GERROA SAND RESOURCE

ANNUAL ENVIRONMENTAL MANAGEMENT REPORT

Period 01 July 2021 – 30 June 2022

Title Block

Name of operation	Gerroa Sand Resource
Name of operator	Cleary Bros (Bombo) Pty Ltd
Development consent #	05/0099
Name of holder of development consent	Cleary Bros (Bombo) Pty Ltd
AEMR start date	1/7/2021
AEMR end date	30/6/2022

I, Helen Cleary, certify that this audit report is a true and accurate record of the compliance status of the Gerroa Sand Resource for the period 1 July 2021 to 30 June 2022 and that I am authorised to make this statement on behalf of Cleary Bros (Bombo) Pty Ltd.

Note

a) The Annual Review is an 'environmental audit' for the purposes of section 122B(2) of the Environmental Planning and Assessment Act 1979. Section 122E provides that a person must not include false or misleading information (or provide information for inclusion in) an audit report produced to the Minister in connection with an environmental audit if the person knows that the information is false or misleading in a material respect. The maximum penalty is, in the case of a corporation, $1 million and for an individual, $250,000.

b) The Crimes Act 1900 contains other offences relating to false and misleading information: section 192G (Intention to defraud by false or misleading statement—maximum penalty 5 years imprisonment); sections 307A, 307B and 307C (False or misleading applications/information/documents—maximum penalty 2 years imprisonment or $22,000, or both).

Name of authorised reporting officer	Helen Cleary
Title of authorised reporting officer	Executive General Manager
Signature of authorised reporting officer	
Date	18/7/2022

Table of Contents

1. Introduction 6

1.1. Statement of Compliance 6

1.2. Background 6

1.3. Objectives of the Annual Environmental Management Report 6

2. Site Description and Activities 8

2.1. Site Identification 8

3. Key Licence Issues 9

3.1. Environmental Protection Licence Annual Reports 9

3.2. Development Consent 9

3.3. Standards and Performance Measures that apply 10

3.4. Works Carried Out in Reporting Period 10

3.5. Works to be Carried Out in the Next Period 10

4. Review of Environmental Performance 12

4.1. Meteorological Monitoring 12

4.2. Groundwater Management 12

4.3. Surface Water Management 30

4.4. Water Use 37

4.5. Air Quality 37

4.6. Noise Monitoring 38

4.7. Community 39

4.8. Rehabilitation & Vegetation Management 40

4.9. Acid Sulphate Monitoring 42

4.10. General Environmental Management & Reporting 43

4.11. Traffic Management 44

4.12. Independent Environmental Audit 44

5. Conclusion 46

Annexures

Annexure A Department of Regional NSW Return 2020/2021

Annexure B Environmental Monitoring Locations

Annexure C Environmental Monitoring Results

Annexure D 14th Annual Report – Flora and Fauna Monitoring Survey

Abbreviations

AEMR	Annual Environmental Management Report
CB	Cleary Bros (Bombo) Pty Ltd
DC	Development Consent (PA 05/0099)
EPA	Environmental Protection Authority
DP	Deposited Plan
DPE	Department of Planning and Environment
EPL	Environmental Protection Licence
LEC	Land & Environment Court
MW	Monitoring Well
QEMP	Quarry Environmental Management Plan

Internal Document Control

Version	Description	Prepared By	Reviewed By	Prepared Date
1	Initial Draft	M Hammond	H Cleary	6/7/2022
2	Final	M Hammond	H Cleary	18/7/2022

1. Introduction

1.1. Statement of Compliance

Were all conditions of the relevant approvals complied with?	
Development consent #05/0099	Yes
Environmental Protection Licence #4146	Yes

1.2. Background

Sand has been extracted from Cleary Bros (CB) sand quarry at Gerroa for approximately 60 years. The works have been authorised by a succession of development approvals.

On 2 September 2008 the Land and Environment Court granted project approval to Cleary Bros (Bombo) Pty Ltd for "Extension and Continuation of Gerroa Sand Quarry". On the 10 June 2022 the Minister for Planning approved Modification 1 for the continuation of sand extraction from the modification area on the northwestern side of Blue Angle Creek. Due to the timing of this modification approval less than one month prior to the end of the reporting period, construction associated with Modification 1 has not yet commenced, and as such this AEMR focuses on the performance of the operation against the requirements of the original Development Consent dated 2 September 2008. Any reference to a Development Consent in the AEMR refers to the original 2008 Court Consent. Future AEMR's (or Annual Review's as they are termed under Modification 1), will be prepared to assess project performance in line with the Modification 1 Consent. Sand extraction by dredging on the property is licensed by the Environment Protection Authority (EPA).

CB currently operates in accordance with the site's Quarry Environmental Management Plan (QEMP) in accordance with the requirements of the sites EPL and Development Consent (DC), which was most recently approved by the Department of Planning, Industry and Environment (DPIE) on 1 February 2017. The QEMP is currently being revised to align with the Modification 1 Consent. The location of the property is shown on Figure 1.

1.3. Objectives of the Annual Environmental Management Report

Condition 4 of Schedule 5 in Land and Environment Court Consent number 10801 of 2007 requires CB to submit an Annual Environmental Management Report (AEMR). The condition requires the AEMR to:

- Identify the standards and performance measures that apply to the project.
- Describe the works carried out in the last 12 months.
- Describe the works that will be carried out in the next 12 months.
- Include a summary of the complaints received during the past year, and compare this to the complaints received in previous years.
- Include a summary of the monitoring results for the project during the past year.
    - Include an analysis of these monitoring results against the relevant:
    - Impact assessment criteria/limits.
    - Monitoring results from previous years.
    - Predictions in the Environmental Assessment (EA).
- Include an evaluation of the effectiveness of the environmental protection requirements and procedures in the AEMR.
- Identify any trends in the monitoring results over the life of the project.
- Identify any non-compliance during the previous year.
- Describe what actions were, or are being taken to ensure compliance.

Figure 1 - Locality Plan

2. Site Description and Activities

2.1. Site Identification

The site comprises all of Lot A DP 185785 and part of Lot 2 DP 1111012. The property is owned by Bridon Pty Ltd, a member of the Cleary Bros group of companies.

The site lies across a local government boundary with approximately two thirds being contained within Kiama Municipal Councils area of governance and approximately one third lying within Shoalhaven City Councils area of governance. The operational area is contained within a small portion of the site in an area totalling approximately 27.5 hectares. The operational area fronts Crooked River Road and Berry Beach Road. The remainder of the property is used for agricultural activities.

The quarrying process involves dredging the sand mixed with water by suction based on a barge and piped back to the wet sorter located on the western edge of the dredge pond. In the wet sorter the gravel and larger materials such as shells are removed from the sand before the sand is sent to the cyclone which removes any remaining silt. From here the sand is deposited into stockpile and the removed silt and excess water are returned to the dredge pond. When the sand stockpile is of sufficient size, it is re-stockpiled away from the wet sorter and cyclone systems to dry. The sand is eventually transferred to the processing area away from the dredging area for storage and sale to the Cleary Bros concrete plants and to the public.

3. Key Licence Issues

3.1. Environmental Protection Licence Annual Reports

The Environment Protection Authority (EPA) has issued an Environmental Protection Licence (Licence No. 4146) for the dredging works on site, which was most recently updated on 9 December 2011.

The licence, issued under s55 of the Protection of the Environment Operations Act 1997, requires an annual return to be submitted to the EPA, for the reporting period of 1st February to 31st January.

The EPA Annual Returns for 2005 to 2021 reporting periods were reviewed to provide a background to this report. These Annual Returns are summarised in the following table.

Reporting Period	Pollution complaints	Concentration monitoring summary	Volume or mass monitoring summary	Compliance with licence conditions
1 Feb 2005 – 31 Jan 2006	Nil	None required	None required	All conditions complied with
1 Feb 2006 – 31 Jan 2007	Nil	None required	None required	All conditions complied with
1 Feb 2007 – 31 Jan 2008	Nil	None required	None required	All conditions complied with
1 Feb 2008 – 31 Jan 2009	Nil	None required	None required	All conditions complied with
1 Feb 2009 – 31 Jan 2010	Nil[1]	None required	None required	All conditions complied with
1 Feb 2010 – 31 Jan 2011	Nil	None required	None required	All conditions complied with
1 Feb 2011 – 31 Jan 2012	Nil	None required	None required	All conditions complied with
1 Feb 2012 – 31 Jan 2013	Nil	None required	None required	All conditions complied with
1 Feb 2013 – 31 Jan 2014	Nil	None required	None required	All conditions complied with
1 Feb 2014 – 31 Jan 2015	Nil	None required	None required	All conditions complied with
1 Feb 2015 – 31 Jan 2016	Nil	None required	None required	All conditions complied with
1 Feb 2016 – 31 Jan 2017	Nil	None required	None required	All conditions complied with
1 Feb 2017 – 31 Jan 2018	Nil	None required	None required	All conditions complied with
1 Feb 2018 – 31 Jan 2019	Nil	None required	None required	All conditions complied with
1 Feb 2019 – 31 Jan 2020	Nil	None required	None required	All conditions complied with
1 Feb 2020 – 31 Jan 2021	Nil	None required	None required	All conditions complied with
1 Feb 2021 – 31 Jan 2022	Nil	None required	None required	All conditions complied with

3.2. Development Consent

The Development Consent (DC) was approved by the Land and Environment Court (LEC) on 02 September 2008 and is the primary consent relevant to sand quarrying operations. As a requirement of the DC an AEMR must be completed annually. As previously described, the Annual Review required as part of the Modification 1 Consent will replace the AEMR in following years.

[1] One other complaint was reported to CB from DoP as a letter dated 2 December 2009 relating to the extent of clearing. This was investigated and found not to be factual (refer CB letter to DoP dated 15 December 2009).

3.3. Standards and Performance Measures that apply

The Environmental Assessment dated October 2006 outlines the predicted impacts of the 2008 Consent. The Gerroa Sand Resource is also licenced by the Environmental Protection Authority under Environmental Protection License 4146. These documents contain the standards and performance measures for the Gerroa Sand Resource, which are identified separately in Section 4.

3.4. Works Carried Out in Reporting Period

The total sand transported from site during the 2021/2022 reporting year was 31,291 tonnes. In the current reporting period, sand was extracted from previous laydown and stockpiling areas, as well as from previously dredged parts, with the current dredge able to extract to a greater depth than the previously used dredge. The previous year's return (2020/2021) to the Department of Regional NSW is included as Annexure A for 43,155 tonnes. The return for the 2021/2022 is due in November 2022 to the Department of Regional NSW and will be included in next year's Annual Review.

3.5. Works to be Carried Out in the Next Period

The dredge will continue extracting sand from within the existing dredge pond, before relocating to the Modification 1 dredge pond within the coming months. The areas planned for extraction in 2022/2023 are shown in Figure 2.

Construction works consistent with the Modification 1 application and Modification 1 Consent will be undertaken in the early parts of the 2022/2023 reporting period, following the approval of the QEMP and associated plans for this area. These works may include grubbing of vegetation, topsoil stripping, construction of flood bunding, installation of pumps and piping infrastructure, and acid sulphate soil management. Other works that are expected to occur in the 2022/2023 reporting period include construction of new fencing, planting of vegetation screens, and the installation of new or relocation of existing environmental monitoring equipment.

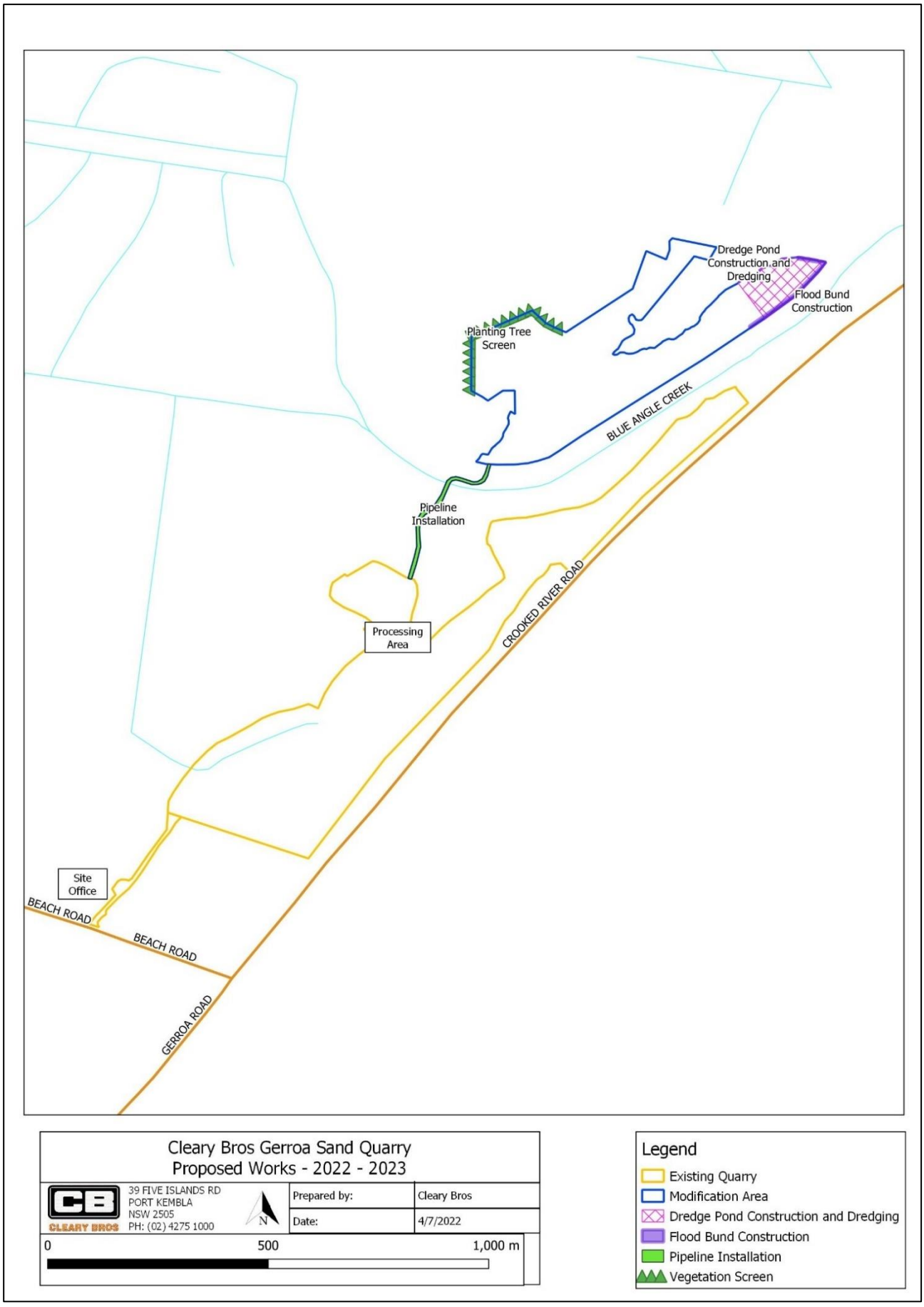


Figure 2 – Description of works

4. Review of Environmental Performance

4.1. Meteorological Monitoring

4.1.1. Licence Requirements

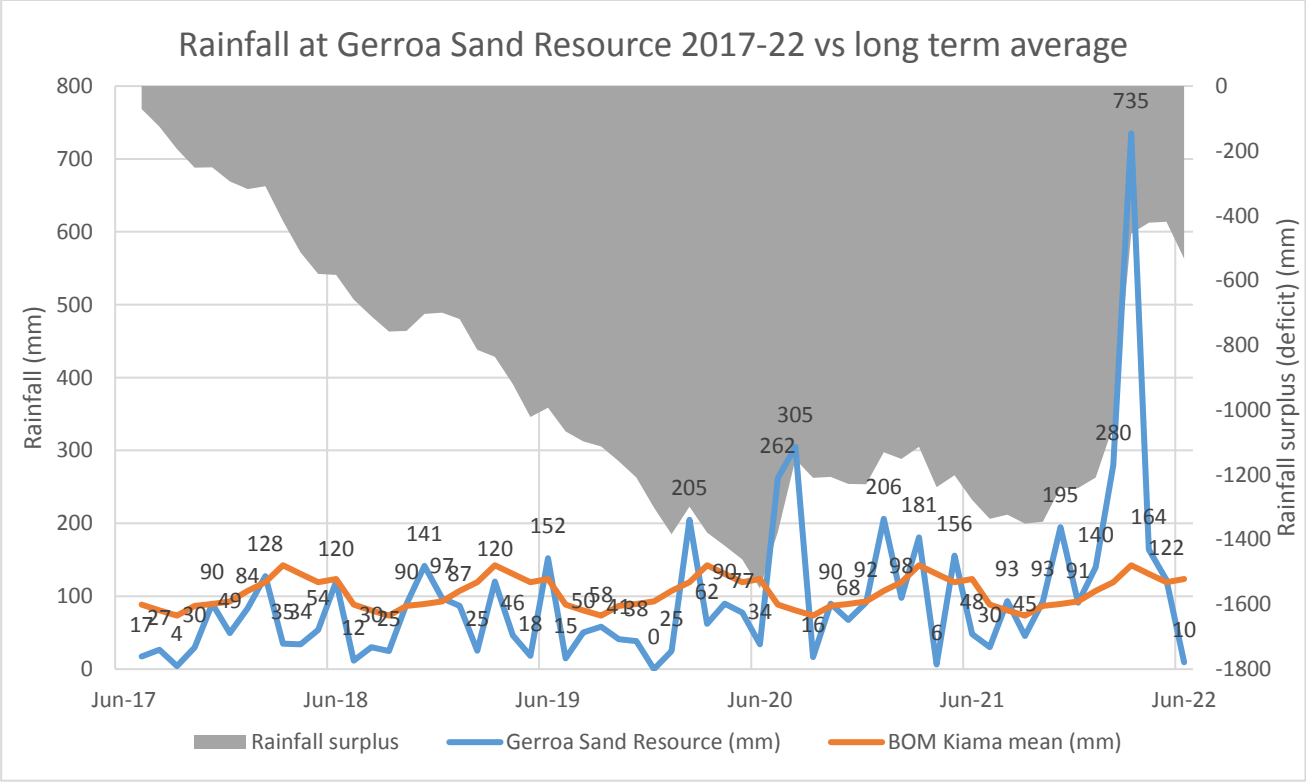
The DC requires Cleary Bros to maintain a meteorological station on site.

4.1.2. Compliance Assessment

A meteorological station is maintained onsite that provides information on rainfall, air temperature, solar radiation and wind speed via mobile telemetry to an online portal. The current weather station was installed in September 2016. The meteorological station has operated during the reporting period, with minimal disruptions due to power supply issues in April 2022 and minor damage from extreme winds in June 2022. These disruptions were quickly identified in each instance and the station repaired with minimal loss of data.

4.1.3. Meteorological Monitoring

Rainfall during the current year was significantly above average, with 1,999 mm of rain falling since July 2021, including 735mm in March 2022 and 280mm in February 2022. This has continued the recent trend since 2020 of above average rainfall, following on from three years of significantly below average rainfall from 2017-2019. The recent rainfall has significantly reduced the cumulative rainfall deficit built up over the 2017-2019 drought, and has replenished the regional groundwater environment, while causing flooding of the adjoining Foys Swamp and across parts of the biodiversity conservation area.



4.2. Groundwater Management

4.2.1. Standards and Performance Measures

There are no specific criteria for groundwater quality in the sites EPL.

The groundwater monitoring requirements from the DC are realised by the sites QEMP. Section 8.6 of the QEMP details the groundwater testing requirements and specifies that 13 boreholes on site require monthly water level readings and quarterly analyte testing. The tabulated results of groundwater monitoring are included in Annex

B. The EA predicted that the project is not expected to result in variation in the range of groundwater levels previously experienced in the monitoring bores on the site. Furthermore, the EA identified that existing low pH levels in groundwater bores to be relatively benign, signifying natural impacts from naturally occurring pyrites and organic acids, with sand extraction not predicted to lead to any deterioration of the groundwater quality.

The groundwater quality objectives which CB should "aim to meet" from the DC (and adopted in the QEMP) are as follows:

Analyte	Units	Objective
pH	pH	6.0 – 8.5
Electrical Conductivity	µS/cm	<1,500
Total Phosphorus	µg/L	<30
Total Nitrogen	µg/L	<350
Chlorophyll-A	µg/L	<5
Faecal Coliforms	Median No./100 mL	<1,000
Enterococci	Median No./100 mL	<230
Sodium	mg/L	<400
Potassium Ion	mg/L	<50
Magnesium Ion	mg/L	<50
Chloride Ion	mg/L	<300
Sulphate Ion	mg/L	<250
Bicarbonate Ion	mg/L	<750
Soluble Iron Ion	mg/L	<6
Ammonium Ion	µg/L*	<20

* amended from mg/L to µg/L as part of Modification 1

However, the target for groundwater dependant ecosystems extracted from the QEMP is that no discernible deterioration of ecosystems or vegetation, attributable to measured changes in groundwater levels or quality.

4.2.2. Environmental Performance

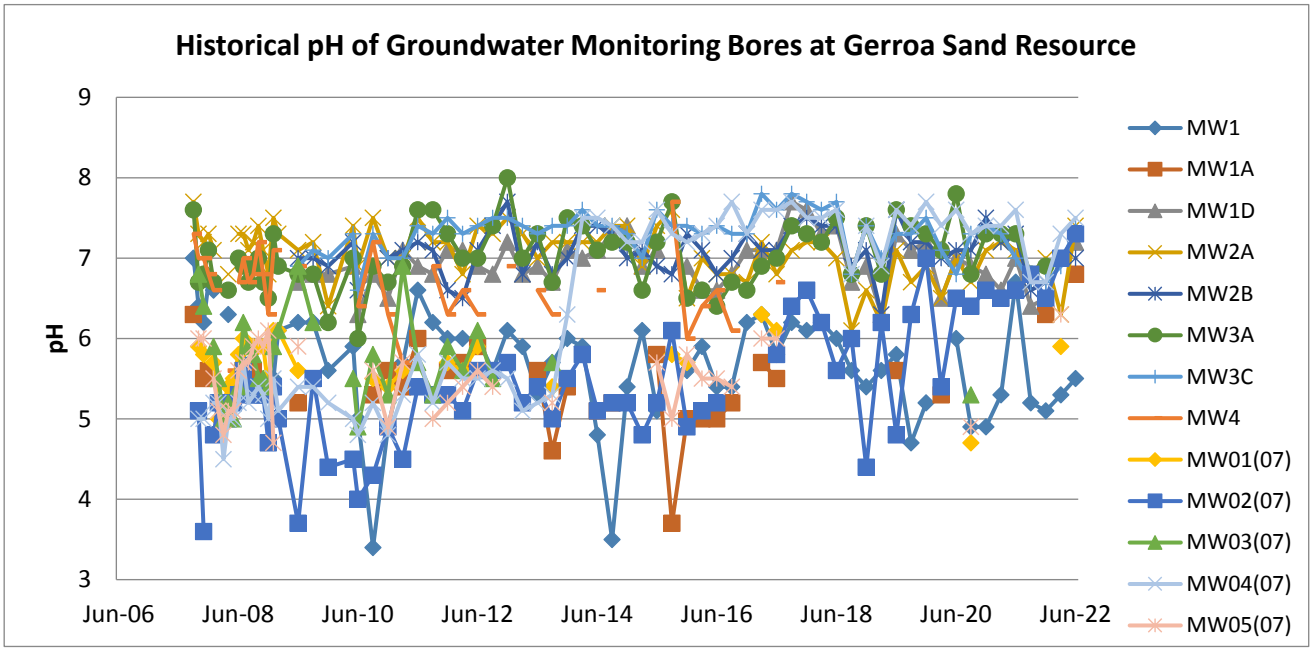
CB has implemented the Groundwater Monitoring Program and Acid Sulphate Soils Management Plan to meet the requirements of the DC. ALS Laboratory Group were engaged during the reporting period to conduct quarterly sampling and testing of the groundwater monitoring sites, as well as monthly testing of the groundwater depths and the leachate from sand extracted by the dredging operation for Total Oxidisable Sulphur.

