department of Climate Change, Energy, the Environment and Water

Attachment A

Detailed advice to the proponent regarding the Dunloe Sand Quarry SWMP and BGAMP

1.0 Water take and licensing

1.1 Recommendation – prior to approval

The proponent should quantify the maximum annual volume of water take due to aquifer interference activities and demonstrate that sufficient entitlement can be acquired in the relevant water source unless an exemption applies.

Explanation

The SWMP does not include a consolidated site water balance or estimates of maximum potential groundwater inflow volumes. Groundwater inflow estimates and licencing requirements need to be addressed for this project.

Water Access Licenses held to cover groundwater take is not adequately reported. Sections 4.2.4 and 4.2.5 of the SWMP report groundwater use on the site for dust suppression (direct take) as well as water contained within pore spaces when transported off site, and evaporation (indirect take).

It is reported on an average year that rainfall recharge to the pond is well in excess of evaporation and therefore this has not been considered in licensing requirements. However, there is no reporting of evaporations volumes relative to recharge during dry years, and whether this will be accounted for in an access licence. This should be assessed against any existing licences.

2.0 Groundwater impacts

2.1 Recommendation – prior to approval

The proponent should review and update the water quality trigger level values to ensure they are compliant with the NSW Aquifer Interference Policy (AIP) 2012 and allow for early detection and response.

Explanation

The NSW AIP minimal impact considerations for coastal sands water sources (water quality) require that:

1. *Any change in the groundwater quality should not lower the beneficial use category of the groundwater source beyond 40m from the activity.*
2. *If condition 1 is not met then appropriate studies will need to demonstrate to the Minister's satisfaction that the change in groundwater quality will not prevent the long-term viability of the dependent ecosystem, significant site or affected water supply works.*

Water quality trigger level values for the groundwater monitoring program are shown in Table 6.2 of the SWMP, however it is unclear how the water quality trigger levels were determined. The following threshold limits may not be compliant with requirement 1 identified above:

- Lower pH value of 4.2
- Upper dissolved iron level of 9.92 mg/L
- EC of 7022 µS/cm (noting the EC licence condition level was set at 3000 µS/cm in 2008).

The NSW AIP 2012 is available at:

- https://water.dpie.nsw.gov.au/__data/assets/pdf_file/0005/151772/NSW-Aquifer-Interference-Policy.pdf

2.2 Recommendation – prior to approval

The proponent should amend the trigger action responses in Table 6.5 of the SWMP to state that responses will be undertaken when breaches of specific values occur, not where there is a "significant variation".

Explanation

Groundwater specific contingencies and trigger level mitigation actions are shown in table 6.5 of the SWMP. These identify actions for trigger exceedance of 'significant variation' for groundwater pH, EC or level. This should be amended to require actions for 'any exceedance of the trigger value', not just a 'significant variation'.

2.3 Recommendation – prior to approval

The proponent should analyse and map the piezometric level and groundwater drawdown distribution caused by the project during wet and dry periods to ensure monitoring bores are correctly located.

Explanation

Five monitoring bores are to be monitored during each of the 2 quarrying stages. It is essential that the number and distribution of these bores is adequate for the timely identification of any water quality changes. A groundwater drawdown and piezometric level map will identify groundwater flow directions to ensure the bores are positioned in line with the direction of impact propagation for early detection and will assist interpretation of monitoring results for reporting.

2.4 Recommendation – prior to approval

The proponent should assess the impact on all groundwater users within the potential drawdown radius of the project.

Explanation

The SWMP does not contain information on adjacent groundwater users. The development of the piezometric map detailed above would assist in determining potential impacts on adjacent groundwater users. DCCEW Water records show 4 users within the potential radius of impact. This assessment may potentially result in the development of make good provisions for adjacent users.

2.5 Recommendation – prior to approval

The proponent should reintroduce major ion analysis in the groundwater quality suite to allow an adequate assessment of groundwater quality risks including the potential impacts of acid sulfate soils.

Explanation

The proponent has removed the major ions analysis and reporting for groundwater from the SWMP groundwater quality assessment based on a recommendation in a report by Ramboll (2021b). Re-introducing major ions to the bore sample water quality will assist in classifying groundwater entering and exiting the site, particularly with respect to impacts from acid sulfate soils.

2.6 Recommendation – prior to approval

The proponent should include details of monitoring bore screen depths to allow appropriate interpretation of groundwater data relative to dredging depths.