4.2.3. Groundwater Monitoring

A summary of groundwater monitoring results for the period is displayed in this section, separated into the different analytes required to be monitored as per the DC. For each analyte, the range and average of the current period's monitoring are displayed, alongside the historical range and average, objectives as described in the DC, and any EA predictions. Where groundwater monitoring results trend outside of the historical range or DC objectives, these are highlighted in the summary with discussion into these results below. For each analyte, a historical graph is also included showing the variations in measurements for each groundwater bore throughout the historical monitoring period.

pH (pH units)

BORE HOLE	2021/22 Reporting Period			Historical Results			DC Objectives	EA Predictions
	Min	Ave	Max	Min	Ave	Max		
MW1	5.1	5.3	5.5	3.4	5.7	7.0	6.0 - 8.5	N/A
MW1A	6.3	6.6	6.8	3.7	5.4	6.3	6.0 - 8.5	N/A
MW1D	6.4	6.7	7.2	6.3	6.9	7.7	6.0 - 8.5	N/A
MW2A	6.3	6.9	7.4	6.1	7.1	7.7	6.0 - 8.5	N/A
MW2B	6.6	6.8	7.0	6.3	7.1	7.7	6.0 - 8.5	N/A
MW3A	6.8	6.9	6.9	6.0	7.0	8.0	6.0 - 8.5	N/A
MW3C	6.7	6.9	7.4	6.6	7.3	7.8	6.0 - 8.5	N/A
MW4	Bore damaged			5.6	6.6	7.7	6.0 - 8.5	N/A
MW01(07)	5.9	5.9	5.9	4.7	5.7	6.3	6.0 - 8.5	N/A
MW02(07)	6.5	6.9	7.3	3.6	5.4	7.0	6.0 - 8.5	N/A
MW03(07)	Insufficient water for sample			4.9	5.7	6.9	6.0 - 8.5	N/A
MW04(07)	6.7	7.1	7.5	4.5	6.3	7.7	6.0 - 8.5	N/A
MW05(07)	6.3	6.3	6.3	4.7	5.5	6.1	6.0 - 8.5	N/A

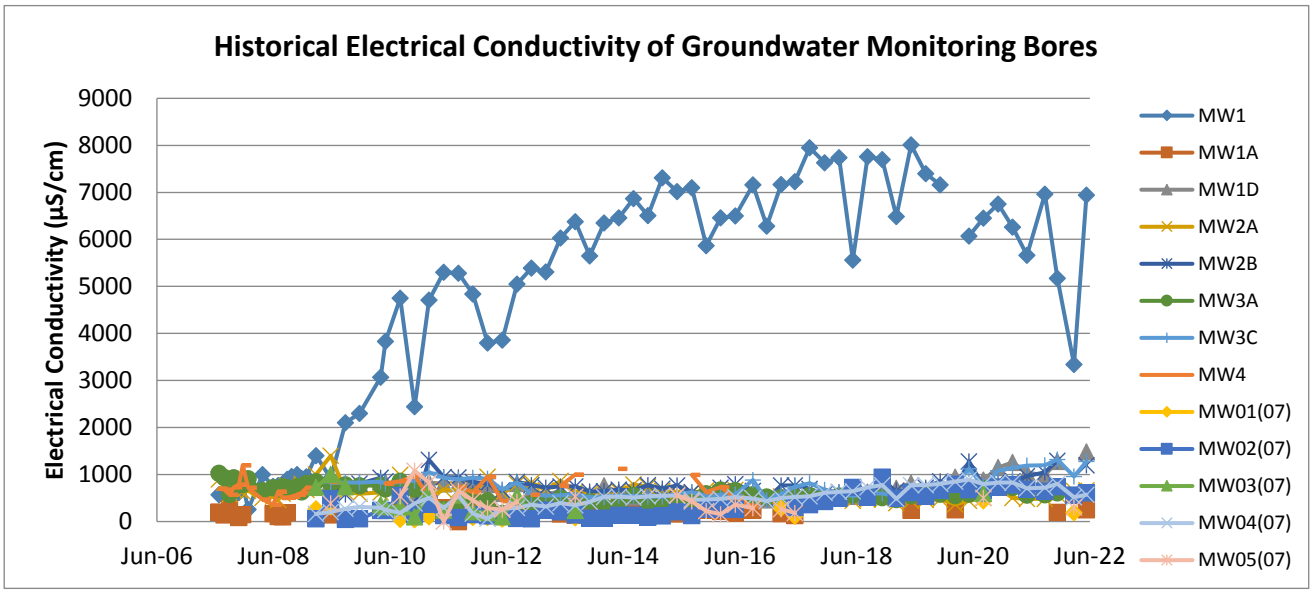


The pH values over the past 12 months have exhibited variability similar to that observed across the historical record. Most groundwater bores recorded pH levels in line with historical averages, with some bores recording slightly higher results, within the DC objectives, related to freshwater inflows associated with the extreme rainfall in early 2022. No monitoring bore recorded a pH value below its historical range, despite the significant increase in the groundwater table observed throughout the reporting period.

Bores MW1, MW01(07), and MW05(07) have continued to exhibit mildly acidic groundwater in line with historical results. Dredging has now progressed through the area of the new (2007) monitoring bores, with pH relatively unchanged as a consequence of dredging. The mildly acidic groundwater in certain bores appears to be a result of natural conditions, rather than as a result of dredging operations.

Electrical Conductivity (µS/cm)

BORE HOLE	2021/22 Reporting Period			Historical Results			DC Objectives	EA Predictions
	Min	Ave	Max	Min	Ave	Max		
MW1	3340	5603	6960	260	4513	8010	< 1500	N/A
MW1A	196	222	248	90	199	350	< 1500	N/A
MW1D	988	1249	1480	457	686	1260	< 1500	N/A
MW2A	483	596	665	366	635	1400	< 1500	N/A
MW2B	1050	1180	1290	300	752	1310	< 1500	N/A
MW3A	574	594	614	176	592	1030	< 1500	N/A
MW3C	957	1189	1320	453	725	1190	< 1500	N/A
MW4	Bore damaged			327	688	1200	< 1500	N/A
MW01(07)	190	190	190	40	164	441	< 1500	N/A
MW02(07)	562	639	739	50	335	948	< 1500	N/A
MW03(07)	Insufficient water for sample			100	430	1000	< 1500	N/A
MW04(07)	516	653	805	60	495	892	< 1500	N/A
MW05(07)	301	301	301	158	441	1080	< 1500	N/A

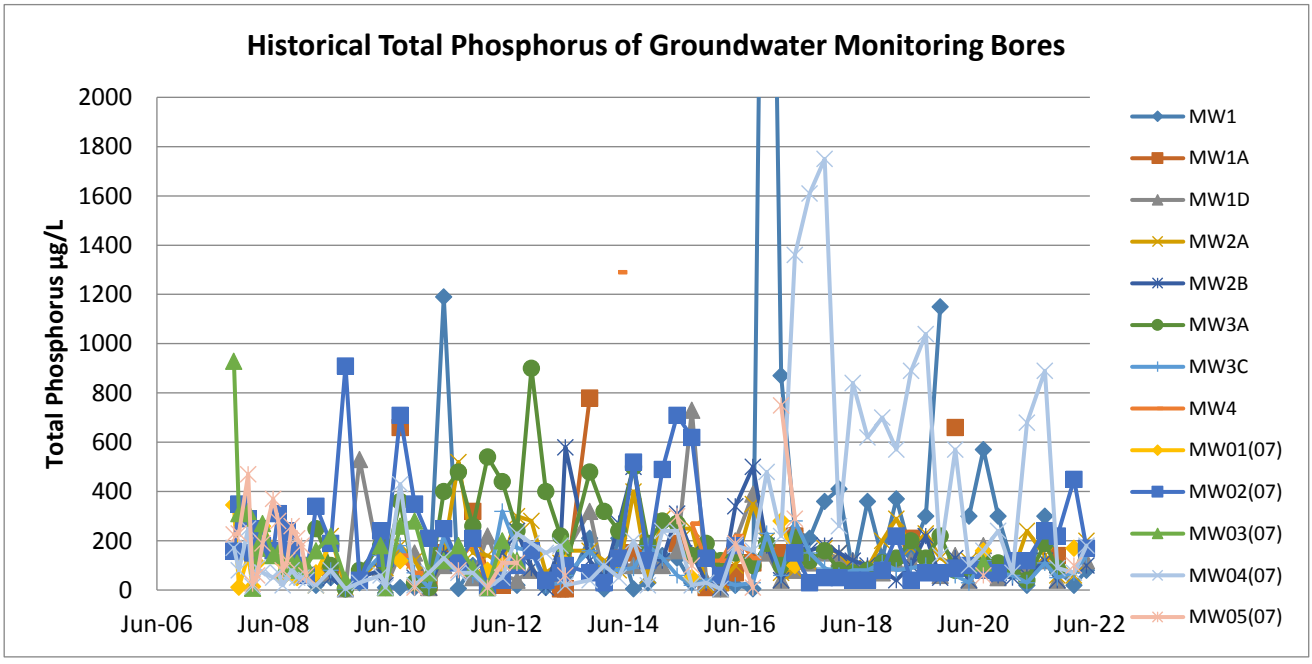


The results over the 12 month period show that the Electrical Conductivity (EC) of the groundwater in the boreholes is within the objective levels for all bores with the exception of MW1. The brackish groundwater in MW1 has not been observed at any other bore or within the dredge pond, and is consistent with other recorded groundwater records for bores screened within the Berry Siltstone unit to the southwest.

The monitoring bores have continued to show significant variability in EC concentrations across the monitoring network, and with the exception of MW1, the southernmost and eastern bores generally showing slightly lower EC than those bores to the northwest, albeit amongst a pattern of ongoing variability. This variability has likely been enhanced at various times throughout the current reporting period with the replenishment of rainfall infiltration to the aquifer. A significant drop in EC was observed across most bores in the March 2022 sample event due to the considerable rainfall, however these appear to have largely stabilised for the June 2022 monitoring event.

Total Phosphorus (µg/L)

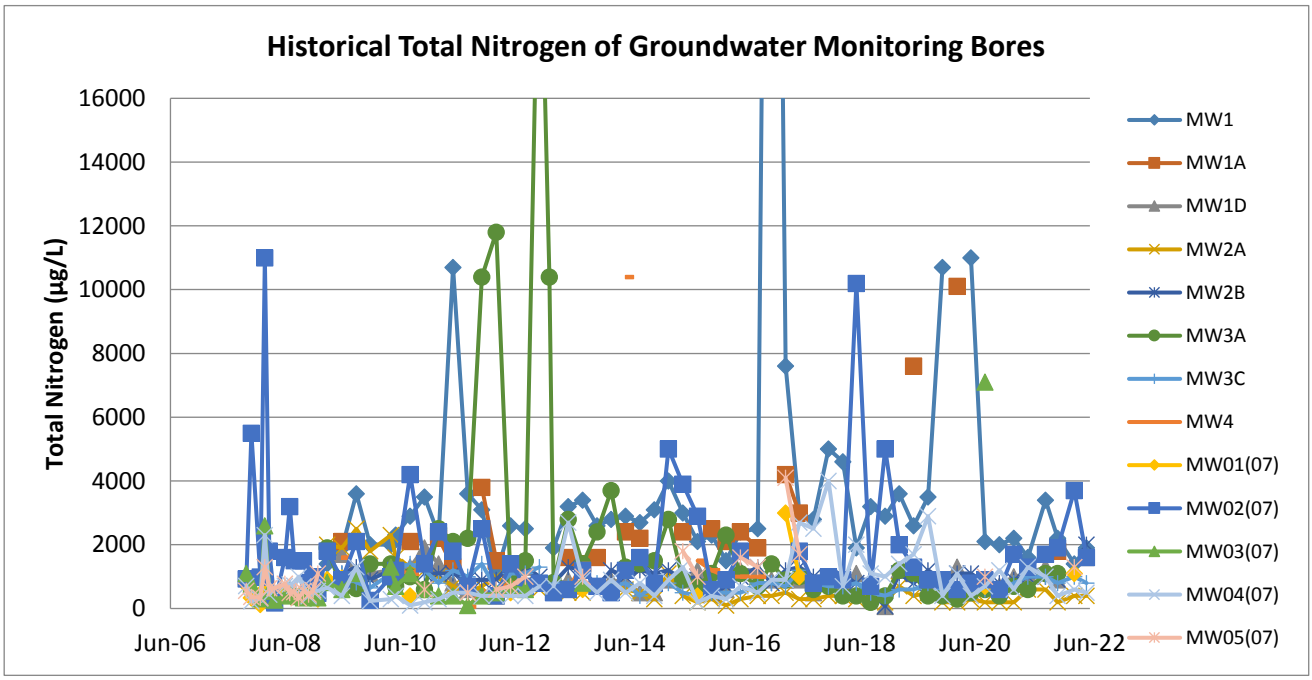
BORE HOLE	2021-22 Reporting Period			Historical Results			DC Objectives	EA Predictions
	Min	Ave	Max	Min	Ave	Max		
MW1	20	120	300	<10	276	4780	< 30	N/A
MW1A	140	140	140	<10	192	780	< 30	N/A
MW1D	40	93	120	<10	127	730	< 30	N/A
MW2A	60	115	200	10	152	520	< 30	N/A
MW2B	40	87	120	<10	135	580	< 30	N/A
MW3A	90	140	190	<10	208	900	< 30	N/A
MW3C	50	93	140	<10	94	320	< 30	N/A
MW4	Bore damaged			70	215	1290	< 30	N/A
MW01(07)	170	170	170	12	119	346	< 30	N/A
MW02(07)	170	270	450	10	186	910	< 30	N/A
MW03(07)	Insufficient water for sample			8	170	929	< 30	N/A
MW04(07)	70	308	890	<10	258	1750	< 30	N/A
MW05(07)	100	100	100	10	179	750	< 30	N/A



Concentrations of total phosphorus in the boreholes were generally above the groundwater quality objective, however they were all within the historical range for their respective bores. During the reporting period, the concentration of total phosphorus in the dredge pond was generally less than that measured in all bores, suggesting the agricultural land uses surrounding the Gerroa Sand Resource may have contributed to the measurements of total phosphorus in all bores.

Total Nitrogen (µg/L)

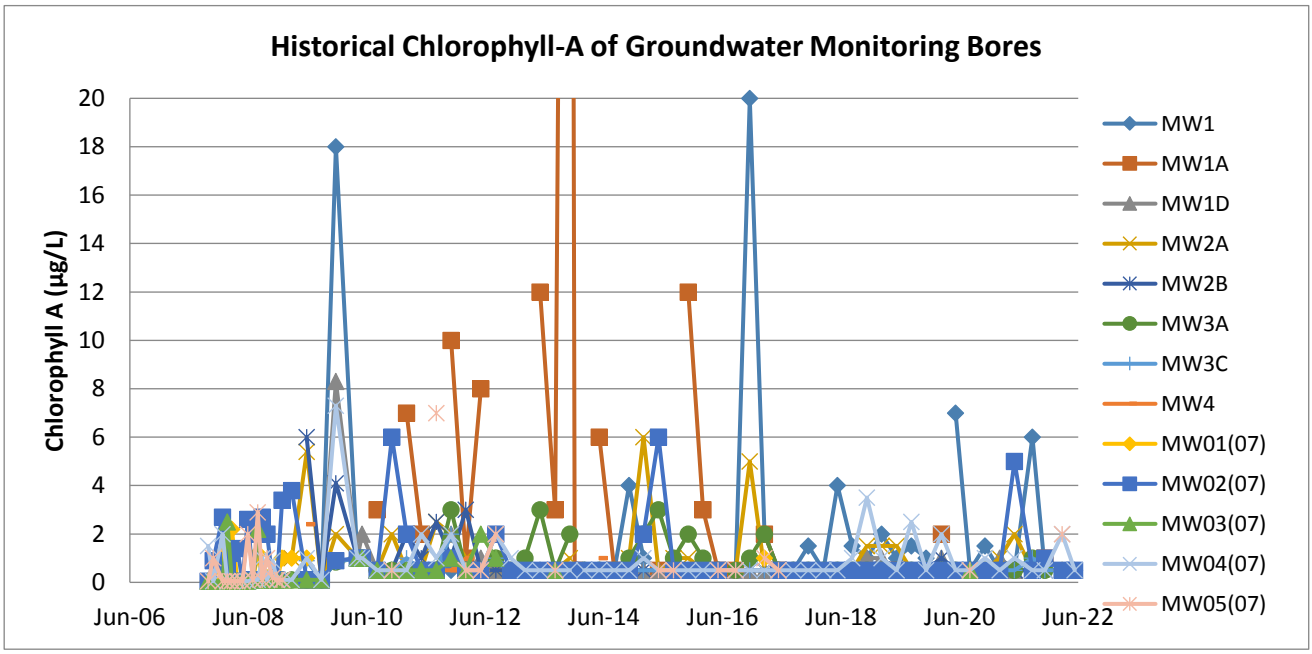
BORE HOLE	2021/22 Reporting Period			Historical Results			DC Objectives	EA Predictions
	Min	Ave	Max	Min	Ave	Max		
MW1	1400	2225	3400	1100	4319	51100	< 350	N/A
MW1A	1800	1800	1800	900	2824	10100	< 350	N/A
MW1D	900	1267	1600	70	912	1900	< 350	N/A
MW2A	200	400	600	100	692	2500	< 350	N/A
MW2B	900	1300	2000	80	996	1400	< 350	N/A
MW3A	1100	1100	1100	200	2162	23200	< 350	N/A
MW3C	800	900	1000	400	797	1400	< 350	N/A
MW4	Bore damaged			60	1579	10400	< 350	N/A
MW01(07)	1100	1100	1100	130	623	3000	< 350	N/A
MW02(07)	1600	2225	3700	180	1804	11000	< 350	N/A
MW03(07)	Insufficient water for sample			100	868	7100	< 350	N/A
MW04(07)	400	625	1000	100	884	4000	< 350	N/A
MW05(07)	1300	1300	1300	330	961	4100	< 350	N/A



The concentrations of Total Nitrogen in all groundwater monitoring bores have consistently exceeded the objective levels since monitoring of groundwater quality began. In the current reporting period, nitrogen concentrations were recorded within the historical range in all bores with the exception of the single result for bore MW2B, which was above the previous historical range. The presence of Total Nitrogen at those concentrations recorded in the bores are likely to be related to the presence of agricultural activities in the area surrounding the Gerroa Sand Resource. This is supported by an analysis of water quality within the dredge pond, which shows that nitrogen concentrations in the pond are consistently lower than that recorded across the broader groundwater monitoring network.

Chlorophyll A (µg/L)

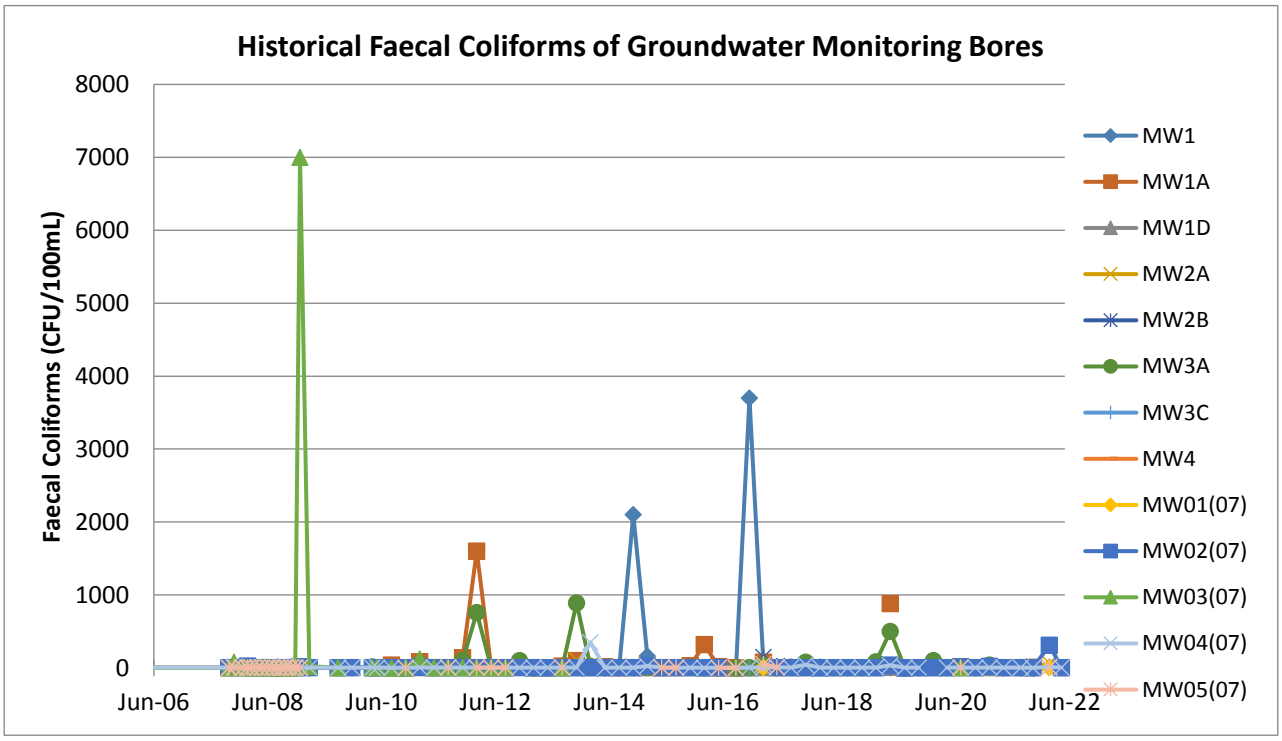
BORE HOLE	2021/22 Reporting Period			Historical Results			DC Objectives	EA Predictions
	Min	Ave	Max	Min	Ave	Max		
MW1	<1	2	6	<1	2.0	20	< 5	N/A
MW1A	1	1	1	<1	8.0	90	< 5	N/A
MW1D	<1	<1	1	<1	<1	8	< 5	N/A
MW2A	<1	<1	1	<1	1.0	6	< 5	N/A
MW2B	<1	<1	<1	<1	<1	6	< 5	N/A
MW3A	<1	<1	1	<1	<1	3	< 5	N/A
MW3C	<1	<1	1	<1	<1	2	< 5	N/A
MW4	Bore damaged			<1	1	2	< 5	N/A
MW01(07)	<1	<1	<1	<1	<1	2	< 5	N/A
MW02(07)	<1	<1	1	<1	1	6	< 5	N/A
MW03(07)	Insufficient water for sample			<1	1	3	< 5	N/A
MW04(07)	<1	<1	2	<1	<1	7	< 5	N/A
MW05(07)	2	2	2	<1	<1	7	< 5	N/A



Chlorophyll-A can fluctuate greatly with plant materials being flushed into the system and any results away from the low levels generally observed can be attributed to tree and leaf matter after windy or rainy periods. The chlorophyll-A levels for the reporting period were within the objective level and historical ranges for the respective bores and were mostly below the limit of reporting.

Faecal Coliforms (median number/100mL)

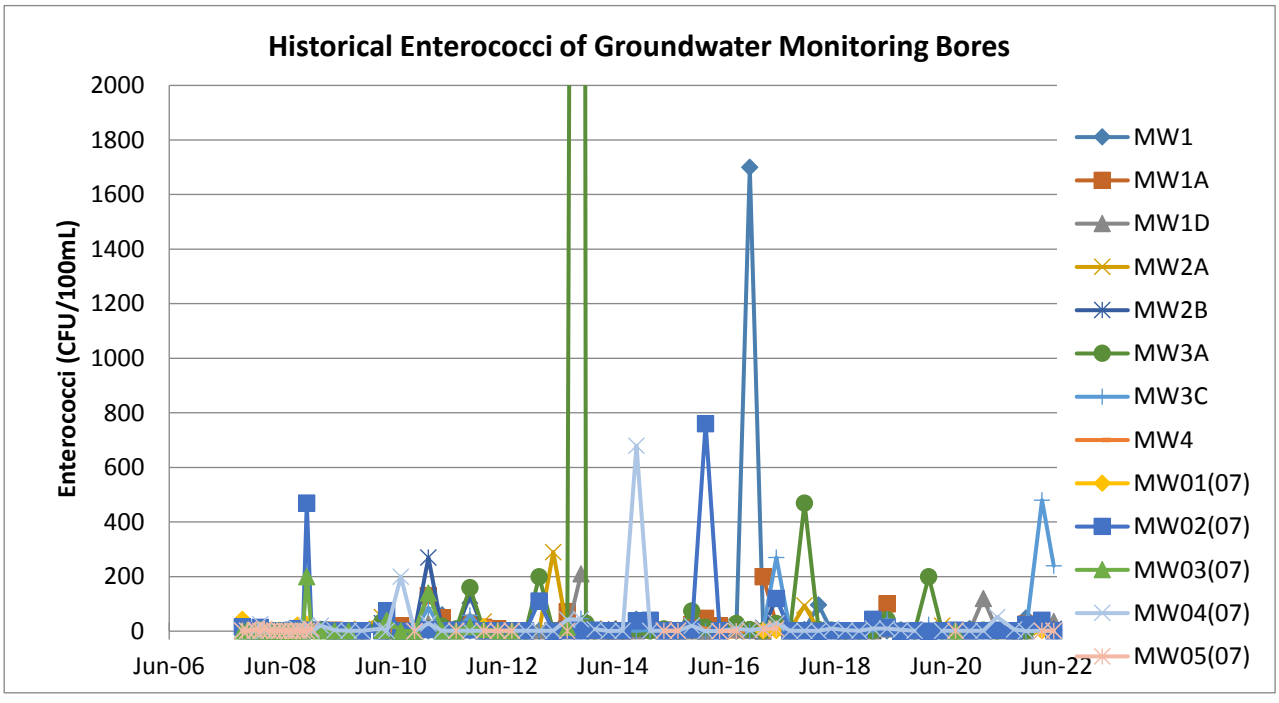
BORE HOLE	2021/22 Reporting Period			Historical Results			DC Objectives	EA Predictions
	Min	Ave	Max	Min	Ave	Max		
MW1	<2	2	6	<1	126	3700	<1000	N/A
MW1A	8	8	8	<1	167	1600	<1000	N/A
MW1D	<2	<2	<2	<1	2	18	<1000	N/A
MW2A	<2	17	64	<1	6	110	<1000	N/A
MW2B	<2	<2	<2	<1	5	150	<1000	N/A
MW3A	<1	<1	<2	<1	57	890	<1000	N/A
MW3C	<1	5	16	<1	3	52	<1000	N/A
MW4	Bore damaged			<1	3	36	<1000	N/A
MW01(07)	4	4	4	<1	2	10	<1000	N/A
MW02(07)	<2	78	310	<1	4	40	<1000	N/A
MW03(07)	Insufficient water for sample			<1	241	7000	<1000	N/A
MW04(07)	<1	3	10	<1	9	350	<1000	N/A
MW05(07)	8	8	8	<1	3	50	<1000	N/A



Faecal coliforms were within the objective levels and historical ranges during the reporting period, with the exception of a single anomalous result for bore MW02(07) which was outside of the historical range for this bore.

Enterococci (median number/100mL)

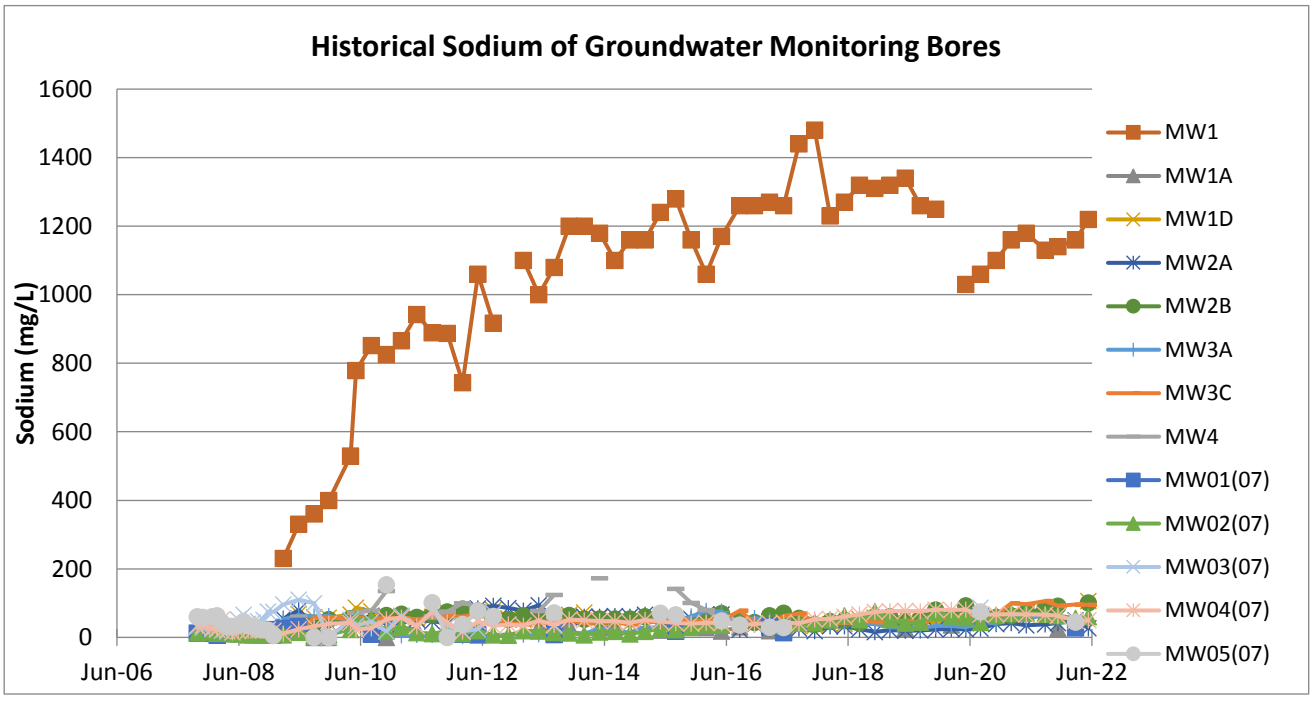
BORE HOLE	2021/22 Reporting Period			Historical Results			DC Objectives	EA Predictions
	Min	Ave	Max	Min	Ave	Max		
MW1	<2	16	48	<1	41	1700	<230	N/A
MW1A	26	26	26	<2	38	200	<230	N/A
MW1D	<2	13	36	<2	12	210	<230	N/A
MW2A	<2	4	14	<1	13	290	<230	N/A
MW2B	<2	3	8	<1	14	270	<230	N/A
MW3A	<1	1	1	<1	322	15000	<230	N/A
MW3C	<2	181	480	<1	13	270	<230	N/A
MW4	Bore damaged			<1	7	32	<230	N/A
MW01(07)	2	2	2	<1	7	44	<230	N/A
MW02(07)	<2	17	40	<1	29	760	<230	N/A
MW03(07)	Insufficient water for sample			<1	15	200	<230	N/A
MW04(07)	<1	2	6	<1	20	680	<230	N/A
MW05(07)	2	2	2	<1	2	10	<230	N/A



Enterococci concentrations were within the objective levels and the historical ranges during the reporting period, with the exception of two samples from bore MW3C. Following a spike in the March 2022 sample, it is showing a trend returning to the typical levels in the June 2022 sample.

Sodium (mg/L)

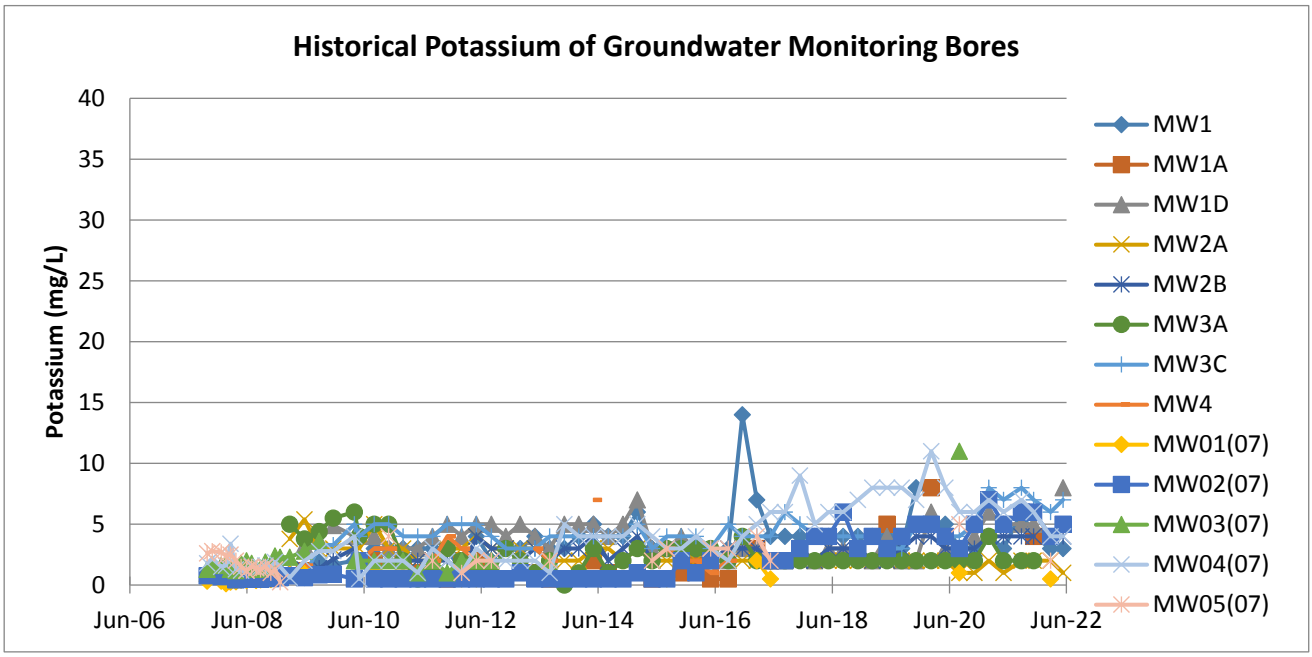
BORE HOLE	2021/22 Reporting Period			Historical Results			DC Objectives	EA Predictions
	Min	Ave	Max	Min	Ave	Max		
MW1	1130	1163	1220	230	1052	1480	< 400	N/A
MW1A	26	26	26	14	27	36	< 400	N/A
MW1D	72	84	106	33	54	87	< 400	N/A
MW2A	27	39	50	16	47	94	< 400	N/A
MW2B	85	92	101	38	59	92	< 400	N/A
MW3A	57	62	66	4	35	77	< 400	N/A
MW3C	92	97	106	11	53	100	< 400	N/A
MW4	Bore damaged			45	92	173	< 400	N/A
MW01(07)	28	28	28	6.2	18	61	< 400	N/A
MW02(07)	56	62	67	5.4	28	75	< 400	N/A
MW03(07)	Insufficient water for sample			17	50	110	< 400	N/A
MW04(07)	48	57	66	11	44	81	< 400	N/A
MW05(07)	45	45	45	5.5	51	154	< 400	N/A



With the exception of borehole MW1, all sodium concentrations recorded in the boreholes are within the DC objectives, and consistently at a low level. Three bores (MW1D, MW2B and MW3C) recorded sodium concentrations slightly above the historical ranges for the respective bores. These bores are closest to Blue Angle Creek, and likely reflects the flushing of salt from the system that was deposited during the previous dry years, due to the significant rainfall experienced in the first half of 2022.

Potassium Ion (mg/L)

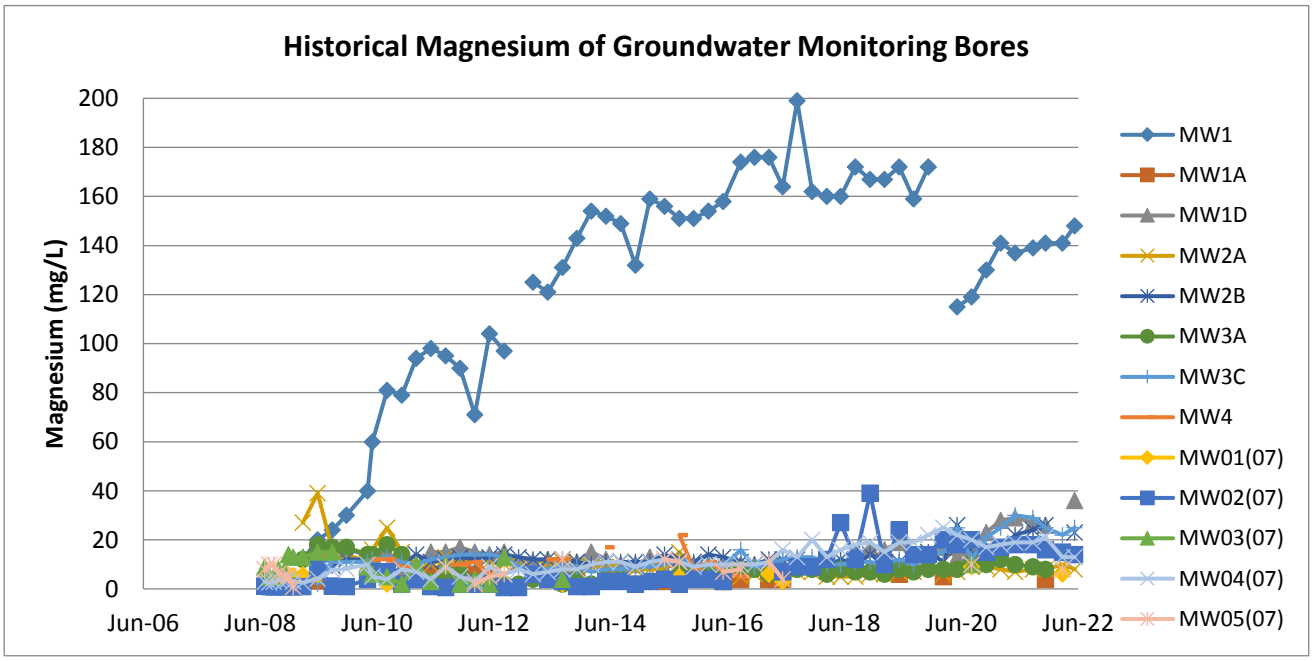
BORE HOLE	2021/22 Reporting Period			Historical Results			DC Objectives	EA Predictions
	Min	Ave	Max	Min	Ave	Max		
MW1	3	4	6	<1	4	14	< 50	N/A
MW1A	4	4	4	<1	2	8	< 50	N/A
MW1D	5	6	8	2	4	7	< 50	N/A
MW2A	1	2	2	1	2	5.4	< 50	N/A
MW2B	4	4	4	1	3	4	< 50	N/A
MW3A	2	2	2	<1	3	6	< 50	N/A
MW3C	6	7	8	<1	4	8	< 50	N/A
MW4	Bore damaged			1	3	7	< 50	N/A
MW01(07)	<1	<1	<1	<1	1	2	< 50	N/A
MW02(07)	4	5	6	<1	2	7	< 50	N/A
MW03(07)	Insufficient water for sample			1	2	11	< 50	N/A
MW04(07)	4	5	7	<1	4	11	< 50	N/A
MW05(07)	2	2	2	<1	2	5	< 50	N/A



Potassium ion concentrations have remained well below DC objective levels during the reporting period and were generally consistent with historical concentrations in the current reporting period. The monitoring results indicate no deterioration in groundwater quality related to potassium ion concentrations in the current reporting year.

Magnesium Ion (mg/L)

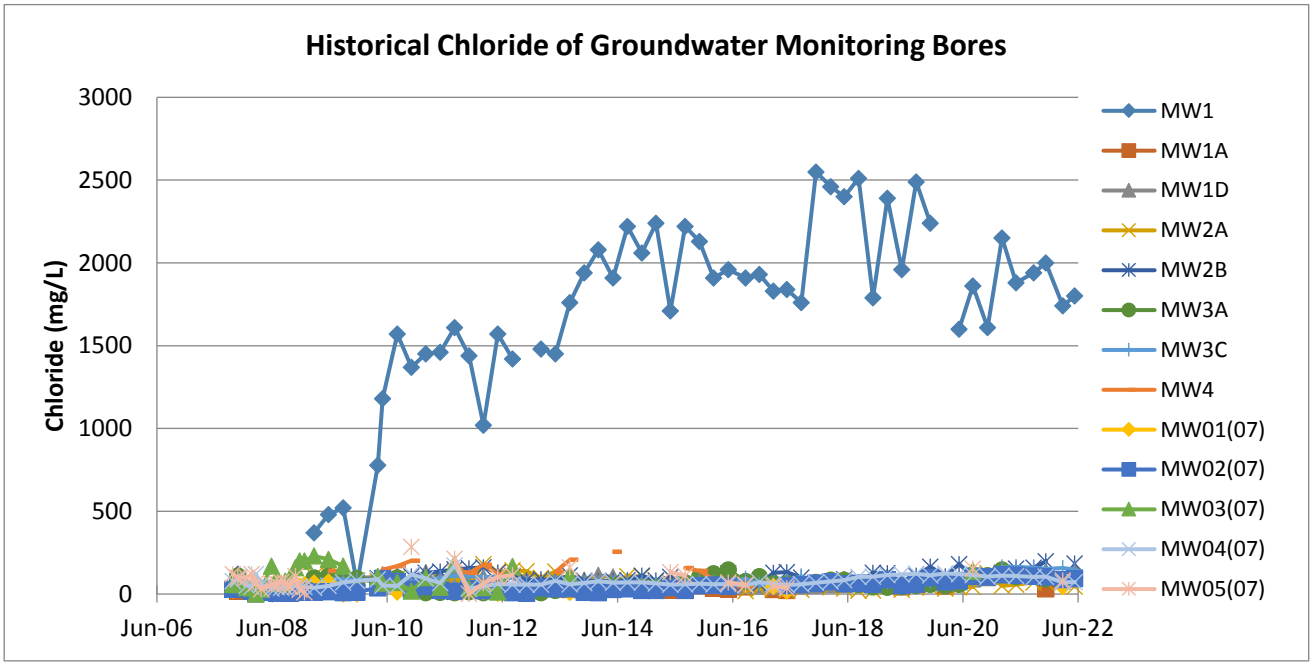
BORE HOLE	2021/22 Reporting Period			Historical Results			DC Objectives	EA Predictions
	Min	Ave	Max	Min	Ave	Max		
MW1	139	142	148	12	126	199	< 50	N/A
MW1A	4	4	4	3	5	7	< 50	N/A
MW1D	26	30	36	8	13	29	< 50	N/A
MW2A	8	9	10	5	10	39	< 50	N/A
MW2B	23	24	26	9	12	26	< 50	N/A
MW3A	8	9	9	2	7	18	< 50	N/A
MW3C	22	25	29	2.1	12	30	< 50	N/A
MW4	Bore damaged			5	11	22	< 50	N/A
MW01(07)	6	6	6	2	4	9	< 50	N/A
MW02(07)	14	16	18	0.5	7	39	< 50	N/A
MW03(07)	Insufficient water for sample			2	8	15	< 50	N/A
MW04(07)	13	17	21	2.5	10	25	< 50	N/A
MW05(07)	8	8	8	0.79	8	12	< 50	N/A



All magnesium ion concentrations were within DC objective levels with the exception of MW1, which has followed similar trends as for conductivity and sodium. All samples were within the historical range for their respective sites with the exception of a single sampled from MW1D was above its historical range. Trends in magnesium concentration appear to be most closely linked with proximity to Blue Angle Creek, with those bores closest to Blue Angle Creek continuing to show increases in magnesium concentration while those furthest away showing reductions in response to the improved rainfall observed in the period.

Chloride Ion (mg/L)

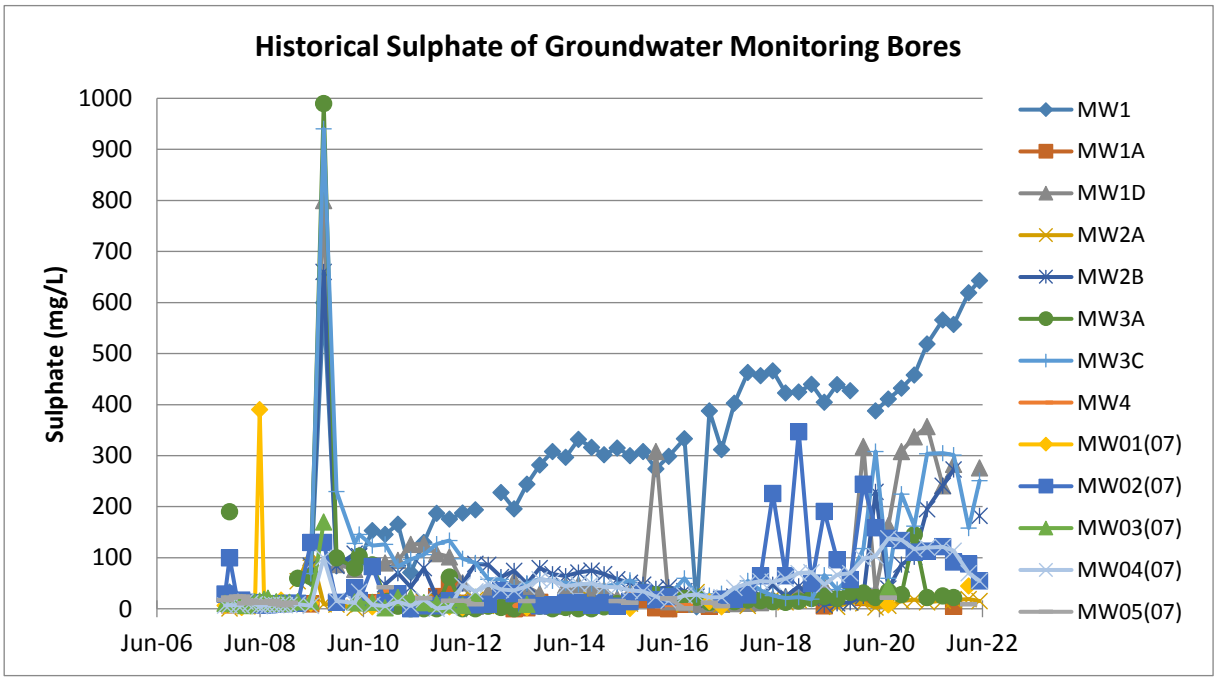
BORE HOLE	2021/22 Reporting Period			Historical Results			DC Objectives	EA Predictions
	Min	Ave	Max	Min	Ave	Max		
MW1	1740	1870	2000	60	1687	2550	< 300	N/A
MW1A	32	32	32	18	38	56	< 300	N/A
MW1D	122	135	148	48	84	142	< 300	N/A
MW2A	46	66	76	18	72	181	< 300	N/A
MW2B	159	180	198	57	105	180	< 300	N/A
MW3A	92	100	108	8	61	146	< 300	N/A
MW3C	147	154	160	55	80	164	< 300	N/A
MW4	Bore damaged			47	141	256	< 300	N/A
MW01(07)	45	45	45	0.5	34	134	< 300	N/A
MW02(07)	88	99	109	0.5	41	116	< 300	N/A
MW03(07)	Insufficient water for sample			0.5	100	230	< 300	N/A
MW04(07)	71	89	106	33	73	172	< 300	N/A
MW05(07)	82	82	82	11	94	286	< 300	N/A



As for sodium, the concentration of chloride in all groundwater bores were within DC objectives with the exception of MW1. Chloride concentrations in MW1 have been variable within the reporting period, consistent with results from recent years. All samples from other bores were measured within the respective historical ranges during the current reporting period, with the exception of samples in bores MW1D and MW2B, which have exhibited variations in line with sodium and electrical conductivity measurements.