Explanation

The Soils and Water Management Plan should be a stand-alone document that provides details of the impacts and understanding of what is being monitored. Groundwater monitoring bore construction bore details including the screen depths should be listed in a table describing the key monitoring bore construction details.

Including monitoring bore screen depths within the SWMP will allow for interpretation of water quality and water level results. This can also be reviewed to ensure that screen depths are in comparison to dredging depths.

Department of Climate Change, Energy, the Environment and Water

Our ref: OUT24/7057

Kristina Robinson
Planning and Assessment
Department of Planning, Housing and Infrastructure

Email: Kristina.Robinson@dpie.nsw.gov.au

20 May 2024

Subject: **Dunloe Sand Quarry (MP06_0030) – Soil and Water Management Plan, version 5**

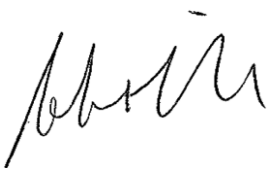
Dear Kristina Robinson,

I refer to your request for advice sent on 23 April 2024 to the Department of Climate Change, Energy, the Environment and Water (DCCEEW) about the above matter. DCCEEW Water advises that a previous version of the Soil and Water Management Plan (SWMP) (version 4, dated October 2023) was reviewed and responded to by DCCEEW Water in January 2024. This response has been included in Appendix 5 of the SWMP.

NSW DCCEEW Water group has reviewed the updated SWMP (version 5) and supporting documents which included the "Technical Note: Dunloe Sand Quarry Groundwater Review" and the document titled "Dunloe SWMP DCCEEW comments register". DCCEEW Water acknowledges the proponent has addressed a number of the previous recommendations in relation to groundwater management. However, DCCEEW Water has identified there are still some remaining issues and makes recommendations in regard to water take and licensing, and groundwater trigger values and contingency responses. These recommendations and further supporting explanation are detailed in Attachment A.

Should you have any further queries in relation to this submission please do not hesitate to contact DCCEEW Water Assessments water.assessments@dpie.nsw.gov.au.

Yours sincerely



Rob Brownbill,
Manager, Assessments, Knowledge Division
Department of Climate Change, Energy, the Environment and Water

Attachment A

Detailed advice to DPHI regarding the Dunloe Sand Quarry SWMP (version 5, March 2024)

1.0 Water take and licensing

1.1 Recommendation – prior to approval

The Department of Planning, Housing and Infrastructure request the proponent to quantify the maximum annual volume of water take due to aquifer interference activities as required by the NSW Aquifer Interference Policy (2012) (AIP).

Explanation

The proponent's response in the "Dunloe SWMP DCCEEW comments register" to DCCEEW Water's previous comments on water take and licensing indicates a misinterpretation with the approach required to account for water take under the NSW AIP. The proponent's comments indicate no groundwater take is occurring as the groundwater is being returned to the pond after on-site use. This interpretation is incorrect as there is no ability to use a net water balance to account for water take and references to groundwater seepage into the pond indicates groundwater take is occurring.

The documentation has not provided any supporting information on the groundwater levels relative to the dredge pond and whether the pond influences groundwater gradients to or from the pond to determine the movement of groundwater.

Water take needs to be calculated based on water take from a water source (direct from the aquifer, or movement from one part of the aquifer to another) and should be calculated for a range of climatic scenarios over a range of stages of the projects life to ensure maximum potential take volumes can be estimated. DCCEEW Water requires a scientific approach commensurate to the scale of the project to validate an estimate for groundwater take. Quantifying groundwater take from the dredge pond needs to assess:

- the maximum annual volume of groundwater removed with the product.
- the maximum annual volume of groundwater inflows into the dredge pond. This could be caused by the pond lake being lower than the adjacent groundwater table due to evaporation or water extraction from the lake.

1.2 Recommendation – prior to approval

The Department of Planning, Housing and Infrastructure request the proponent to demonstrate sufficient entitlement can be acquired in the relevant water source/s to account for the predicted water take unless an exemption applies.

Explanation

Demonstrating the ability to acquire the necessary water entitlement is required to indicate the viability of the project in terms of meeting the regulatory requirements of the *Water Management Act 2000.*

This includes considering the entitlement required to account for the groundwater take referred to in the above recommendation and also for surface water take should there be any clean water catchments, or water take that does not satisfy an exemption. Prior to commencement of Stage 2 it is recommended the proponent assess the potential for surface water take and determine any licensing requirements from the streams onsite as there is a stream mapped within the extraction area. Clean water diversions are recommended to minimise surface water take.