Sulphate Ion (mg/L)

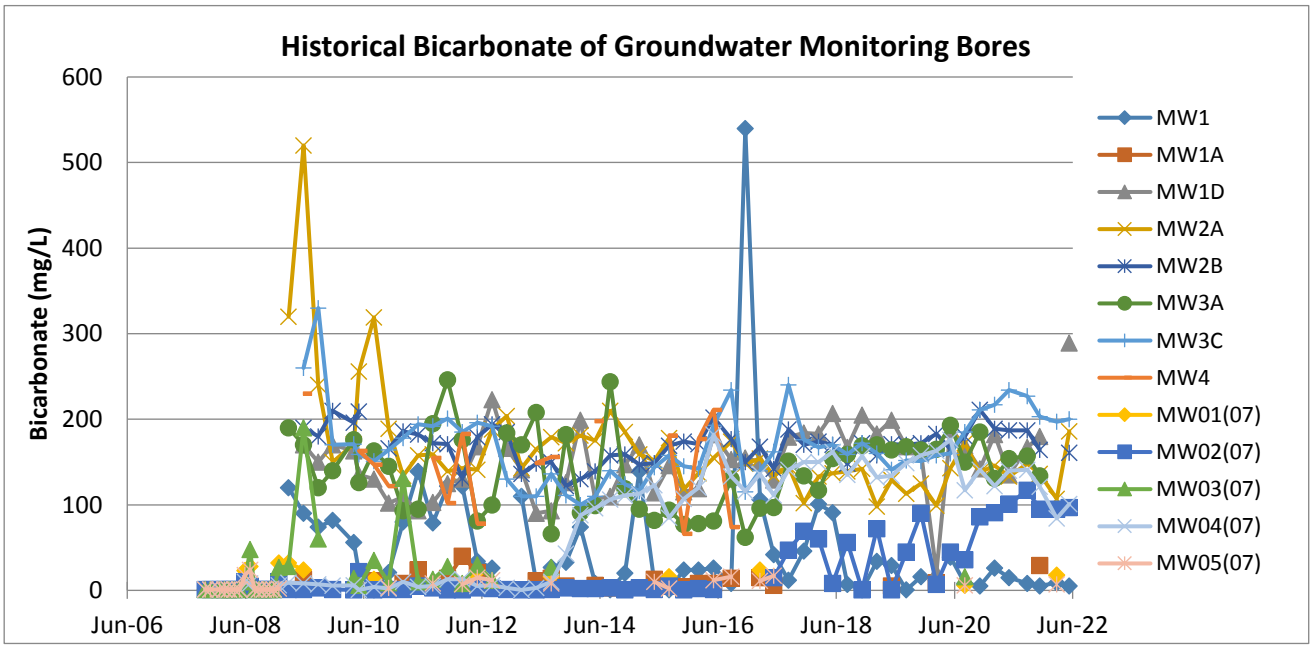
BORE HOLE	2021/22 Reporting Period			Historical Results			DC Objectives	EA Predictions
	Min	Ave	Max	Min	Ave	Max		
MW1	557	596	643	4	286	600	< 250	N/A
MW1A	5	5	5	0.5	12	48	< 250	N/A
MW1D	241	267	283	5	93	800	< 250	N/A
MW2A	15	17	19	1	16	110	< 250	N/A
MW2B	182	232	273	8	71	660	< 250	N/A
MW3A	22	24	25	0.5	48	990	< 250	N/A
MW3C	158	254	305	19	100	940	< 250	N/A
MW4	Bore damaged			2	15	36	< 250	N/A
MW01(07)	45	45	45	1	23	390	< 250	N/A
MW02(07)	55	89	122	0.5	50	347	< 250	N/A
MW03(07)	Insufficient water for sample			2	19	170	< 250	N/A
MW04(07)	55	90	121	0.5	38	138	< 250	N/A
MW05(07)	9	9	9	1	15	42	< 250	N/A



The concentration of sulphate in all groundwater bores were within DC objectives with the exception of MW1, MW1D, MW2B, and MW3C. With the exception of MW1, all results were within the historical ranges for the respective bores, while MW1 has continued to follow the trend of other major ions. Other bores have continued to show considerable variability in the current reporting period, which is likely related to rainfall infiltration to the groundwater table that has seen lower levels in recent years.

Bicarbonate Ion (mg/L)

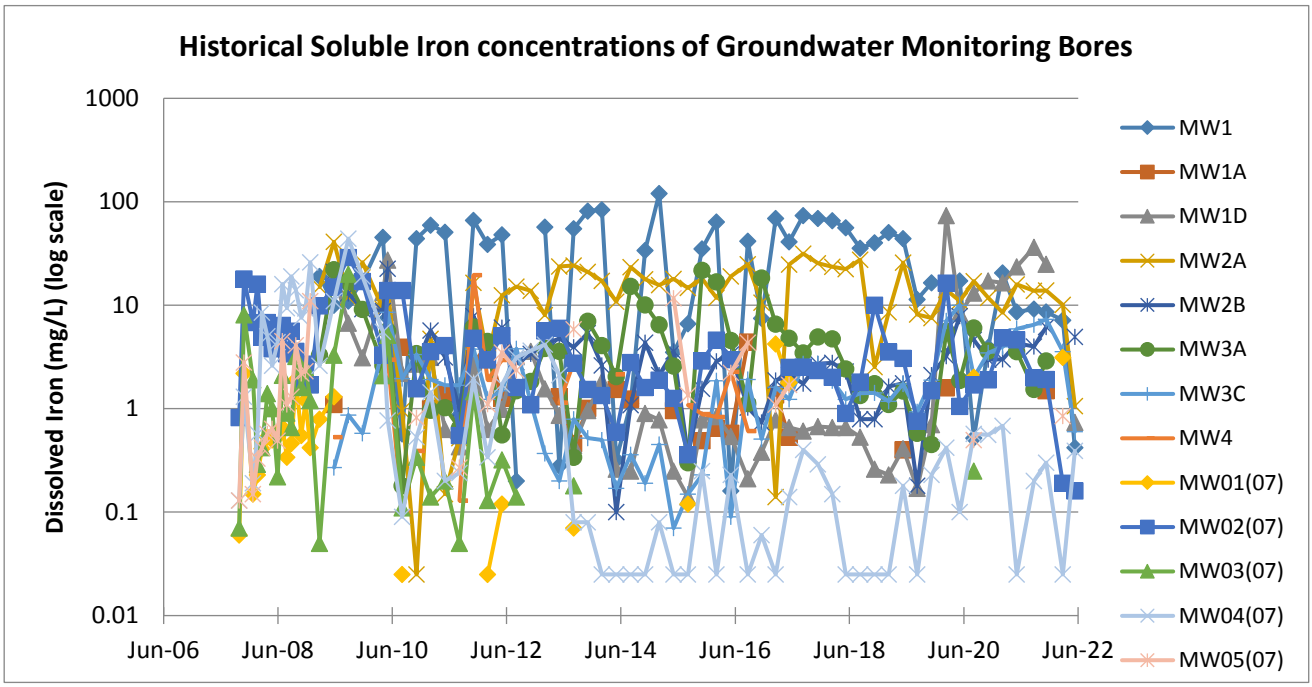
BORE HOLE	2021/22 Reporting Period			Historical Results			DC Objectives	EA Predictions
	Min	Ave	Max	Min	Ave	Max		
MW1	5	7	9	<1	56	540	< 750	N/A
MW1A	29	29	29	3	12	40	< 750	N/A
MW1D	167	212	289	21	148	223	< 750	N/A
MW2A	107	144	186	98	169	520	< 750	N/A
MW2B	161	171	187	122	170	211	< 750	N/A
MW3A	134	146	157	62	140	246	< 750	N/A
MW3C	197	207	227	100	168	330	< 750	N/A
MW4	Bore damaged			66	150	230	< 750	N/A
MW01(07)	18	18	18	1	11	32	< 750	N/A
MW02(07)	95	101	117	<1	15	101	< 750	N/A
MW03(07)	Insufficient water for sample			1	24	190	< 750	N/A
MW04(07)	84	112	141	<1	65	182	< 750	N/A
MW05(07)	7	7	7	1	7	24	< 750	N/A



Bicarbonate concentrations remained below the objective level in all groundwater bores during the current reporting year. All bores have remained relatively stable, with only a single result from each of bores MW1D and MW02(07) above the historical ranges. These are within expected and historical variabilities, and as such does not reflect a deterioration in groundwater quality.

Soluble Iron Ion (mg/L)

BORE HOLE	2021/22 Reporting Period			Historical Results			DC Objectives	EA Predictions
	Min	Ave	Max	Min	Ave	Max		
MW1	0.42	6.4	9.21	0.16	34.0	120	< 6	N/A
MW1A	1.49	1.5	1.49	0.4	1.5	4.4	< 6	N/A
MW1D	0.74	20.7	36.4	0.14	5.3	73.5	< 6	N/A
MW2A	1.06	9.7	13.9	<0.05	15.0	41	< 6	N/A
MW2B	3.98	5.0	6.15	0.1	4.2	22.5	< 6	N/A
MW3A	1.54	2.2	2.9	0.18	5.2	22	< 6	N/A
MW3C	0.6	4.5	7.3	0.07	2.0	9.99	< 6	N/A
MW4	Bore damaged			0.1	2.5	19.5	< 6	N/A
MW01(07)	3.14	3.1	3.14	<0.05	0.9	4.23	< 6	N/A
MW02(07)	0.16	1.1	1.99	0.36	5.1	29	< 6	N/A
MW03(07)	Insufficient water for sample			0.05	2.0	20	< 6	N/A
MW04(07)	<0.05	0.2	0.39	<0.05	3.6	44	< 6	N/A
MW05(07)	0.85	0.9	0.85	0.13	2.5	11.7	< 6	N/A

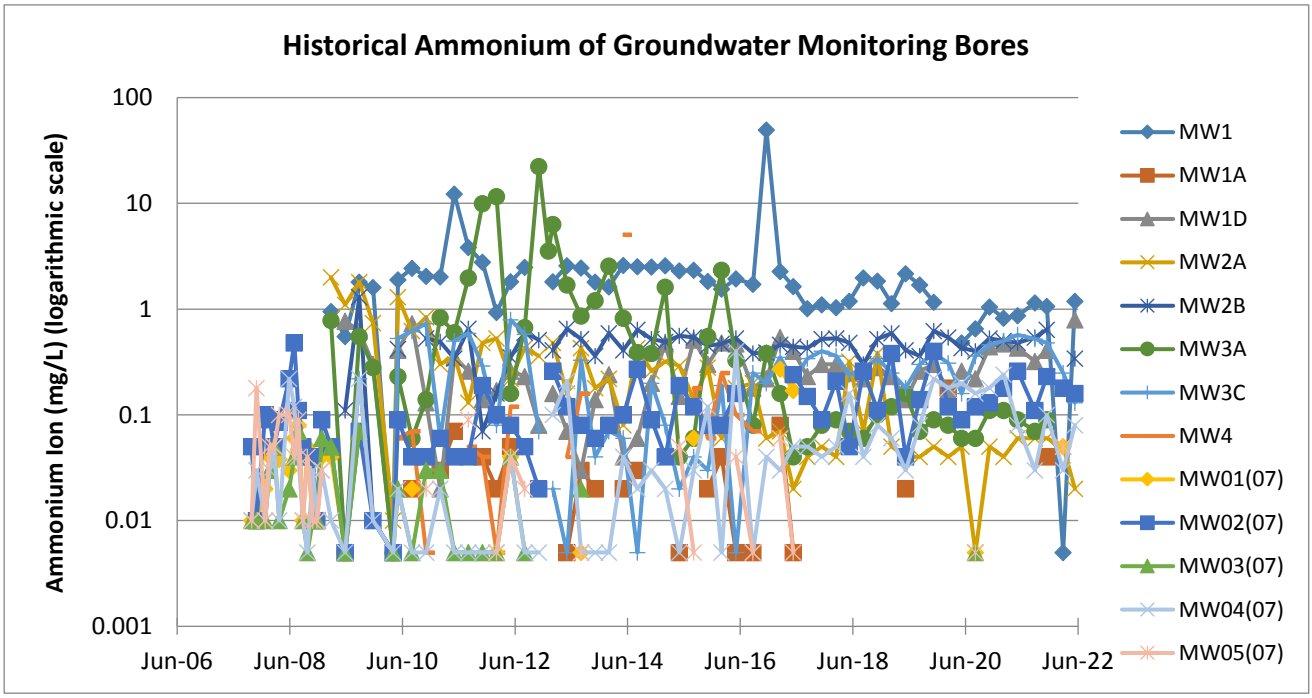


The dissolved iron concentrations were above the objective levels for several bores at times during this reporting period. This is a common phenomenon, with the graph above showing significant fluctuations throughout the historical period of monitoring for all bores. This historical trend has continued in the current reporting period. The concentrations of dissolved iron in all bores for the reporting period are within the historical range for the respective bores, which indicates no deterioration in groundwater quality as evident by soluble iron concentration across the monitoring network.

Ammonium Ion (mg/L)

BORE HOLE	2021/22 Reporting Period			Historical Results			DC Objectives	EA Predictions
	Min	Ave	Max	Min	Ave	Max		
MW1	<0.01	0.85	1.19	<0.01	2.94	49.50	< 0.02*	N/A
MW1A	0.04	0.04	0.04	<0.01	0.03	0.18	< 0.02*	N/A
MW1D	0.32	0.51	0.79	<0.01	0.28	0.77	< 0.02*	N/A
MW2A	0.02	0.05	0.06	<0.01	0.33	2.00	< 0.02*	N/A
MW2B	0.34	0.51	0.64	<0.01	0.46	1.30	< 0.02*	N/A
MW3A	0.07	0.08	0.09	<0.01	1.47	22.30	< 0.02*	N/A
MW3C	0.13	0.35	0.52	<0.01	0.26	0.79	< 0.02*	N/A
MW4	Bore damaged			<0.01	0.39	5.07	< 0.02*	N/A
MW01(07)	0.05	0.05	0.05	<0.01	0.05	0.27	< 0.02*	N/A
MW02(07)	0.11	0.17	0.23	<0.01	0.12	0.48	< 0.02*	N/A
MW03(07)	Insufficient water for sample			<0.01	0.02	0.07	< 0.02*	N/A
MW04(07)	0.03	0.06	0.10	<0.01	0.06	0.40	< 0.02*	N/A
MW05(07)	0.05	0.05	0.05	<0.01	0.04	0.18	< 0.02*	N/A

* Objective level changed from 20 mg/L to 0.02 mg/L (20µg/L) as part of Modification 1 amendment to Conditions of Consent.

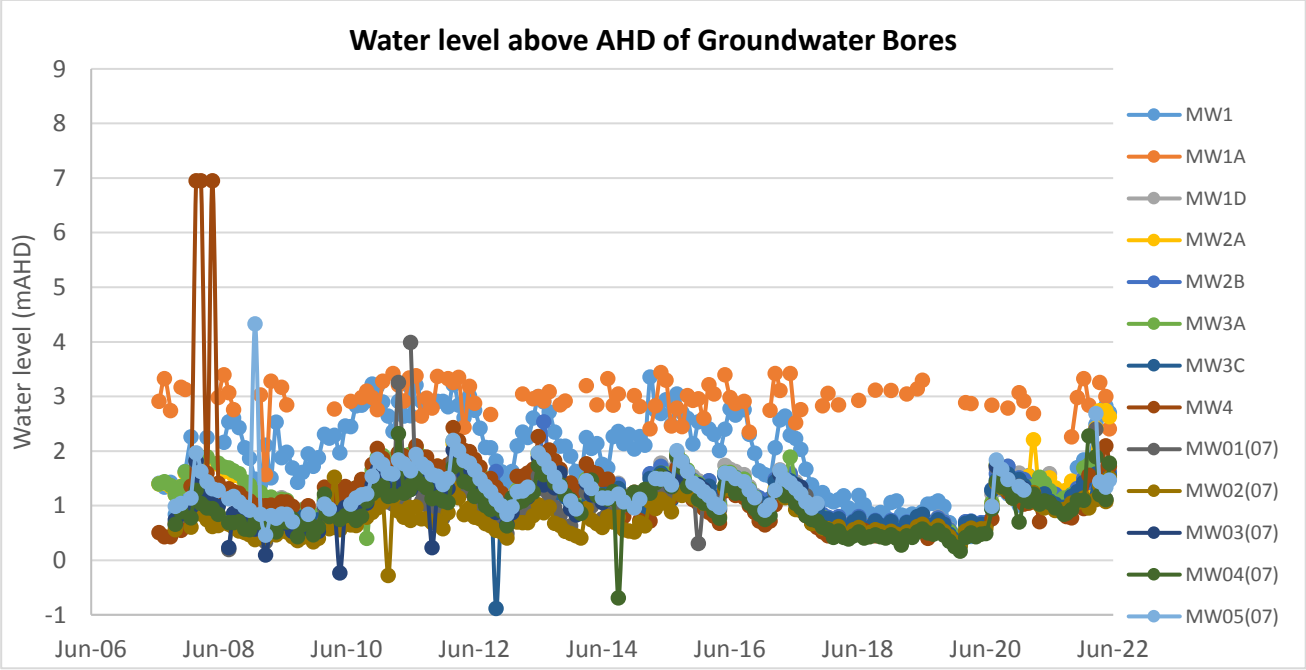


Ammonium ion concentrations were below the objective levels of the original development consent during the current reporting period, however consistently above the amended objective level which has been adopted as part of Modification 1. This change in objective level reflects the NSW Surface Water Quality Objective Level, and as such is not directly relevant to the groundwater environment. All measurements were within the historical ranges for all samples during the current reporting period with the exception of a single result for MW1D which was marginally above the historical range for this bore. This indicates that there is no deterioration in groundwater quality as a result of dredging operations.

Depth (m)

The depths of the borehole are reported as metres above the Australian Height Datum

BORE HOLE	2021/22 Reporting Period			Historical Results			DC Objectives	EA Predictions
	Min	Ave	Max	Min	Ave	Max		
MW1	1.13	1.89	2.83	0.26	1.93	3.36	N/A	N/A
MW1A	2.26	2.87	3.33	1.57	2.97	3.44	N/A	N/A
MW1D	0.97	1.38	1.73	0.35	1.23	1.83	N/A	N/A
MW2A	0.97	1.75	2.74	0.34	1.23	2.21	N/A	N/A
MW2B	1.04	1.33	1.62	0.35	1.18	2.54	N/A	N/A
MW3A	0.85	1.27	1.75	0.34	1.25	2.19	N/A	N/A
MW3C	0.95	1.27	1.58	-0.88	1.06	1.6	N/A	N/A
MW4	0.78	1.25	2.1	0.4	1.36	6.95	N/A	N/A
MW01(07)	1.12	1.57	2.4	0.2	1.08	3.99	N/A	N/A
MW02(07)	0.91	1.09	1.51	-0.28	0.75	1.52	N/A	N/A
MW03(07)	Insufficient water for sample			-0.23	1.14	2.02	N/A	N/A
MW04(07)	0.84	1.26	2.28	-0.69	0.95	2.32	N/A	N/A
MW05(07)	1.34	1.74	2.69	0.46	1.36	4.33	N/A	N/A



Groundwater levels have varied consistently with significant rainfall events during the current reporting period, increasing significantly since October - November 2021 due to the significantly above-average rainfall received during this time. While some bores have experienced greater fluctuations than others, all bores have recorded an increasing trend. These increases have come off a very low base in 2020 following an extended drought period, and reflects the significant natural variability of the local groundwater regime, suggesting climate is the predominant driver of groundwater levels within each bore across the monitoring network. All measurements were within the historical ranges for the respective bores, except for recent measurements for MW2A, which are above the historical range, consistent with many of the other bores which currently show groundwater levels near their historical maximums.

4.1.4 Groundwater Monitoring Results Interpretation

From the data gathered above as part of the groundwater monitoring program for the Gerroa Sand Resource, groundwater quality has for the most part remained relatively stable during the current reporting period. Some increases were observed in major ion concentrations in bores close to Blue Angle Creek, which is likely attributable to the effect of tidal influence from the Crooked River estuary combining with recent flushing of salts due to rainfall. This reflects the background variability of the environment, with no changes to groundwater quality as a result of dredging operations, as predicted by the Gerroa Sand Quarry Extension Environmental Assessment (2006).

Monitoring bore MW1 is connected to the Berry Siltstone aquifer, which forms the topographical high to the southwest of the project area. The Berry Siltstone aquifer is a slightly brackish water reservoir, with a relative deficiency of potassium, which is reflected in the monitoring results of MW1. Historical monitoring from this bore shows that higher salinity and major ion concentrations have been observed at various times since 1993. These records show that many of the water quality objectives in the Development Consent are not appropriate for this bore, given the inherent natural variability at the interface of the Berry Siltstone aquifer and alluvial aquifer. Nevertheless, the current monitoring program is well placed to both monitor any variations in groundwater quality over time, as well as monitoring the spatial distribution of any brackish influence in the vicinity of the dredging operation.

One of the key observations made during previous annual reviews revolved around the shortcomings of the current groundwater quality objectives and their applicability to the natural groundwater regime of the site. This is highlighted by the natural presence of iron sulphides in the local geology, which has contributed to a number of bores regularly and naturally recording pH levels below the objective range, and soluble iron concentrations above the objective level. Similarly, concentrations of nitrogen and phosphorus in the groundwater are regularly higher than the objective levels, despite no forms of these substances used or brought on to site as part of extraction activities. Nitrogen and phosphorus concentrations in the surface water of the dredge pond are typically close to or below standard laboratory reporting limits, supporting determinations that extraction activities are not contributing to the observed concentrations of these analytes in the groundwater. For these reasons, the objective levels of these analytes do not suitably reflect the natural groundwater regime, and comparison with historical results provides a far better method of detecting any adverse impacts on groundwater resources as a result of dredging and associated activities.

The current groundwater monitoring program is sufficient in monitoring for any spatial or temporal changes in the groundwater quality and quantity in the local environment. Current procedures allow for an accurate representation of any longer term trends in groundwater quality and availability. With the commencement of the dredging in the Modification 1 area planned for 2022-2023, the groundwater monitoring program will be modified to align with an updated Water Management Plan.

There were no non-compliances with conditions of the Development Consent or Environmental Protection Licence 4146 related to groundwater in the 2021-2022 reporting period.

4.3. Surface Water Management

4.3.1. Standards and Performance Measures

There are no specific requirements for surface water quality in the sites EPL other than with regard to discharges from the site, as detailed below:

Water and land

EPA Identification no.	Type of Monitoring Point	Type of Discharge Point	Location Description
1		Discharge to waters	The end of the "Overflow Pipe" from the dredge pond as labelled on the map titled "Gerroa Sand Resource" dated 7/12/11 and held on EPA file 281283A8.

The overflow pipe indicated is licenced in case of extreme wet weather in which flood water would be allowed to drain to the adjacent Foy's Swamp. To date the dredge pond water has never required use of the overflow pipe.

The surface water monitoring requirements from the DC are realised by the sites QEMP. Section 8.5 of the QEMP details the surface water testing requirements and specifies that the dredge pond and main channel require weekly water level readings and the dredge pond requires quarterly analyte testing. The EA predicted that the project is not predicted to lead to any deterioration of the water quality of the dredge pond, or the surrounding area.

The surface water quality objectives which CB should "aim to meet" from the DC (and adopted in the QEMP) are as follows:

Analyte	Units	Objective
Turbidity	NTU	5 - 20
pH	pH	6.0 – 8.5
Salinity	µS/cm	<1,500
Dissolved Oxygen	mg/L	>6
Total Phosphorus	µg/L	<30
Total Nitrogen	µg/L	<350
Chlorophyll-A	µg/L	<5
Faecal Coliforms	Median No./100 mL	<1,000
Enterococci	Median No./100 mL	<230
Algae & BGA	No. Cells/mL	<15,000
Sodium	mg/L	<400
Potassium	mg/L	<50
Magnesium	mg/L	<50
Chloride	mg/L	<300
Sulphate	mg/L	<250
Bicarbonate	mg/L	<750
Soluble Iron	mg/L	<6
Ammonium	µg/L*	<20

* amended from mg/L to µg/L as part of Modification 1

4.3.2. Environmental Performance

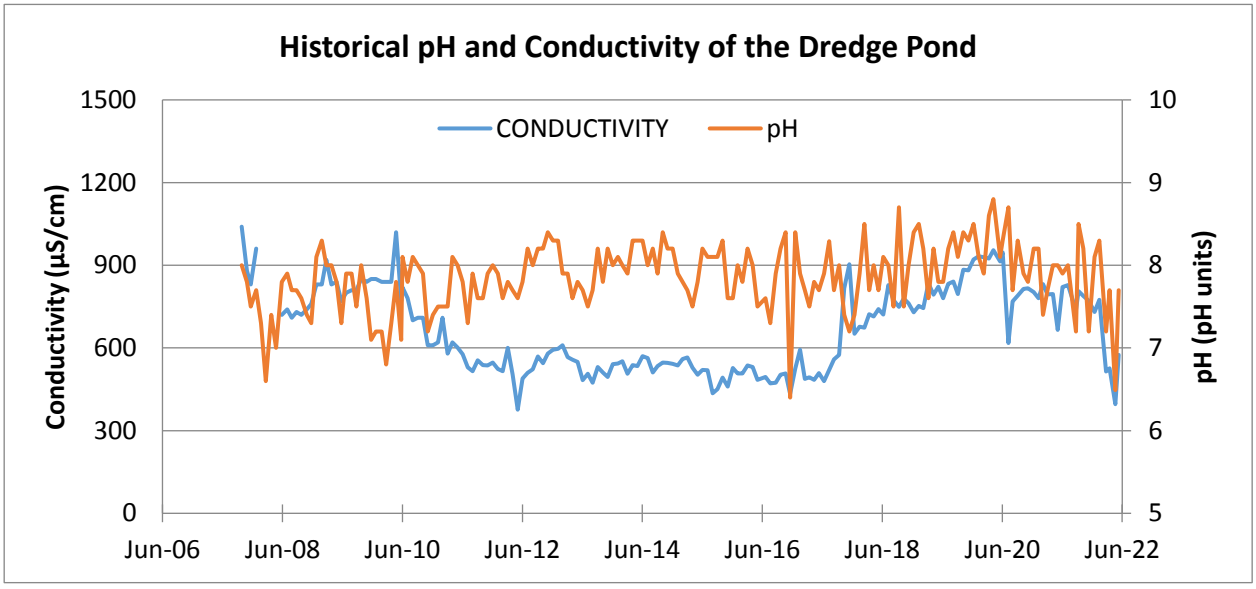
CB has implemented the Surface Water Monitoring Program and Acid Sulphate Soils Management Plan to meet the requirements of the DC. ALS Laboratory Group were engaged during the reporting period to conduct monthly sampling and testing of the water in the dredge pond for pH and Electrical Conductivity and of the leachate from sand extracted by the dredging operation for Total Oxidisable Sulphur, as well as quarterly testing of the dredge pond water for the larger suite of water quality parameters listed in Section 4.3.1 above.

4.3.3. Surface Water Monitoring

A summary of surface water monitoring results for the period is tabulated in this section, with the range and average of each analyte displayed alongside the historical range and average, objectives as described in the Development Consent, and any EA predictions. Units of reporting are listed in the table in Section 4.3.1. Graphs are also included to show trends in all analytes over the historical period of monitoring in the dredge pond. Where surface water monitoring results trend outside of the historical range or DC objectives, these are discussed after each graph.

Analyte	2021/22 Reporting Period			Historical Results			DC Objectives	EA Predictions
	Min	Ave	Max	Min	Ave	Max		
Conductivity	396	689	828	376	669	1040	< 1,500	N/A
pH	6.5	7.7	8.5	6.4	7.9	8.8	6 - 8.5	N/A
Total Algae	885	66621	220000	525	139073	2070000	< 15,000	N/A
Cyanophyta	200	61300	207000	0	110848	2070000	< 15,000	N/A
Total phosphorus	5	21	50	3	44	790	< 30	N/A
Total nitrogen	300	675	1000	40	627	6900	< 350	N/A
Chlorophyll-a	2	5	11	<1	7	49	< 5	N/A
Faecal coliforms	1	15	50	1	113	2100	< 1000	N/A
Enterococci	5	22	36	<1	42	690	< 230	N/A
Sodium	47	57	68	33	55	91	< 400	N/A
Potassium ion	4	5	6	1	5	8	< 50	N/A
Magnesium ion	12	15	19	9	14	22	< 50	N/A
Chloride	71	88	105	16	85	140	< 300	N/A
Sulphate ion	55	90	122	25	111	1300	< 250	N/A
Bicarbonate ion	85	108	136	<2	98	313	< 750	N/A
Soluble iron ion	<0.05	<0.05	0.09	<0.05	0.08	0.77	< 6	N/A
Ammonium ion	<10	50	180	<10	30	360	< 20	N/A
Turbidity	1	16	54	1	10	98	1 - 20	N/A
DO (mg/L)	2.2	5.6	8.8	4.2	8.9	11.3	> 6	N/A
DO (%)	26	59	82	52	98	125	80-110	N/A

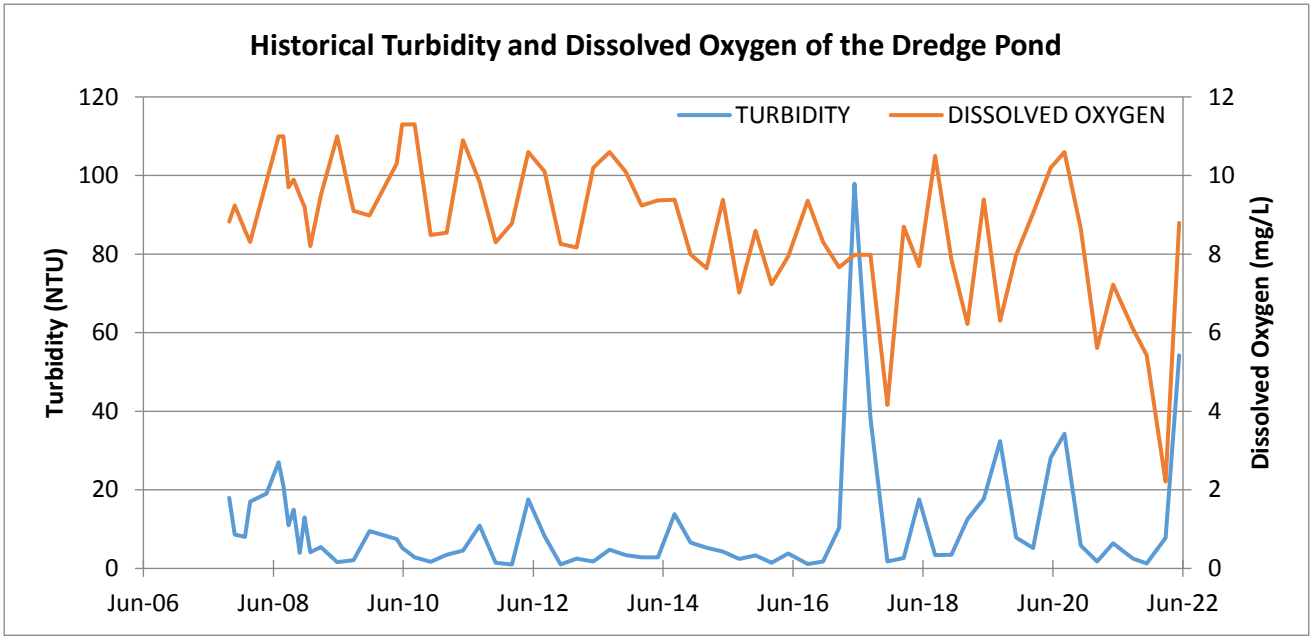
pH and Electrical Conductivity



In the current reporting period, the dredge pond pH has reduced slightly as the water level has increased, to return to levels approximating the long term average pH of the dredge pond. The lowest pH measurement of 6.5 was recorded in early May 2022 following the extensive rainfall recorded in the first half of 2022, and aligns with

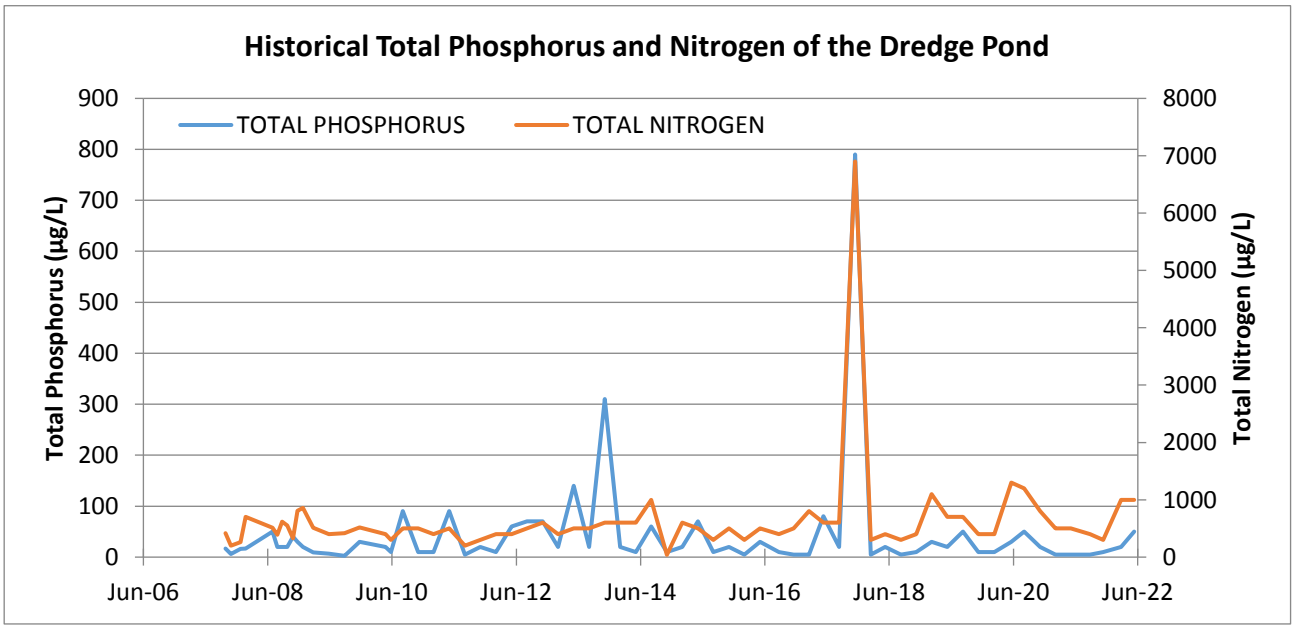
a peak in the dredge pond water level. Similarly, Electrical Conductivity has decreased significantly in response to heavy rain in the first half of 2022, with concentrations more typical of the years prior to the 2017-2020 drought event. All pH and conductivity measurements were within the surface water quality objectives and the historical ranges during the reporting period.

Turbidity and Dissolved Oxygen



Turbidity has remained within the historical range in the current reporting period, while dissolved oxygen dropped below the historical range in March 2022, before returning to typical concentrations during the June 2022 sample. Dissolved Oxygen samples earlier in the reporting period were below the percent saturation objective level, before returning to the objective level range during the most recent sample in June 2022. One sample was above the upper limit of the turbidity objective, however within the historical range of this analyte, with all other results very low (less than 10 NTU).

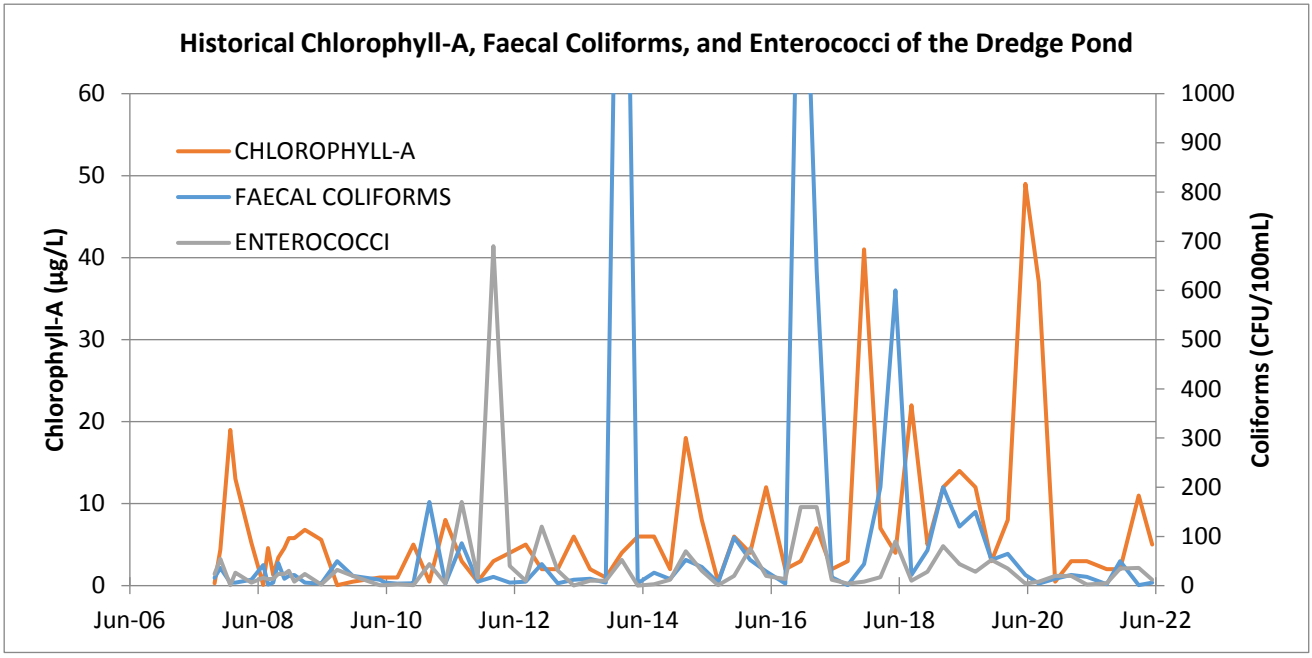
Total Phosphorus and Nitrogen



All nitrogen and phosphorus samples remained within the historical ranges for these analytes in the current reporting period, while concentrations of nitrogen and phosphorus were both above their respective objective

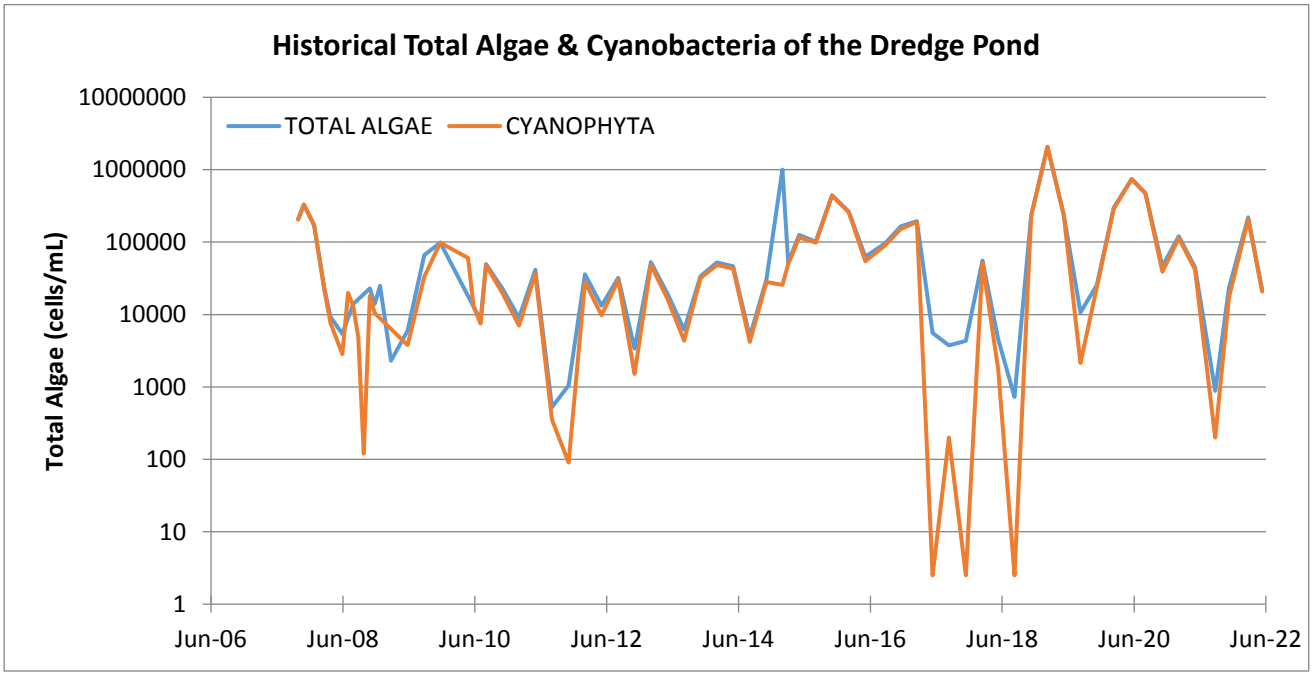
levels in the first half of 2022 with rainfall-related inflows to the dredge pond during this time. Nevertheless, concentrations of both nitrogen and phosphorus were consistent with longer term trends at all times during the reporting period. This is reflective of the agricultural land use prevalent in the district, and unrelated to dredging operations.

Chlorophyll-A, Faecal Coliforms, and Enterococci



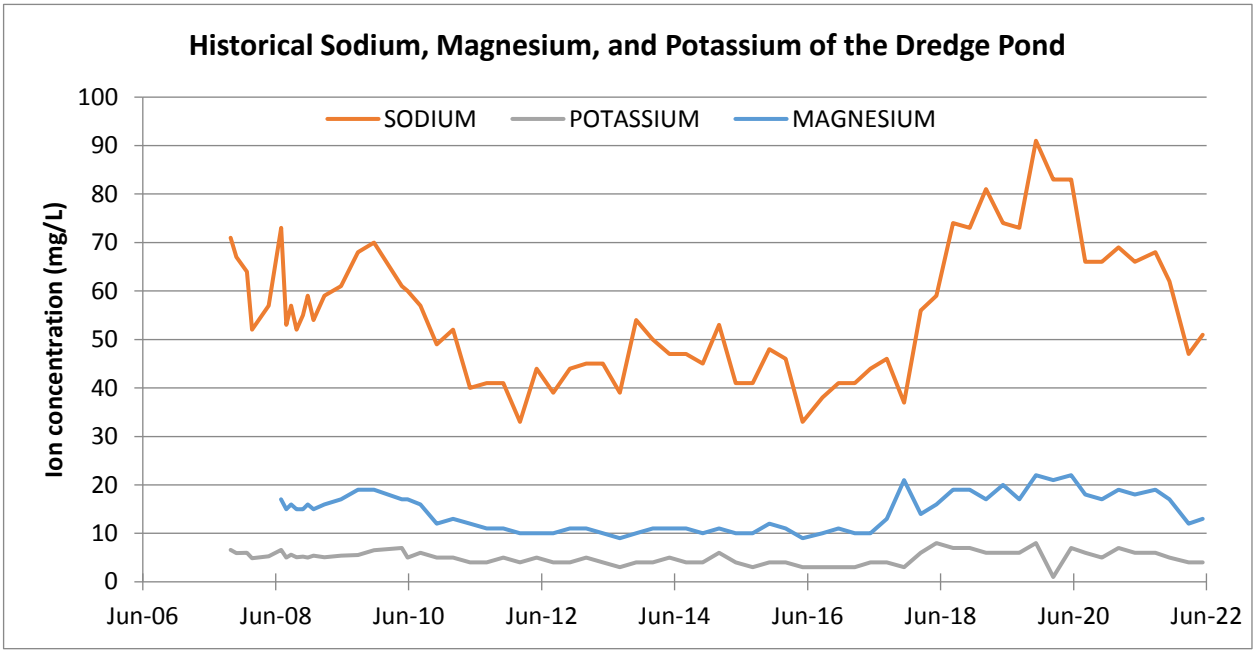
All chlorophyll-A, faecal coliform, and enterococci results were within the historical ranges and the objective levels for the respective analytes during the reporting period, and generally below historical averages.

Algae and Cyanobacteria



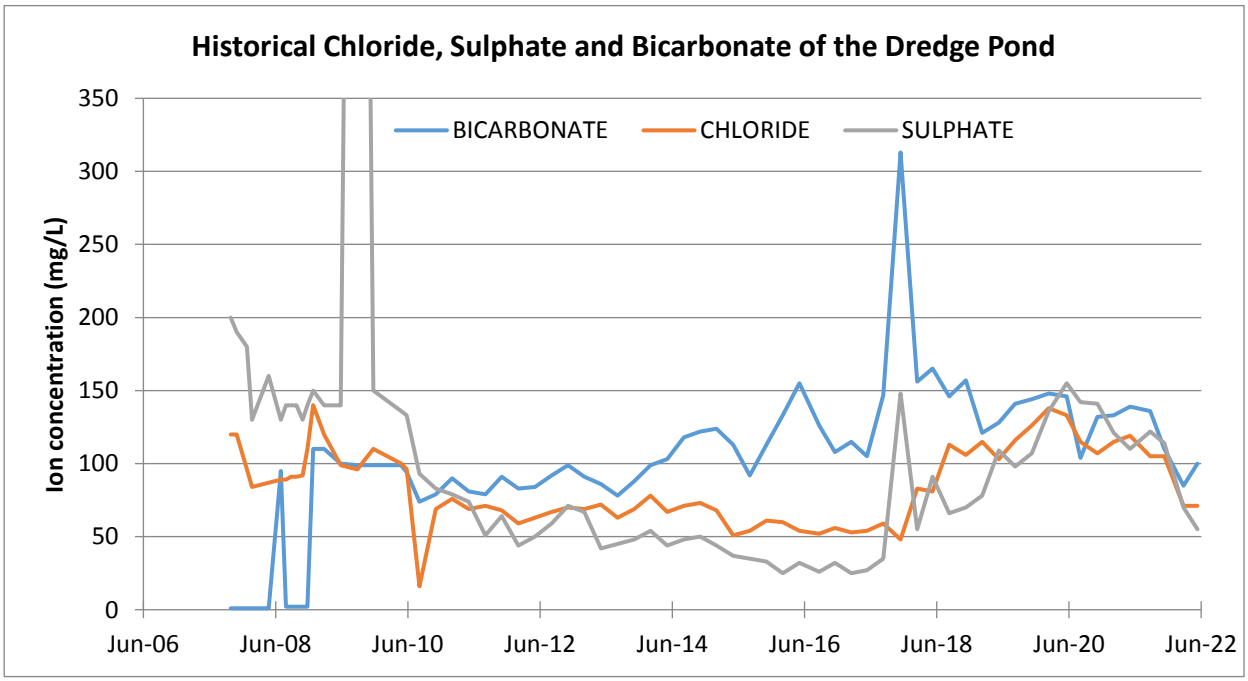
Total algae and cyanobacteria concentrations followed historical patterns, with seasonal fluctuations in concentrations of these organisms. Concentrations of both analytes were recorded above the objective levels during the year, which is consistent with historical results and does not reflect a decline in the water quality of the dredge pond.