1.3 Recommendation – post approval

The Department of Planning, Housing and Infrastructure advise the proponent that should contingency water supply options be required that further assessment of the impacts and viability of these would be required prior to implementation.

Explanation

The water supply options listed in section 4.2.5 for consideration if on-site water storages decline over time are yet to be investigated for viability, impacts and licensing or approval requirements. Further investigation will be required prior to implementation. It is noted that the use of Harvestable Rights must be within land owned by that landholder and the option to modify the clean water diversion into the quarry would require entitlement to be held unless an exemption applies.

2.0 Groundwater impacts and management

2.1 Recommendation – prior to approval

The Department of Planning, Housing and Infrastructure request the proponent to document the rationale for defining groundwater trigger exceedances.

Explanation

This recommendation was included in DCCEEW Water's previous response and is yet to be adequately addressed. No supporting detail is presented to support the calculation of the proposed groundwater trigger values in Table 6.2 – Groundwater Monitoring Program – Trigger Values. Therefore, it is difficult for DCCEEW to advise on the appropriateness of the nominated values. It is also noted that the trigger values have been adjusted more than once with subsequent SWMP's since 2008, Further information on this matter is sought in considering appropriateness of the current nominated control points.

2.2 Recommendation – prior to approval

The Department of Planning, Housing and Infrastructure request the proponent to provide additional detail in the contingency response plan to clarify:

- the process to respond to single and/or persistent trigger value exceedances,
- the timeframes to investigate, document and notify agencies,

- viable mitigation actions should the quarry related activities result in exceedances of minimal environmental impact.

Explanation

The contingency responses to a groundwater trigger exceedance stated in Table 6.5 are deficient in providing assurances that potential impacts will be appropriately investigated and reported. The deficiencies include no detail on:

- timeframes to complete an assessment of the exceedance,
- how the assessment will be documented and reported to whom,
- the need for agency notification,
- a tiered approach as to how the proponent will respond to repeated or continuous exceedances.

End Attachment A

NSW Department of Climate Change, Energy, the Environment and Water

Our ref: OUT25/4671

Dozie Egeonu
Environment Manager - NSW & ACT
Holcim (Australia) Pty Ltd
Suite 201, Level 2, 7-9 Irvine Place
Bella Vista NSW 2153
M: 0429557493

23 April 2025

Subject: **Dunloe Quarry - Dunloe Soil Water Management Plan (MP06_0030-PA-20) – Request for Information**

Dear Dozie,

I refer to your request for advice sent on 24 March 2025 to the Department of Climate Change, Energy, the Environment and Water (DCCEEW) Water Group about the above matter.

NSW DCCEEW Water Group has reviewed the Soil Water Management Plan and has recommendations regarding groundwater modelling and monitoring. Please see **Attachment A** for more detail.

Should you have any further queries in relation to this submission please do not hesitate to contact the Water Assessments team at water.assessments@dpie.nsw.gov.au.

Yours sincerely,

Rob Brownbill
Manager, Assessments, Knowledge Division
NSW Department of Climate Change, Energy, the Environment and Water

Attachment A

Detailed advice regarding the Dunloe Quarry - Dunloe Soil Water Management Plan (MP06_0030-PA-20) – Request for Information

1.0 Groundwater modelling and monitoring

1.1 Recommendation – pre-determination

The proposed analytical groundwater model should include the following:

a. a minimum of 24 months monitoring data

b. water take due to the dredging operations in both northern (Stage 1) and southern (Stage 2) ponds.

Explanation

The proposal includes using 12 months of water level monitoring data from the 4 newly drilled monitoring bores for the final hydrogeological assessment. This baseline data is insufficient, as it falls short of the minimum 2-year monitoring period required for Aquifer Interference (AI) activities under the NSW Aquifer Interference Policy (AIP). It is ideal that if any previous groundwater monitoring data available in the vicinity of the project also be used to establish baseline groundwater conditions.

The current Stage 1 quarry dredging operation occurs in the northern pond. Stage 2 quarry operation will commence in 5 years in the southern extraction pond. It is not clear if the Hydrogeological assessment includes the maximum groundwater take estimate for both dredge ponds. Both stages of operation must be included to accurately estimate the total maximum groundwater take.

1.2 Recommendation – pre-determination

The Soil Water Management Plan should include 24 months groundwater quality monitoring data to establish baseline water quality.

Explanation

The Soil Water Management Plan focuses on estimating groundwater take but does not establish baseline groundwater quality. As this project is an AI activity, it is essential to establish baseline water quality using samples from the proposed four monitoring bores and other bores previously monitored.