Major Cations



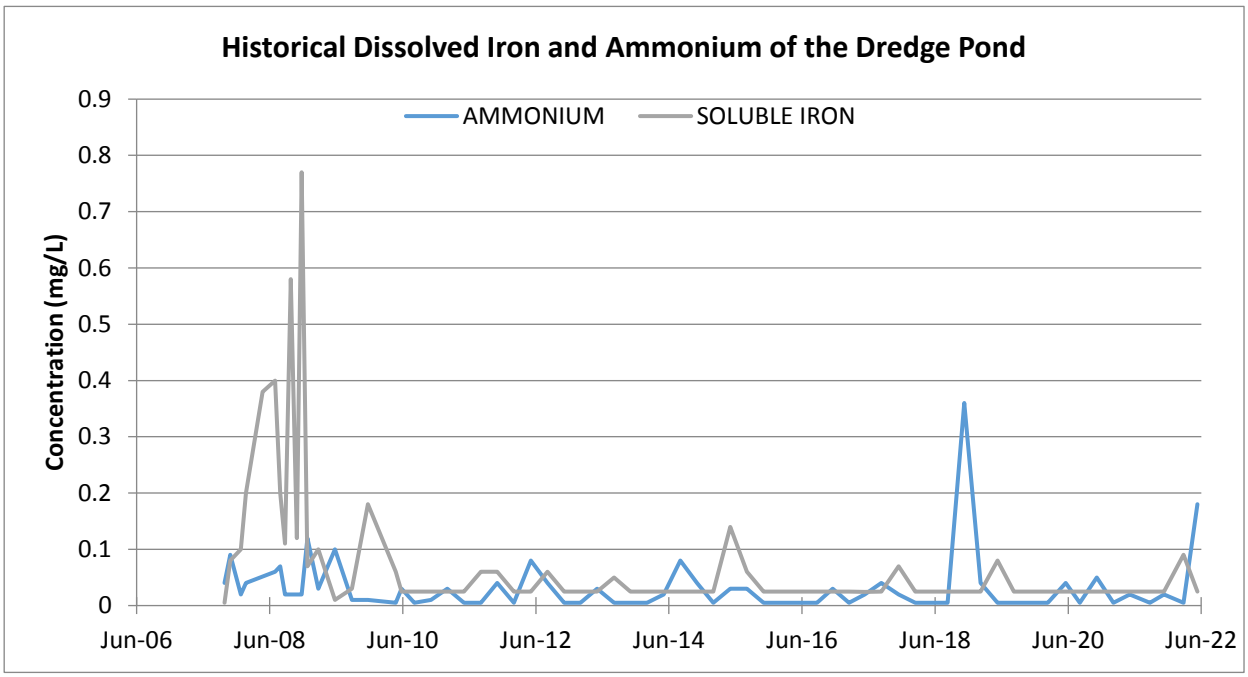
Sodium, magnesium, and potassium ion concentrations have followed the recent trends in electrical conductivity, showing an overall decline in the current reporting period in response to recent above average rainfall. All analytes remained within the objective levels and the historical ranges for the site during the reporting period.

Major Anions



Concentrations of chloride, sulphate, and bicarbonate have remained well below the objective levels during the current reporting period and are consistent with historical levels. They have shown a decreasing trend in the current reporting period consistent with the patterns shown for cations and electrical conductivity.

Soluble Iron and Ammonium



Soluble iron and ammonium ion concentrations have remained relatively stable and at low levels during the current reporting period, consistent with historical values. Concentrations of soluble iron were below the objective levels, while concentrations of ammonium were below the objective level that was current at the time of sampling, noting this objective level has reduced as part of Modification 1.

4.3.4. Surface Water Monitoring Results Interpretation

Surface water quality and water levels within the dredge pond continue to be governed by rainfall. During the current reporting period this has included a significant increase in water level in early 2022 with in excess of one metre of rain falling on the site over a two-month period. This rainfall has also led to a reduction in major ion concentration (and electrical conductivity) due to dilution, while nutrient concentrations have increased as these have been flushed into the pond. Despite the increase in nutrients, there has been no unseasonal change observed in any biological parameters, including algae, bacteria, or chlorophyll-a, all of which have remained relatively unchanged or simply followed their typical seasonal fluctuations. The sudden increase in water level following a long period of relative drought has led to a reduction in pH values, however the buffering capacity of the dredge pond has minimised this expected reduction with all pH measurements remaining within the water quality objectives for the site. Similarly, the significant inflows led to a reduction in the dissolved oxygen of the dredge pond in the March 2022 sample, with a full recovery observed by the following sampling period.

While parameters were at times outside the water quality objectives for the site, all results were within the respective historical ranges for the dredge pond, with the exception of a single dissolved oxygen concentration in the March 2022, which returned to the historical range and water quality objective in the subsequent sampling period. The dredge pond continues to represent a surface water body of excellent water quality, with no observable impacts to water quality or levels as a result of dredging.

The current surface water monitoring program is sufficient in monitoring for any changes in the water quality of the dredge pond. Current procedures allow for an accurate representation of any longer term trends in surface water quality and any potential impacts on surface and groundwater quality of the wider area. With the commencement of the dredging in the Modification 1 area planned for 2022-2023, the surface water monitoring program will be modified to align with an updated Water Management Plan.

There were no non-compliances with conditions of the Development Consent or Environmental Protection Licence 4146 related to surface water in the 2021-2022 reporting period.

4.4. Water Use

4.4.1. Standards and Performance Measures

Cleary Bros holds a Water Access Licence which permits the "take" of water from the environment for site operations. WAL43272 includes a share component of 56 units of the Metropolitan Coastal Sands Groundwater Source of the Greater Metropolitan Region Groundwater Sources Water Sharing Plan. The Gerroa Sand Resource is required to adjust site operations where appropriate to ensure it has sufficient shares to meet its take of water. For the 2021-2022 reporting year, the 56 units allowed the Gerroa Sand Resource to take up to 56 ML from the coastal sands aquifer.

4.4.2. Environmental Performance

CB takes water in three ways at the Gerroa Sand Resource:

- Water used to dredge and pump the sand as a slurry to the processing plant. This water is then returned to the dredge pond where it is reused to dredge and pump the sand slurry on subsequent days. This is recorded as the day of maximum production during the reporting period (day on which the maximum water is taken, with subsequent days reusing this water).
- Water entrained in the sand which is transported off site. This is a volume weighted measurement based on the regular measurement of the moisture concentration of the sand when delivered.
- Water used for dust suppression and watering of seedlings for revegetation. This is calculated from water truck load counts during the reporting period, based on the capacity of the water truck.

4.4.3. Water Take and Compliance Assessment

During the 2021-2022 reporting period, Cleary Bros pumped a daily maximum of 1,306t (502m^3) of sand during the period with 335kL of water used to pump this sand on this day. This volume represents the total water take associated with the dredging process during the reporting period.

Cleary Bros transported 31,291 tonnes of sand during the reporting period, at a volume-weighted average moisture of 5.6%/m^3, representing a take of 0.672 ML water from sand transported from the site.

Water cart usage during the reporting period was lower than normal due to the consistent rainfall and lower site production. 330 loads representing a total take of 3.96 ML were used for dust suppression and seedling watering during the reporting period.

Combined water take during the 2021-2022 reporting period totalled 4.97 ML, which is within the 56ML entitlement under WAL43272.

4.5. Air Quality

4.5.1. Standards and Performance Measures

There are no specific requirements for air quality in the sites EPL.

The air quality monitoring requirements from the Development Consent are realised by the sites QEMP. Section 8.4 of the QEMP details the air quality testing requirements and specifies that 3 dust gauges are to be tested on site. The contribution from site operations to annual average dust deposition must not cause additional exceedances of the following criteria at any residence on privately owned land or on more than 25% of any privately owned land:-

- 2g/m^2/month, maximum increase in deposited dust level; and
- 4g/m^2/month, maximum annual average deposited dust level.

4.5.2. Environmental Performance

CB has implemented the Air Quality Monitoring Program to meet the requirements of the DC. ALS Laboratory Group were engaged during the reporting period to service the three depositional dust gauges on a monthly basis, in line with *AS/NZS 3580.10.1-2003: Methods for Sampling and Analysis of Ambient Air – Determination of Particulates – Deposited Matter – Gravimetric Method*. In addition, Cleary Bros has sealed the first 200 metres of the site entrance and utilised a water truck when required on the unsealed sections to minimise the generation of dust from unsealed roads.

4.5.3. Air Quality Monitoring

The following table provides Total Insoluble Solids concentrations (in g/m2/month) recorded in the three dust depositional gauges at the Gerroa Sand Resource.

Dust Gauge	2021/22 Reporting Period			Historical Results		
Units: g/m^2/month	Min	Average	Max	Min	Average#	Max
1A	0.5	1.9	9.8	0.1	2.2	20.1
2A	0.2	1.0	1.9	0.1	2.1	49.7
3A	0.1	0.6	1.5	0.1	1.4	220.0
DC Criteria / EA Predictions		< 4			< 4	

4.5.4. Air Quality Monitoring Results Interpretation

The results indicate that the activities associated with the Gerroa Sand Resource are having very little effect on local dust deposition, with levels consistent with the historical performance and well below the total annual average deposition criteria. Dredging operations at the site commenced in the 1960's, well before depositional dust monitoring commenced, and as such the incremental impact of the project cannot be accurately determined. Therefore monitoring will continue to focus on measuring compliance with the total annual average deposition criteria.

The depositional dust monitoring results demonstrate that the measures to control dust generation associated with the Gerroa Sand Mine are effective in minimising any dust impacts from activities on site, and in maintaining a high standard of air quality in the local area. The air quality monitoring program currently in place is sufficient to monitor any potential impacts on air quality to surrounding receivers.

There were no non-compliances with conditions of the Development Consent or Environmental Protection Licence 4146 related to air quality in the 2021-2022 reporting period.

4.6. Noise Monitoring

4.6.1. Standards and Performance Measures

There are no specific requirements for noise monitoring in the sites EPL.

The noise monitoring requirements from the Development Consent are realised by the site's QEMP. Section 8.3 of the QEMP details the noise testing requirements and specifies that noise testing is required within 3 months of commencement of operations on the extension site. Subsequent noise monitoring will only be required if there are exceedances or a significant change to operations or machinery likely to have noise implications.

4.6.2. Environmental Performance

CB has constructed the visual and acoustic bund along the northern, eastern, and southern boundaries of the dredging operation. A preventative maintenance program is in place to ensure all equipment employed at the site are maintained in accordance with manufacturers' specifications, with no changes to equipment in operation at the site during the current reporting period. Dredging operations were restricted to the approved hours during the current reporting period.

4.6.3. Noise Monitoring

There was no requirement to conduct noise monitoring during this reporting period as there were no exceedances or any significant change to operations or machinery likely to have noise implications.

4.6.4. Noise Findings

Current strategies described above to minimise noise impacts on surrounding receivers have been effective during the current reporting year, which is supported by the continued absence of any noise related complaints related to the site.

There were no non-compliances with conditions of the Development Consent or Environmental Protection Licence 4146 related to noise in the 2021-2022 reporting period. The QEMP is currently being updated to include a Noise Management Plan that aligns with the Modification 1 Consent, and once approved, will guide noise management strategies for the 2022-2023 reporting period.

4.7. Community

4.7.1. Licence Requirement

Licence condition M4 of the site's EPL provides that Cleary Bros must keep records of all complaints received for the site including any action taken regarding the complaint.

The Development Consent has no direct requirements for complaint handling however, the QEMP dedicates chapter 7 to Complaints Management, which describes the process for recording and responding to community complaints. Furthermore, Cleary Bros held two Community Consultative Committee meetings during the reporting period in July and December 2021, with the latter including a site visit. Minutes of these meetings have been sent to the DPE and are also available on the Cleary Bros website.

4.7.2. Tabulated Results

No complaints were received in relation to the Gerroa Sand Resource in 2021/2022, which is in line with number of complaints received in previous years.

Year	Environmental Complaints
2005/2006	0
2006/2007	0
2007/2008	0
2008/2009	0
2009/2010	0*
2010/2011	0
2012/2013	0
2013/2014	0

Year	Environmental Complaints
2014/2015	0
2015/2016	0
2016/2017	0
2017/2018	0
2018/2019	0
2019/2020	0
2020/2021	0
2021/2022	0

*One complaint was reported to Cleary Bros from DoP as a letter dated 2 December 2009 relating to the extent of clearing. This was investigated and found not to be factual (refer Cleary Bros letter to DoP dated 15 December 2009).

4.7.3. Environmental Complaints Results Interpretation

The absence of any environmental complaints since 2005 reinforces the low environmental and amenity impact of the Gerroa Sand Resource and demonstrates that the site is functioning in harmony with the surrounding residents.

4.8. Rehabilitation & Vegetation Management

4.8.1. Standards and Performance Measures

There are no specific requirements for rehabilitation or vegetation management in the sites EPL.

The DC and QEMP set out long and short term requirements and objectives regarding rehabilitation and vegetation management. These objectives are included in the Landscape and Rehabilitation Management Plan. For the purposes of this AEMR only conditions required to be completed within the fourteenth year of operation will be reviewed. The fourteenth year requires routine maintenance only in all areas as required, including weed control, maintenance of fences, pest control, and the replacement of plants. The QEMP requires that Cleary Bros inspect the planting and conservation works quarterly and that a qualified ecologist monitors the entire area annually. Quarterly inspections of the plantings and the conservation works are carried out by site personnel. An ecologist from Niche Environment and Heritage carried out the fourteenth annual survey in June 2022 and it is attached as Annexure C.

4.8.2. Summary of Quarterly Inspections and Key Works

Quarterly inspections were carried out for September 2021, December 2021, March 2022 and June 2022.

Primary planting has been completed for all areas of revegetation, with infill planting and maintenance of these areas continuing in the current reporting period. In the current reporting period, approximately 1,030 tubestock and advanced plantings were planted in Zones 2C.1, 2C.2, and 2D during the previous year. The main species planted included *Casuarina*, *Banksia*, *Acacia* and *Pittosporum* species. Almost all plantings were undertaken during the second half of 2021, with the significantly above average rainfall in early 2022 prohibiting any further plantings over the last 6 months due to flooded ground or inaccessibilty. This has resulted in a significant increase in stock held within the onsite greenhouse, with approximately 1800 plants presently held and ready to plant once conditions permit. The greenhouse has been a valuable addition to the site, allowing Cleary Bros to source plants as they become available, and then plant them during optimum site conditions.

Approximate numbers of plants installed in various zones in FY22 as well as current stock in the greenhouse awaiting planting are summarised in the table below.

Species	2C.1	2C.2	2D	Greenhouse
Acacia implexa	50			
Angophora floribunda				100
Banksia integrifolia	50	50	100	
Casuarina glauca	50	300	300	950
Eucalyptus botryoides				200
Eucalyptus pillularis				100
Eucalyptus robusta			10	240
Ficus macrophylla	10			
Livistona australis	5	5		
Lomandra longifolia				12
Melaleuca stypheloides				240
Pittosporum revolutum	50	50		50

Figure 3 – Greenhouse in early June 2022 with seedlings ready for planting

The batters of the dredge pond foreshore are stable on both the east and west sides with minimal erosion evident. The sections of the batter that were planted in earlier years have established very well with significant growth and cover now evident. Redundant tree guards were removed from established trees in some of the planting areas in the year, with further tree guards to be removed in the coming year as they are no longer required on established trees.

In addition to supporting the growth of existing plantings on site, considerable weed control has been undertaken in the current reporting period in response to the improved growing conditions, with both native and non-native species showing considerable growth. The main weeds targeted included the ongoing suppression of lantana, and to a lesser extent the control of Bitou Bush, Cassia, and Tobacco Bush. Additional weed control was undertaken to support plantings using either herbicide or mechanical removal (mowing) of grasses. Approximately 194 hours of targeted weed control was undertaken across the management areas during the

reporting period, with efforts concentrated in the first half the reporting period (H2 2021) due to the prolific growth of all vegetation on site, and with reduced access due to localised flooding and poor ground conditions throughout the first half of 2022.

4.8.3. Success of the Northern Corridor

The flora and fauna surveys over the first six years of this project, that is since the habitat establishment began in the Northern Corridor, found that the indigenous biota that inhabits and that traverses the corridor is equal to or greater than that recorded in the East-West Link. The successful establishment of the Northern Corridor has been described extensively in previous reports.

4.8.4. Findings and Recommendations from Annual Inspection

The fourteenth annual report included an inspection of each zone where practicable (noting some zones were inaccessible due to flooding), principally focusing on any areas for improvement where vegetation management efforts should be directed in the following year. The report stated the following general comments around the overall progress of the rehabilitation program and current priorities:

> *Overall, the revegetation works completed throughout the Site are in good condition with evidence of continued plant growth and natural regeneration occurring.*
>
> *Given the wetter weather conditions experienced in 2021/2022, some zones have been largely inaccessible and have subsequently become inundated with weed species. Some plantings were also impacted by the recent floodings and will need to be replaced, the most severely impacted being zone 2C.2. Management of these zones should be undertaken immediately as access becomes available again.*
>
> *Continued targeting of priority weed species across the southern and eastern extent of the Site in conjunction with ongoing maintenance of planting areas will continue to improve canopy connectivity across the Site. Whilst mature native species continue to flower and fruit, ongoing revegetation will continue to increase the proportion of native flora species until new plantings become self-sustaining in years to come.*

Management activities to be undertaken in the 2022-23 period will be in accordance with the recommendations in the fourteenth annual report. This will include maintenance of existing younger plantings, with a focus on plantings in those areas affected by flooding, and weed control focusing on localised control of Tobacco Bush, Lantana and Senna, with other highlighted weeds targeted in specific areas. In addition, site efforts will focus on planting the backlog of seedlings currently held in the site greenhouse.

4.9. Acid Sulphate Monitoring

4.9.1. Standards and Performance Measures

There are no requirements for acid sulphate soils monitoring in the sites EPL.

The DC for the site requires an Acid Sulphate Management Plan to be prepared. This plan has been prepared and is included in the sites QEMP, which requires regular sampling and testing of the sand, stockpile leachate, and dredge pond water for analytes including pH, total oxidisable sulphur and other analytes to assess the site-specific risk of acid sulphate soils. Where an elevated risk is identified, further controls are required to be executed to minimise the risk of increased acidity developing in the dredge pond, and its effects on the local environment.

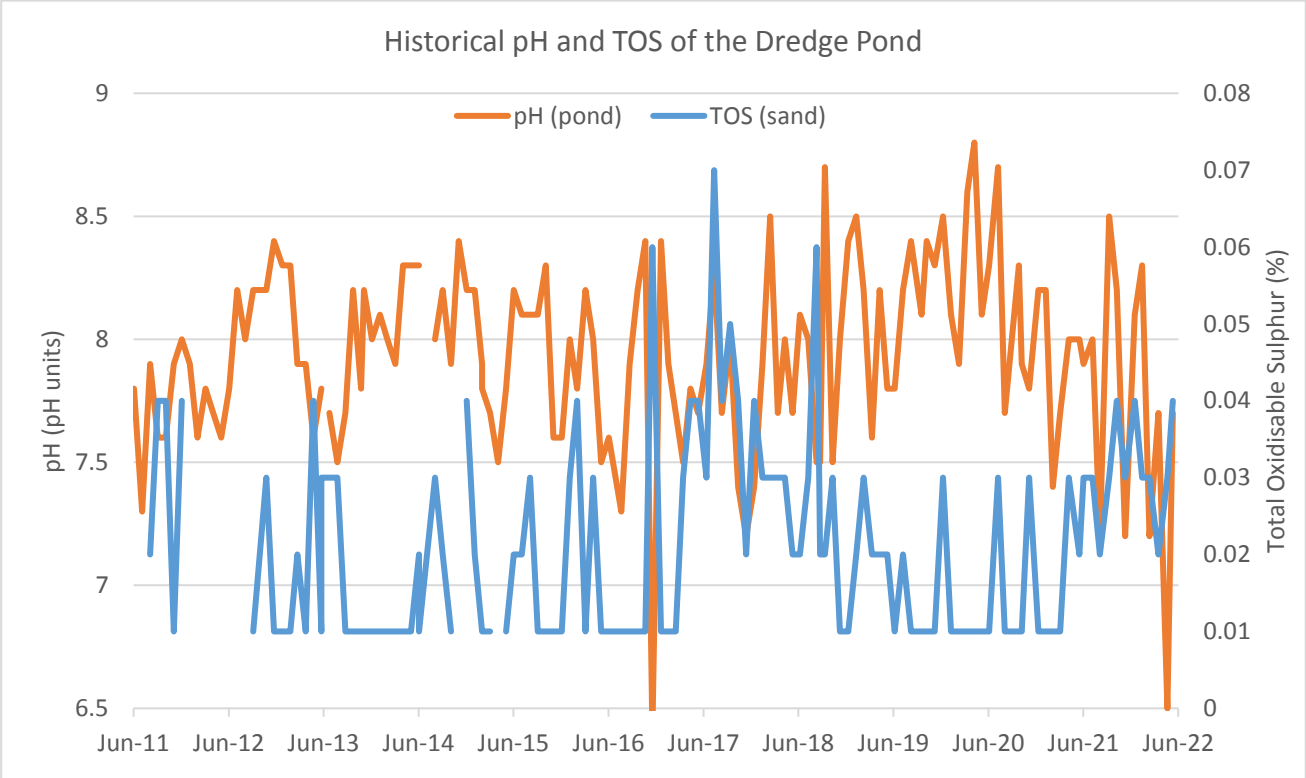
4.9.2. Environmental Performance

Stockpiles were examined regularly during the reporting period, and where leachate was present, pH was sampled. Water sampling of the dredge pond water was also undertaken on a monthly basis, as described in Section 4.3. Sampling of stockpiles was also undertaken for pH and the concentration of total oxidisable sulphur in the washed sand. The sand stockpiles are oriented to ensure runoff was towards the dredge pond and the sand also tested to ensure it could be used in concrete manufacture.

4.9.3. Acid Sulphate Monitoring

Progressive pH testing has not yet found any results outside the desired range of 6.5 – 9 pH units in the current reporting period. During the year, the constituency of the sand has had some minor variability, as dredging continues through areas previously dredged, however all testing of total oxidisable sulphur (TOS) returned low levels with a maximum of 0.04 recorded. A summary of the results of TOS of the extracted sand and pH of the dredge pond water is shown in the table below, with a graphical representation of historical trends also shown.

Parameter	2021/22 Reporting Period			Historical Results		
	Min	Average	Max	Min	Average	Max
pH (pH units)	6.5	7.7	8.5	6.4	8.0	8.8
TOS (%)	<0.02	0.03	0.04	<0.02	0.02	0.07
DC Criteria	N/A					
EA Predictions	N/A					



4.9.4. Acid Sulphate Monitoring Results Interpretation

As detailed above, testing indicates that the sand extracted for the period could not be considered an acid sulphate soil, with all results generally low and within the historical range.

Current strategies described above to minimise the risk of adverse impacts from acid sulphate soils have been effective during the current reporting year, which is supported by the stable water and soil quality of the site.

There were no non-compliances with conditions of the Development Consent or Environmental Protection Licence 4146 related to acid sulphate soils in the 2021-2022 reporting period.

4.10. General Environmental Management & Reporting

4.10.1. Licence Requirements

The EPL has various conditions regarding general environmental performance including reporting requirements for complaints, environmental harm and lodgement of an annual return.

The DC includes various environmental management and reporting procedural requirements that are implemented in the sites QEMP. The conditions that required attention beyond implementation into the QEMP are assessed below.

4.10.2. Performance Criteria and Compliance Assessment

Cleary Bros employs an authorised Environmental Officer to manage all compliance activities at the site, in association with the Quarry Manager.

4.11. Traffic Management

4.11.1. Licence Requirements

The DC requires Cleary Bros to ensure that no truck associated with the project uses Gerroa Road, except where the destination lies along or adjacent to that road.

4.11.2. Compliance Assessment

Cleary Bros Site Induction and Work Instructions for the site indicates which roads are to be used when entering and exiting the site and further prohibits incidental use of Gerroa road. Staff are trained in these Work Instructions regularly.

4.12. Independent Environmental Audit

4.12.1. Licence Requirements

The DC requires Cleary Bros to commission and carry out an Independent Environmental Audit within 12 months of the commencement of the Project and every three years thereafter.

4.12.2. Compliance Assessment

Cleary Bros commissioned ERM to carry out the fourth Independent Environmental Audit in November 2019. No “high” or “medium” non-compliances with the Site’s Environmental Protection Licence or Development Consent were identified in the audit. A copy of the audit was sent to the EPA, Kiama Council, Shoalhaven Council and the CCC members. A copy of the audit was also posted on Cleary Bros web site.

The below table summarises the progress of the corrective actions undertaken to address the non-conformances identified in the 2019 Independent Environmental Audit. The next audit is scheduled for later in 2022.

Condition Number	Auditor Comment	Auditor Recommendation	Progress of Corrective Actions
Sch 2 Cond 1	Site management advised ERM that waste drums are being squashed with a front-end loader and recycled with scrap metal. Crushing used drums which have not been triple rinsed may resulting minor quantities of waste oil products being released to ground.	The practice of crushing drums on un-sealed ground should be ceased.	Completed - Oil drums will be removed from site once empty, and as such will no longer be crushed on site.
Sch 2 Cond 6	The annual production volumes records presented by management are summarized below: • FY2017 - 80,020 t • FY2018 - 49,128 t • FY2019 - 55,790 t The exceedance for the FY2017 period was reported to the Department and a caution was Issued in relation to this matter.	ERM reviewed the letter from CB to the Department in relation to the production exceedance which outlined plans for the Environmental Officer to undertake monthly cumulative production quantity monitoring.	Completed - Corrective action in relation to this notified event has been completed. No further action proposed.
Sch 2 Cond 8	During the site visit, ERM observed a drum suspended above a pump which appeared to	ERM recommends that this drum be replaced.	Completed - Drum replaced with

Condition Number	Auditor Comment	Auditor Recommendation	Progress of Corrective Actions
	be in use for oil storage. The drum appeared to be corroded, which suggests there is an increased likelihood of failure.		appropriate storage vessel
Sch 3 Cond 11(d)	ERM understands that CB are not currently undertaking any hydraulic conductivity testing required by Section 6.5 of the QEMP. Site management advised ERM that the original objective or this design feature was to prevent low hydraulic conductivity material from being imported and placed on site, altering the conditions which were present prior to dredging. The site is currently only emplacing processing returns from the wash-plant screening process which has a high hydraulic conductivity. Given that no imported material is being emplaced at the site and the hydraulic conductivity would be expected to be similar to the surrounding material, this non-conformance is considered minor in nature.	ERM recommends CB review the QEMP and revise the plan in consultation with the Department to allow emplacement of processing returns without hydraulic conductivity testing.	Completed - QEMP updated with proposed procedure and submitted to DPIE for approval. Hydraulic conductivity of emplaced material has been tested and is consistent with reference site.
Sch 3 Cond 16	ERM has reviewed correspondence from CB to the Department and the proposed Planning Agreement document. Management advised that the Department have not yet responded and therefore no agreement has been formally entered into, therefore this requirement has not been formally met.	No action required while awaiting response from the Department.	In progress - CB has followed up with the Department and the VPA is currently in the process of being finalised.

5. Conclusion

The primary issue identified in this AEMR is the continuing departure of surface and ground water quality from the objective levels listed in the DC. However monitoring undertaken in the current reporting period demonstrates that the water quality is generally consistent with historical levels, with no deterioration in groundwater or surface water quality related to dredging operations.

Site conditions during the current reporting period were characterised by a significant increase in water availability associated with the well-above average rainfall recorded on the site, coming off an extended drought from 2017-2020. This has seen improvements in surface water and groundwater quality and availability, as well as the prolific growth of both native and non-native species in the rehabilitation areas. The ongoing rainfall has hampered maintenance of the conservation areas, with some minor damage due to flooding, and reduced access to many areas in 2022 reducing weed management opportunities. Groundwater levels have generally returned to traditional levels across the monitoring network, while groundwater quality has been relatively unchanged. With the improved soil moisture conditions, dust deposition has remained at very low levels.

Generally the site is performing well within the individual criteria and limits assigned to it in regard to environmental performance. There have been no non-compliances with the DC and no community complaints in the reporting period, with the site continuing to have no unexpected impacts on the local environment.

Annexure A

Return to Department of Regional NSW 2020/2021

Extractive Materials Return 2020-2021

NSW GOVERNMENT | Regional NSW

Form S1 – Period Ending 30 June 2021

Quote RIMS ID in all correspondence

Quarry Id: 4507 Rims ID: 400491 Operators Name: CLEARY BROS (BOMBO) PTY LTD Address: PO BOX 210 PORT KEMBLA NSW 2505 Email: Quarry Name: GERROA SAND RESOURCE Quarry Address: CNR BEACH RD & CROOKED RIVER RD	**Inquiries** please telephone: (02) 4063 6713 **Completed or Nil Returns** Email – mineral.royalty@planning.nsw.gov.au Postal Address (see below) ***Please amend name, postal address and location of mine or quarry if incorrect or incomplete.***

The return should be completed and forwarded to **Senior Advisory Officer, RESOURCE ECONOMICS, STRATEGY, PERFORMANCE & INDUSTRY DEVELOPMENT, DEPARTMENT OF REGIONAL NSW, PO BOX 344 HUNTER REGION MAIL CENTRE NSW 2310 on or before 31 October 2021**. If completion of the return is unavoidably delayed, an application for extension of time should be requested **before** the due date. If no work was done during the year, a **NIL** return must be forwarded.

The return should relate to the **above quarrying establishment** and should cover the operations of quarrying and treatment (such as crushing, screening, washing etc.) carried out at or near the quarry. A return is required even if the operations are solely of a developmental nature and whether the area being worked is held under a mining title or otherwise.

Director, Resources Policy

Please complete all the following information to assist in identifying the location of the Quarry

Typical Geology: Sand

Nearest Town to Quarry: Gerroa

Local Council Name: Kiama Municipal Council, Shoalhaven Regional Council

Deposited Plan and Lot Number/s of Quarry: Lot A DP185785, Lot 2 DP1111012

Email Address of Operator:

Name of Owner or Licensee: Cleary Bros (Bombo) Pty Ltd

Postal Address of Licensee: PO Box 210, Port Kembla NSW 2505

Licence/Lease Number/s (if any)

From Mining, Exploration & Geoscience (NSW Mineral Resources): N/A

From Crown Lands or other NSW Department: N/A

If any output was obtained from land NOT held under licence from the above Departments, state the Name/s and Address/es of the Owners of the land: Bridon Pty Ltd, PO Box 210, Port Kembla NSW 2505

To the best of my knowledge, information entered in this return is correct and no blank spaces left where figures should have been inserted.

- **SIGNATURE of PROPRIETOR or MANAGER** _____ **DATE: 14/9/2021**
- **CONTACT PERSON for this return:**
- **NAME** (Block letters): **Telephone**

Regional NSW | 1

Extractive Materials Return 2020-2021

NSW GOVERNMENT | Regional NSW

Form S1 – Period Ending 30 June 2021

Sales During 2020-2021

Production information may be published in aggregated form for statistical reporting. However, production data for individual operations is kept strictly confidential.

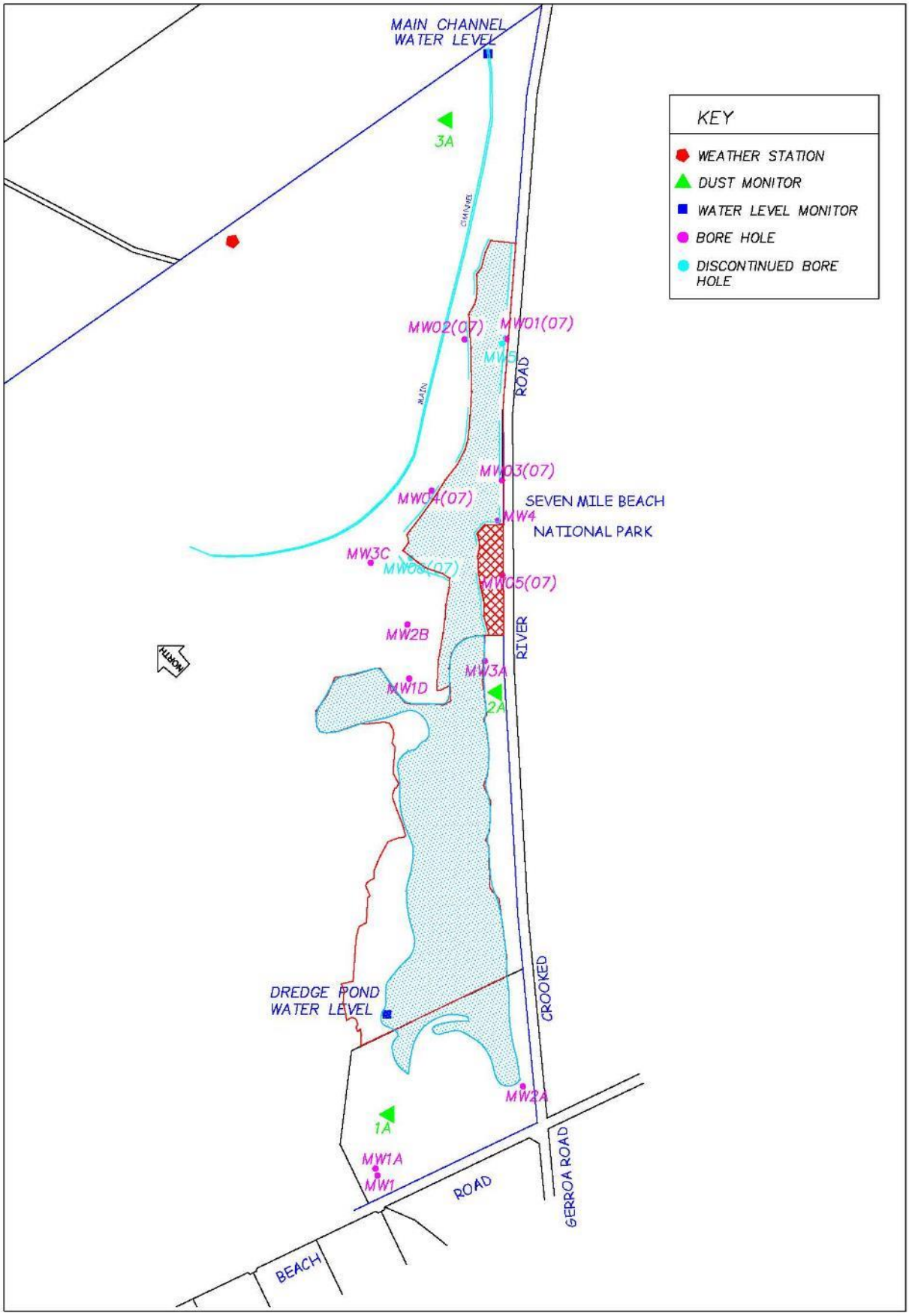
Product	Description	Quantity Tonnes
Virgin Materials		
Crushed Coarse Aggregates		
Over 75mm		-
Over 30mm to 75mm		-
5mm to 30mm		-
Under 5mm		-
Natural Sand		-
Manufactured Sand		-
Prepared Road Base & Sub Base		-
Other Unprocessed Materials		-
Recycled Materials		
Crushed Coarse Aggregates		
Over 75mm		-
Over 30mm to 75mm		-
5mm to 30mm		-
Under 5mm		-
Natural Sand		-
Manufactured Sand		-
Prepared Road Base & Sub Base		-
Other Unprocessed Materials		-
River Gravel		
Over 30mm		-
5mm to 30mm		-
Under 5mm		-
Construction Sand	Excluding Industrial	**43,155**
Industrial Sand		
Foundry, Moulding		-
Glass		-
Other (Specify)		-
Dimension Stone	Building, Ornamental, Monumental	
Quarried in Blocks		-
Quarried in Slabs		-
Decorative Aggregate	Including Terrazzo	-
Loam	Soil for Topdressing, Garden soil, Horticultural purposes)	-
TOTAL SITE PRODUCTION		**43,155**
Gross Value ($) of all Sales		
Type of Material	**Sand**	
Number of Full-Time Equivalent (FTE) Employees	**Employees: 2**	**Contractors:3**

Please Note: A return for clay-based products can be obtained by contacting the inquiry number.

Regional NSW | 2

Annexure B

Environmental Monitoring Locations



Annexure B – Environmental Monitoring Locations

Annexure C

2021/22 Environmental Monitoring Results

Groundwater Monitoring Results

	pH (pH units)				EC (µS/cm)				Total Phosphorus (µg/L)				Total Nitrogen (µg/L)			
	Sep-21	Dec-21	Mar-22	Jun-22	Sep-21	Dec-21	Mar-22	Jun-22	Sep-21	Dec-21	Mar-22	Jun-22	Sep-21	Dec-21	Mar-22	Jun-22
MW1	5.2	5.1	5.3	5.5	6960	5170	3340	6940	300	80	20	80	3400	2200	1400	1900
MW1A	dry	6.3	insufficent sample	6.8	insufficent sample	196	insufficent sample	248	dry	140	insufficent sample	insufficent sample	dry	1800	insufficent sample	insufficent sample
MW1D	6.4	6.5	access flooded	7.2	988	1280	access flooded	1480	120	40	access flooded	120	1300	900	access flooded	1600
MW2A	6.8	7	6.3	7.4	483	580	655	665	140	60	60	200	600	200	400	400
MW2B	6.6	6.7	access flooded	7	1050	1290	access flooded	1200	120	40	access flooded	100	1000	900	access flooded	2000
MW3A	6.8	6.9	access flooded	access flooded	574	614	access flooded	access flooded	190	90	access flooded	access flooded	1100	1100	access flooded	access flooded
MW3C	6.7	6.7	6.9	7.4	1200	1320	957	1280	110	50	70	140	1000	800	1000	800
MW4	dry	dry	damaged	damaged	dry	dry	damaged	damaged	dry	dry	damaged	damaged	dry	dry	damaged	damaged
MW01(07)	dry	dry	5.9	dry	dry	dry	190	dry	dry	dry	170	dry	dry	dry	1100	dry
MW02(07)	6.8	6.5	7	7.3	644	739	562	610	240	220	450	170	1700	1900	3700	1600
MW03(07)	dry	dry	insufficent sample	dry	dry	dry	insufficent sample	dry	dry	dry	insufficent sample	dry	dry	dry	insufficent sample	dry
MW04(07)	6.7	6.7	7.3	7.5	722	805	516	570	890	90	70	180	1000	400	600	500
MW05(07)	dry	dry	6.3	insufficent sample	dry	dry	301	insufficent sample	dry	dry	100	insufficent sample	dry	dry	1300	insufficent sample

	Sodium (mg/L)				Potassium (mg/L)				Magnesium (mg/L)				Chloride (mg/L)			
	Sep-21	Dec-21	Mar-22	Jun-22	Sep-21	Dec-21	Mar-22	Jun-22	Sep-21	Dec-21	Mar-22	Jun-22	Sep-21	Dec-21	Mar-22	Jun-22
MW1	1130	1140	1160	1220	6	4	3	3	139	141	141	148	1940	2000	1740	1800
MW1A	dry	26	insufficent sample	insufficent sample	dry	4	insufficent sample	insufficent sample	dry	4	insufficent sample	insufficent sample	dry	32	insufficent sample	insufficent sample
MW1D	72	74	access flooded	106	5	5	access flooded	8	27	26	access flooded	36	122	136	access flooded	148
MW2A	38	42	50	27	2	2	2	1	8	8	10	8	70	72	76	46
MW2B	85	91	access flooded	101	4	4	access flooded	4	24	26	access flooded	23	159	198	access flooded	184
MW3A	66	57	access flooded	access flooded	2	2	access flooded	access flooded	9	8	access flooded	access flooded	108	92	access flooded	access flooded
MW3C	106	92	96	95	8	7	6	7	29	25	22	25	160	151	158	147
MW4	dry	dry	bore damaged	bore damaged	dry	dry	bore damaged	bore damaged	dry	dry	bore damaged	bore damaged	dry	dry	bore damaged	bore damaged
MW01(07)	dry	dry	28	dry	dry	dry	<1	dry	dry	dry	6	dry	dry	dry	45	dry
MW02(07)	67	63	56	60	6	6	4	5	18	16	15	14	109	104	88	93
MW03(07)	dry	dry	insufficent sample	dry	dry	dry	insufficent sample	dry	dry	dry	insufficent sample	dry	dry	dry	insufficent sample	dry
MW04(07)	66	63	48	50	7	6	4	4	19	21	13	13	104	106	71	73
MW05(07)	dry	dry	45	insufficent sample	dry	dry	2	insufficent sample	dry	dry	8	insufficent sample	dry	dry	82	insufficent sample

	Sulphate (mg/L)				Bicarbonate (mg/L)				Soluble Iron (mg/L)				Ammonium (mg/L)			
	Sep-21	Dec-21	Mar-22	Jun-22	Sep-21	Dec-21	Mar-22	Jun-22	Sep-21	Dec-21	Mar-22	Jun-22	Sep-21	Dec-21	Mar-22	Jun-22
MW1	566	557	619	643	8	5	9	5	9.21	8.64	7.14	0.42	1.15	1.06	<0.01	1.19
MW1A	dry	<10	insufficent sample	insufficent sample	dry	29	insufficent sample	insufficent sample	dry	1.49	insufficent sample	insufficent sample	dry	0.04	insufficent sample	insufficent sample
MW1D	241	283	access flooded	276	167	180	access flooded	289	36.4	25	access flooded	0.74	0.32	0.41	access flooded	0.79
MW2A	16	17	19	15	148	136	107	186	13.8	13.9	10.1	1.06	0.06	0.06	0.05	0.02
MW2B	241	273	access flooded	182	187	164	access flooded	161	3.98	6.15	access flooded	4.95	0.54	0.64	access flooded	0.34
MW3A	25	22	access flooded	access flooded	157	134	access flooded	access flooded	1.54	2.9	access flooded	access flooded	0.07	0.09	access flooded	access flooded
MW3C	305	301	158	251	227	203	197	200	6.48	7.3	3.57	0.6	0.52	0.48	0.25	0.13
MW4	dry	dry	bore damaged	bore damaged	dry	dry	bore damaged	bore damaged	dry	dry	bore damaged	bore damaged	dry	dry	bore damaged	bore damaged
MW01(07)	dry	dry	45	dry	dry	dry	18	dry	dry	dry	3.14	dry	dry	dry	0.05	dry
MW02(07)	122	92	88	55	117	95	95	97	1.99	1.92	0.19	0.16	0.11	0.23	0.18	0.16
MW03(07)	dry	dry	insufficent sample	dry	dry	dry	insufficent sample	dry	dry	dry	insufficent sample	dry	dry	dry	insufficent sample	dry
MW04(07)	121	114	70	55	141	121	84	101	0.2	0.3	<0.05	0.39	0.03	0.1	0.03	0.08
MW05(07)	dry	dry	9	insufficent sample	dry	dry	7	insufficent sample	dry	dry	0.85	insufficent sample	dry	dry	0.05	insufficent sample

	Chlorophyll-a (µg/L)				Faecal Coliforms (CFU/100mL)				Entercocci (CFU/100mL)			
	Sep-21	Dec-21	Mar-22	Jun-22	Sep-21	Dec-21	Mar-22	Jun-22	Sep-21	Dec-21	Mar-22	Jun-22
MW1	6	<1	<1	<1	<2	<2	~6	<2	<2	48	~14	<2
MW1A	dry	<2	insufficent sample	insufficent sample	dry	~8	insufficent sample	insufficent sample	dry	26	insufficent sample	insufficent sample
MW1D	<1	<2	access flooded	<1	<2	<2	access flooded	<2	<2	<2	access flooded	36
MW2A	<1	<2	<1	<1	<2	<2	~64	<2	<2	<2	~14	<2
MW2B	<1	<1	access flooded	<1	<2	<2	access flooded	<2	<2	<2	access flooded	~8
MW3A	1	<1	access flooded	access flooded	<2	<1	access flooded	access flooded	<2	<2	access flooded	access flooded
MW3C	1	<1	<1	<1	<2	<1	~16	<2	<2	<2	480	240
MW4	dry	dry	bore damaged	bore damaged	dry	dry	bore damaged	bore damaged	dry	dry	bore damaged	bore damaged
MW01(07)	dry	dry	<1	dry	dry	dry	~4	dry	dry	dry	~2	dry
MW02(07)	<1	<2	<1	<1	<2	<2	~310	<2	~2	24	~40	<2
MW03(07)	dry	dry	insufficent sample	dry	dry	dry	insufficent sample	dry	dry	dry	insufficent sample	dry
MW04(07)	<1	<1	2	<1	<2	<1	~10	<2	~6	<1	~2	<2
MW05(07)	dry	dry	2	insufficent sample	dry	dry	~8	insufficent sample	dry	dry	~2	insufficent sample

Groundwater and Surface Water Level Monitoring Results

(mAHD)	Jul-21	Aug-21	Sep-21	Oct-21	Nov-21	Dec-21	Jan-22	Feb-22	Mar-22	Apr-22	May-22	Jun-22
MW1	2.62	2.68	dry	2.73	2.78	2.21	2.07	2.12	1.42	1.26	1.08	1.2
MW1A	dry	dry	dry	dry	1.65	0.93	0.58	1.07	insufficent sample	0.65	0.91	1.5
MW1D	1.36	1.81	1.88	1.98	1.75	1.64	1.42	1.48	*	1.42	1.3	1.22
MW2A	2.43	2.61	2.97	2.65	2.49	2.78	2.71	2.42	1.52	1.2	1.2	1.31
MW2B	1.92	1.91	2.02	2.08	1.92	1.8	1.62	1.69	*	1.62	1.58	1.5
MW3A	1.93	2.14	2.07	2.36	2.01	2.03	1.52	1.46	*	*	*	*
MW3C	1.79	1.85	1.91	1.93	1.71	1.62	1.45	1.84	1.3	1.31	1.35	1.32
MW4	5.93	6.03	dry	6.15	6.17	dry	6	5.39	bore damaged	5.52	4.85	5.23
MW01(07)	dry	dry	dry	dry	dry	dry	dry	dry	3.5	4.7	4.78	dry
MW02(07)	1.52	1.65	1.63	1.62	1.51	1.5	1.42	1.6	1.45	1.19	1.48	1.05
MW03(07)	dry	dry	dry	dry	dry	dry	dry	dry	insufficent sample	insufficent sample	dry	dry
MW04(07)	3.34	3.44	3.56	3.54	3.47	3.3	3.3	2.12	2.5	3.2	3.29	2.62
MW05(07)	dry	dry	dry	dry	dry	dry	dry	dry	3.75	5	5.1	4.97
Dredge Pond	1.3	1.2	1	1.2	1.2	1.2	1.3	1.2	2.3	2.4	2.4	2.2
Channel (depth)	0.6	0.3	0.5	0.6	0.8	0.6	0.9	0.5	1.1	1.2	0.8	0.5