End Attachment A

NSW Department of Climate Change, Energy, the Environment and Water

Our ref: OUT25/12924

Kristina Robinson
NSW Department of Planning, Housing & Infrastructure (DPHI)
Email: kristina.robinson@dpie.nsw.gov.au

04 November 2025

Subject: **Dunloe Sand Quarry - Soil and Water Management Plan v7 (MP06_0030-PA-20)**

Dear Kristina Robinson,

I refer to your request for advice sent on 30 September 2025 to the Department of Climate Change, Energy, the Environment and Water (DCCEEW) Water Group about the above matter.

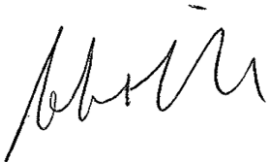
NSW DCCEEW Water Group has reviewed the Soil and Water Management Plan and has recommendations regarding:

- quantifying the maximum annual volume of water take due to aquifer interference activities
- demonstrating sufficient entitlement can be acquired in the relevant water sources
- assessment of the water licensing viability of contingency water supply options, if required
- updating the Soil Water Management Plan to include 24 months of groundwater quality monitoring data to establish baseline water quality, once the data has been gathered.

Please see **Attachment A** for detail.

Should you have any further queries in relation to this submission please do not hesitate to contact the Water Assessments team at water.assessments@dpie.nsw.gov.au.

Yours sincerely,



Rob Brownbill
Manager, Assessments, Knowledge Division
NSW Department of Climate Change, Energy, the Environment and Water

Attachment A

Detailed advice regarding the Dunloe Sand Quarry Soil and Water Management Plan v7 (MP06_0030-PA-20)

1.0 Water supply, take and licensing

1.1 Recommendation – prior to approval

The Department of Planning, Housing & Infrastructure (DPHI) should request the proponent to quantify maximum annual volume of water take due to aquifer interference activities.

Explanation

The proponent has applied a net water balance calculation to determine the volume of water take for the project which is not suitable. Water take should be calculated for a range of climatic scenarios to ensure *maximum* potential take volumes can be estimated. The proponent has determined take through the direct removal of groundwater with the sand product, and water extracted to meet site water demands (e.g. dust suppression). However, they have not accounted for indirect water take from the aquifer via groundwater inflows into the pit due to water removal from the lake by evaporation or other means. This needs to be calculated over a range of stages of the project's life and in consideration of a range of climatic conditions to determine the potential maximum water take.

The water balance approach also provides a credit for water returned to the extraction area. NSW water policy does not allow the re-credit of water entitlement for water returned.

1.2 Recommendation – prior to approval

DPHI should request the proponent demonstrate sufficient groundwater entitlement can be acquired in the relevant water sources unless an exemption applies.

Explanation

As per recommendation 1.1 above, sufficient entitlement must be held to account for maximum potential take once the recalculated volume of water take is known.

1.3 Recommendation – post approval

DPHI should request the proponent provide an assessment of the surface water licensing requirements prior to implementation if contingency water supply options are needed.

Explanation

Section 4.2.5 of the SWMP v7 presents a list of water supply contingency options if on-site water storage volumes are deficient. These include:

1. Sourcing water from existing dams on adjoining lands, which is normally close to or at capacity. This would include the Maximum Harvestable Right Dam Capacity (max. 10% runoff) for the site.
2. Modify the clean water diversion channel to discharge 100% of this flow into the quarry.
3. Increase the proportion of sand that is sold unwashed to reduce the amount consumed in the washing process.
4. Decrease the rate sand production to reduce the amount consumed in the washing process.

Options 1 and 2 would need further water licensing assessment before implementation.

Water obtained from Harvestable Rights must be used within land owned by that landholder.

Should there be any water taken from clean water catchments, these would need to be assessed for licensing requirements. The option to modify the clean water diversion into the quarry would require surface water entitlement to be held unless an exemption applies.

2.0 Groundwater impacts

2.1 Recommendation – post approval

DPHI should request the proponent to update the Soil Water Management Plan to include 24 months of groundwater quality monitoring data to establish baseline water quality, once the data has been gathered.

Explanation

The proponent has committed to complete 24-months of water level monitoring for the newly drilled bores. The SWMP and any water quality triggers based on the established baseline water quality data should be updated once the 24 months of data has been collected to meet the requirements of the NSW Aquifer Interference Policy 2012 (AIP).

End Attachment A