Dredge Pond Surface Water Monitoring Results

	Jul-21	Aug-21	Sep-21	Oct-21	Nov-21	Dec-21	Jan-22	Feb-22	Mar-22	Apr-22	May-22	Jun-22
EC (µS/cm)	821	828	738	806	788	771	731	775	514	526	396	575
pH (pH units)	7.9	8	7.2	8.5	8.2	7.2	8.1	8.3	7.2	7.7	6.49	7.7
Total Algae (cells/mL)			885			23500			220000			22100
Cyanophyta (cells/mL)			200			17200			207000			20800
Total Phosphorus (µg/L)			<10			10			20			50
Total Nitrogen (µg/L)			400			300			1000			1000
Chlorophyll-a (µg/L)			2			2			11			5
Faecal Coliforms (CFU/100mL)			~3			50			<2			~6
Entercocci (CFU/100mL)			~5			35			36			~12
Sodium (mg/L)			68			62			47			51
Potassium (mg/L)			6			5			4			4
Magnesium (mg/L)			19			17			12			13
Chloride (mg/L)			105			105			71			71
Sulphate (mg/L)			122			114			70			55
Bicarbonate (mg/L)			136			110			85			100
Soluble Iron (mg/L)			<0.05			<0.05			0.09			<0.05
Ammonium (mg/L)			<0.01			0.02			<0.01			0.18
Turbidity (NTU)			2.5			1.3			7.8			54.2
Dissolved Oxygen (mg/L)			6.1			5.42			2.21			8.8
Dissolved Oxygen (%)			66.1			61.2			25.8			81.7

Air Quality Monitoring Results – Depositional Dust Gauges

TIS (g/m2/month)	1A	2A	3A
Jul-21	0.5	1.3	0.2
Aug-21	1.0	0.4	0.1
Sep-21	1.5	0.5	0.5
Oct-21	2.2	1.7	0.3
Nov-21	1.9	0.8	0.9
Dec-21	0.6	0.2	1.5
Jan-22	0.9	1.9	0.9
Feb-22	0.5	0.4	0.4
Mar-22	2.4	0.7	0.5
Apr-22	9.8	1.8	0.1
May-22	0.6	0.9	1.0
Jun-22	0.6	1.5	1.0

Acid Sulphate Monitoring

	TOS (%)
Jul-21	0.03
Aug-21	0.03
Sep-21	0.02
Oct-21	0.03
Nov-21	0.04
Dec-21	0.03
Jan-22	0.04
Feb-22	0.03
Mar-22	0.03
Apr-22	<0.02
May-22	0.03
Jun-22	0.03

Annexure D

Fourteenth Annual Review

Landscape and Rehabilitation Management Plan

Niche Environment and Heritage

27 June 2022

Excellence in your environment

niche Environment and Heritage

Gerroa Sand Quarry

Annual Review

Vegetation Management Plan

Prepared for Cleary Bros (Bombo) Pty Limited | 5 July 2022

niche-eh.com

Excellence in your environment

Document control

Project number	Client	Project manager	LGA
6743	Cleary Bros (Bombo) Pty Limited	Amy Legge	Kiama

Version	Author	Review	Status	Date
D1	Amy Legge	Sian Griffiths	Draft	23 June 2022
Rev0	Amy Legge	Sian Griffiths	Final	27 June 2022
Rev1	Amy Legge	Mark Hammond	Final	1 July 2022
Final	Amy Legge	Ryan Sébire	Final	5 July 2022

Enquiries should be addressed to:

Sydney Head Office
Niche Environment and Heritage
02 9630 5658
info@niche-eh.com
PO Box 2443 North Parramatta
NSW 1750 Australia

Table of Contents

Table of Contents ..... **ii**

List of Figures ii

1. Vegetation Management Plan: Annual Monitoring Report **3**

1.1 Introduction 3

1.2 Background 3

2. Assessment of Individual Zones **5**

Table 1: Recommendations for the management zones 6

3. Discussion and recommendations **27**

References **28**

Plates **29**

Appendix 1: Selected Conditions of Approval **37**

Appendix 2: Priority weeds for the South East region, *Biosecurity Act 2015* **39**

List of Figures

Figure 1: Map of Gerroa Sand Quarry Planting and Conservation Areas 4

List of Plates

Plate 1: Deer rubbing on *Banksia integrifolia* within subzone 2C.2 planting area. Note: the length of weedy grass species. 29

Plate 2: Damage to planting site from recent flooding at subzone 2C.2. 30

Plate 3: Old planting, remove tree guard to encourage future growth. 31

Plate 4: Crofton weed stands in subzone 1.2. 32

Plate 5: Native Common Silkpod (*Parsonisa straminea*) not to be confused with Moth Vine (*Araujia sericifera*) when targeting Moth Vine in Zones 1.2, 1.4 and 5. 33

Plate 6: Grass growing through tree guard and strangling planting, avoidance via more frequent mowing and hand removal to improve revegetation success. 34

Plate 7: A fruiting Senna stand near Site entry. Stands like this should be removed and fruits bagged and disposed of correctly to avoid further seed dispersal. 35

Plate 8: Asparagus fern encroaching on subzone 2A.1. Control methods to be put in place to stop spread throughout the Site. 36

1. Vegetation Management Plan: Annual Monitoring Report

1.1 Introduction

Niche Environment and Heritage Pty Ltd (Niche) was commissioned by Cleary Bros (Bombo) Pty Limited (Cleary Bros) to complete the Gerroa Sand Quarry (the Project) annual rehabilitation monitoring, located at the corner of Beach Road and Crooked River Road, Gerroa (the Site). A map of Gerroa Sand Quarry Planting and Conservation Areas is provided in Figure 1.

The primary objective of this report is to update any necessary control measures required with regards to priority weed management within the designated zones across the Site and provide advice on any management actions that can be implemented to encourage the rehabilitation of the Site.

Primarily, this report aims to meet the Conditions of Approval granted by the NSW Land and Environment Court for the extension of the Gerroa Sand Quarry, operated by Cleary Bros (Bombo) Pty Limited (see Appendix 1). This report satisfies the condition requiring an annual report on the progress of the revegetation project.

This report is the 14th such annual report covering the Site at Gerroa prepared since 2009. This report is based on an inspection that was undertaken on the 15th of June 2022.

1.2 Background

Cleary Bros have undertaken annual monitoring of the Gerroa Sand Quarry since 2009. The sites mentioned in this report are those consistent with the document "Landscape and Rehabilitation Management Plan, Extension and Continuation of Gerroa Sand Quarry, Municipality of Kiama, City of Shoalhaven" Kevin Mills & Associates (KMA) (2008), which is the Court approved management plan for the Site.

This report is the annual inspection for the year 2021/2022; a similar report has been prepared annually since the beginning of the quarry expansion by Kevin Mills & Associates. The following has occurred at the Site in recent years (KMA 2018):

- The 'Northern Corridor' has been shown to be successful in terms of creating habitat and use by native animals, as compared to the 'East-West Link'.
- The quarry has moved northwards and the forest in the East-West Link has been removed, the quarry subsequently reaching its most northern limit.
- Quarterly inspections and reports have continued to be undertaken during 2019-21, providing regular updates of the progress of the revegetation/rehabilitation areas.
- Nearly all plantings within the designated revegetation areas have been completed and these areas are now in maintenance phase.
- Significant effort has been made to reduce the extent of Lantana on the Site through herbicide spraying.

Recent annual reports have detailed inspections of the revegetation areas with a focus of analysing the progress towards native dominant forest and making relevant recommendations to improve management outcomes if required. There have been no wildlife surveys since 2016 as this was deemed no longer necessary by KMA (2018).

Note that the background information, detailed description of survey methods and the extensive survey information from the first nine years of reporting are contained in the earlier reports KMA (2018); this information is not repeated here.

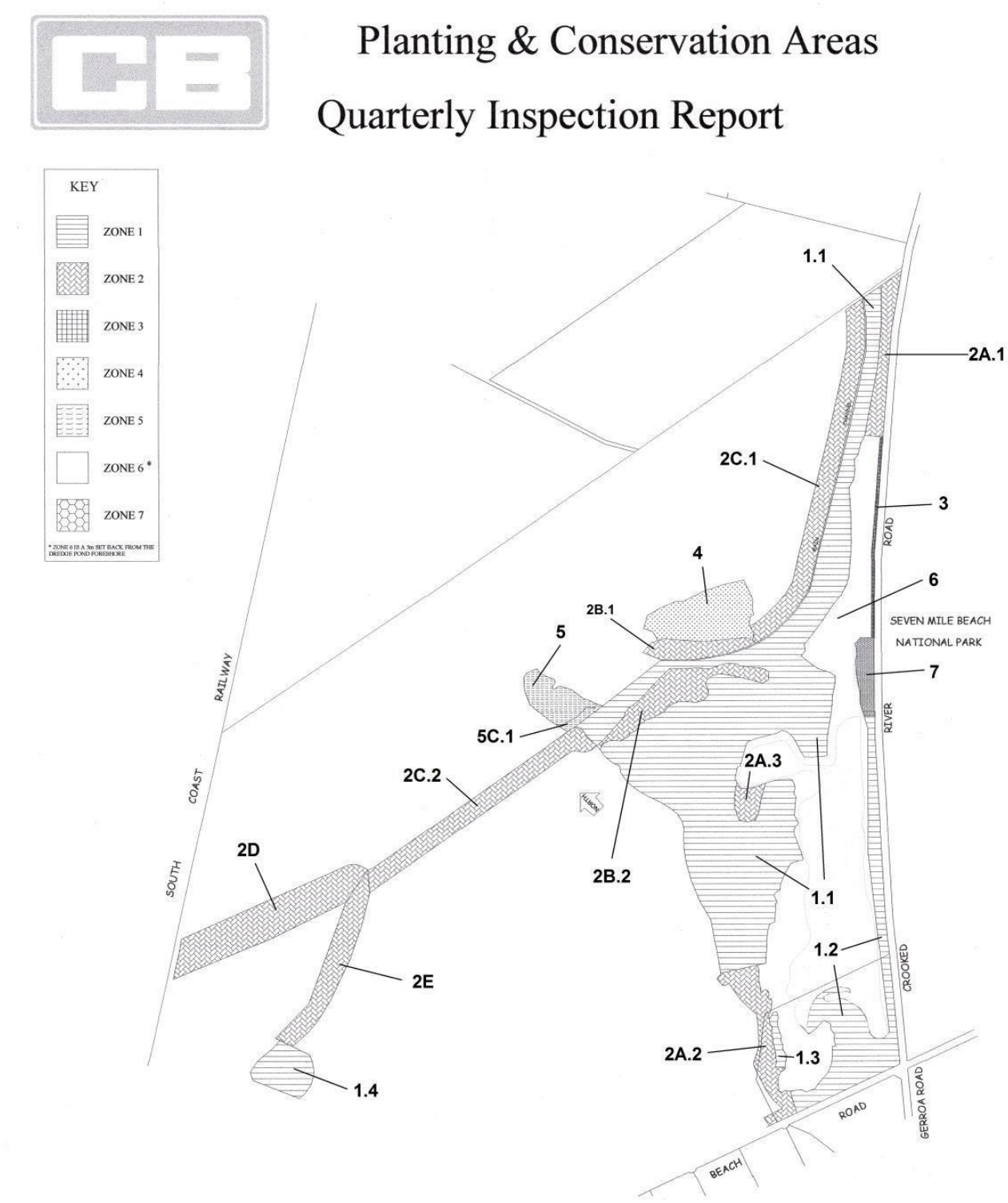


Figure 1: Map of Gerroa Sand Quarry Planting and Conservation Areas

2. Assessment of Individual Zones

Most of the plantings were completed at each zone early on in the monitoring program and are now in the maintenance phase. The most recent plantings have occurred in Zone 2B.1, 2D, 2C.2 and Zone 2C.1 (see Figure 1) to expand the vegetation buffer along Blue Angle Creek, creating suitable habitat for local fauna. These areas are now similarly in the maintenance phase and will require further plantings to replace any lost in the past year.

Weed maintenance has been carried out at each of the planting areas since the early stages of the project and are now considered to be under control. An updated description and condition of each of the zones (Figure 1) and the planting areas has been provided in **Table 1**.

Over the previous year, all zones were inspected by Cleary Bros staff and assessed during quarterly inspections. Due to the weather and the subsequential floodings in the past year, access became difficult to some zones near Blue Angle Creek, including zones 5, 5C.1, 2C.2, 2D, 2E and 1.4. Maintenance work and inspections were therefore only conducted in these zones when access was safe and achievable. The recommendations for the rehabilitation zones (Figure 1) detailed in Table 1 were made following the site inspection conducted by ecologist Amy Legge on the 15th of June 2022. A weeds list for the Site was also created and provides further detail on control methods (Appendix 2).

Table 1: Recommendations for the management zones

Zone	Location/description	Recommendations for ongoing works 2022/23	Reference Images
Zone 1: Forest Enhancement Zone Objectives (41.95 ha) • Improve the quality of the forest by removal of weeds • Restrict access to grazing stock • Monitor the health of the forest • Strengthen tree cover south of previous dredge pond Work in the past has included Lantana control and removal of selected weeds such as Bitou Bush. Weed management is ongoing and is guided by the Weed Management Plan for the Site (KMA 2008)			

Subzone 1.1	This is the main area of existing forest, extending from the southern to northern end of the property boundary.	Removal of Giant Arundo Grass (*Arundo donax*) from the roadside and lower lying areas via cut and paint method. Ongoing Lantana (*Lantana camara*) treatment to reduce extent throughout the area using cut and paint method. Spraying for African Love Grass (*Eragrostis curvula*) along roadside.	

Subzone 1.2	This subzone covers the forest around the eastern and southern sides of the old dredge pond. This area was revegetated early in the rehabilitation program and is now well established.	Efforts of previous Lantana management are evident. Continue cut and paint control methods of woody weeds, specifically Lantana. Moth Vine (*Araujia sericifera*) also requires maintenance particularly in eastern section of the subzone. Control of herbaceous weeds such as Fire weed (*Senecio madagascariensis*), Crofton weed (*Ageratina adenophora*) (Plate 4) and Bidens (*Bidens pilosa*) that are encroaching from the eastern roadside. Continue to promote native tree and shrub cover via planting of native species to lessen risk of weed reinvasion.	

Zone	Location/description	Recommendations for ongoing works 2022/23	Reference Images
Subzone 1.3	Covers the old bund wall that was revegetated earlier in the rehabilitation program. This subzone is located behind the site office and towards the front gate.	Lantana thickets should be the priority weed in this area using cut and paint methods, however, Senna (*Senna pendula* var. *glabrata*) (Plate 7) and Crofton weed (*Ageratina adenophora*) weeds should also be controlled to reduce spreading.	

Zone	Location/description	Recommendations for ongoing works 2022/23	Reference Images
Subzone 1.4	A fenced patch of Swamp Oak within grazing land, which now has a planted link to the east (planting zone 2E). Vegetation is well established and requires very little ongoing work.	Unable to inspect subzone due to recent flooding. Previously stated to be a good condition *Allocasuarina* stand, some Moth Vine starting to creep into swamp extent. If any Moth vine still present continue weed control efforts via cut and paint, be sure not to confuse with nearby native Common Silkpod (*Parsonisa straminea*) – see Plate 5.	N/A
Zone 2: Broad scale planting zone Objectives (25.39 ha) • Develop habitat by planting forest communities in accordance with the Landscape and Rehabilitation Management Plan (KMA 2008) • Establish stronger habitat corridors to the north and south of the existing forest • Monitor plantings and complete maintenance, including the removal of unused plant guards. • Strengthen east-west and north-south links between the established forest and Seven Mile Beach National Park.			

Subzone 2A.1	This is the main area that has been used to develop the forested link in the northeast corner of the Site. Extensive work has been carried out over the past twelve years to develop this area as habitat for native fauna.	Ongoing maintenance to roadside required – tend to Crofton weed, Asparagus fern (*Asparagus aethiopicus*) (Plate 8) and Tobacco bush (*Solanum mauritianum*) along road extent via spray and cut and paint. methods (Plate 8). Multiple, small stands of Lantana encroaching from the eastern sides of the road should be prioritised in the oldest revegetation site to maintain the areas good condition.	

Subzone 2A.2	This area is important for the forest link to the south and into Seven Mile Beach National Park on the southern side of Beach Road. Planted trees are becoming well established in most places. Previously most of the planted Swamp Oak (*Casuarina glauca*) in the northern area died. A total of 24 replacement trees were subsequently planted in the following year to replace the trees that died (KMA 2018).	Ongoing Lantana management required via cut and paint method. Stands of Senna, Moth vine (pictured) and Wild Tobacco require continued management.	

Zone	Location/description	Recommendations for ongoing works 2022/23	Reference Images
Subzone 2A.3	This area was revegetated early in the re-planting program. The plantings that have survived in this area have become well established despite previous impacts from grazing native fauna.	Continued control of Lantana via cut and paint methods should be the main priority in this subzone. Removal of small clustering of Moth vine evident.	

Zone	Location/description	Recommendations for ongoing works 2022/23	Reference Images
Subzone 2C.1 (southern end)	Small revegetation patch that was completed recently to link the forest with Zone 4, located roadside adjacent to subzone 1.1.	This subzone requires continued monitoring and management of noxious woody weed growth. Continue to mow around tree guards and remove Kikuyu grass from within the guards when required (Plate 6). The plantings have been subjected to grazing pressures but overall, the plants are in good condition. If grazing continues to impact the plantings, measures to protect them will need to be put into place i.e. A fence similar to subzone 2C.1. Continue to promote native tree and shrub cover via planting of native species to lessen risk of weed reinvasion.	

Zone	Location/description	Recommendations for ongoing works 2022/23	Reference Images
Subzone 2B.2	This area is located in a low-lying swamp and is being colonised by Swamp Oak. Some planting was carried out on a higher part of the subzone in the south and west in previous years (KMA 2018). The natural regeneration occurring in this subzone is adequate.	The understorey in this subzone is largely made up of pasture grass. Small stands of Tobacco Bush, Lantana and Thistle are evident near the roadside that should be managed via cut and paint methods.	

Zone	Location/description	Recommendations for ongoing works 2022/23	Reference Images
Subzone 2B.1	This subzone is a narrow area that was regenerated to link the creek-side forest to that within Zone 4. The subzone was spread with topsoil and timber debris, and plantings were undertaken. Considerable growth of the plantings has since been noted.	Creek area in a moderate condition, access restricted given recent rainfall. Inspection limited to a distance.	N/A

Zone	Location/description	Recommendations for ongoing works 2022/23	Reference Images
Subzone 2C.1	This subzone is known as 'The Garden' and is a planted area adjacent to more established vegetation located in subzone 1.1.	'The Garden' is in good condition, plantings have become well established and the area is generally free from high threat weeds. This subzone is a good example for techniques that should be implemented on newer plantings. Undertake infill plantings as required to promote native tree and shrub growth and to lessen risk of weed reinvasion.	

Zone	Location/description	Recommendations for ongoing works 2022/23	Reference Images
Subzone 2C.2	A long narrow area supporting some well-established plantings.	Some plantings have been impacted by recent flooding events. There was also evidence of deer grazing on the plantings (Plate 1), deer control methods may need to be implemented if this continues. Further planting is required to replace plants that were impacted and to promote growth of surrounding native plants. Management of weeds and pasture grasses should be completed once area starts to recover from flood damage.	

Zone	Location/description	Recommendations for ongoing works 2022/23	Reference Images
Subzone 2D	Modified some time ago to a triangular area between subzones 2E and 2D. This area was originally sprayed and partly spread with timber mulch prior to plantings. This area is prone to water inundation during wetter months, limiting some access to areas.	Unable to access area due to recent flooding. When accessible again, continue to mow/slash the exotic grasses to keep competition with plantings to a minimum. Monitor plantings for any evidence of deer grazing and update fencing accordingly if grazing is still occurring.	N/A

Zone	Location/description	Recommendations for ongoing works 2022/23	Reference Images
Subzone 2E	Plantings in this area have become well established and tree growth continues to be progressing well. This narrow strip of trees extends into subzone 1.4, an established area of trees.	Only able to access northern end of subzone due to recent weather. This area overall is in good condition. Continued treatment of any woody weeds that reappear and monitor for any Moth vine.	

Zone 3: Screen Planting Zone Objectives (0.42 ha)

- Establish a screen of native vegetation along the eastern edge of pond extension
- Maintain existing trees on south eastern boundary, remove Lantana and replace with native plantings.

Zone	Location/description	Recommendations for ongoing works 2022/23	Reference Images
Zone 3	This zone includes the bund wall which reached its final height early in 2015. A screen of native vegetation was established along the eastern edge of the pond extension. The sand bund is currently stabilised by growth of plants, the majority of which are weeds.	Evidence of previous spraying of Lantana but the bund wall is still currently overrun with Lantana. Continue removal of Lantana using spraying and cut and paint methods. Planting is required to encourage native growth to stabilise bund wall. Removal of old plant guards on mature plants (Plate 3) to encourage future growth.	
Zone 4: Bangalay Sand Forest (3.32 ha) • Restrict access to grazing stock • Establish a forest link to nearby larger area through plantings • Monitor the health of the forest • Remove weeds when required.			

Zone	Location/description	Recommendations for ongoing works 2022/23	Reference Images
Zone 4	This zone is remnant Bangalay Sand Forest vegetation. This area has an intact Bangalay and Blackbutt canopy and is of high habitat value. Lantana has been heavily targeted in this zone and continued maintenance has been completed.	This zone still retains Lantana stands that require attention. Single Coral tree (*Erythrina crista-galli*) that requires cut and paint method.	

Zone 5: Swamp Oak Forest Objectives (1.82 ha)

- Restrict access to grazing stock
- Establish a forest link to nearby larger area through plantings
- Monitor the health of the forest
- Remove weeds when required.

Zone	Location/description	Recommendations for ongoing works 2022/23	Reference Images
Zone 5	This zone includes remnant Swamp Oak Forest. Area is overall in good condition with a relatively open mid/understorey.	Continue to maintain perimeter fencing to stop stock from grazing on plantings. Undertake weed control on any woody weeds present and carry out future plantings to promote native growth and help out compete pasture grasses.	

Zone	Location/description	Recommendations for ongoing works 2022/23	Reference Images
Zone 5C.1	Occurs between the Swamp Oak Forest in zone 5 and the creek that has been planted. The area is dominated by Kikuyu Grass. The shrub *Melaleuca ericifolia* is continuing to expand from the creek-side.	Control of Lantana via cut and paint methods to encourage the growth of native vegetation.	

Zone 6: Dredge Pond Foreshore Objectives

Dredge Pond Foreshore (includes 5 m setback from pond and batter slopes on both the existing and extension pond)

- Stabilise the batters on the edges of the dredge pond
- Undertake plantings within the 5 m set back area along the edge of the retained Littoral Rainforest (Zone 7) as soon as practical after dredging is completed in this area
- Continue rehabilitation of previous dredge pond areas.

Zone	Location/description	Recommendations for ongoing works 2022/23	Reference Images
Zone 6	This zone occurs within the foreshore areas of the Dredge Pond. The foreshore has been previously shaped, had topsoil spread and planted as the dredge pond has expanded northwards. Overall, the pond bank is stable with little to no erosion evident. Natural regeneration and pre-existing native growth have helped to stabilise area.	Monitor and control of priority weeds such as Lantana, Bitou bush and Tobacco bush using cut and paint method as necessary. Avoid spraying in this area to ensure native species retain dredge pond bank stability. Additional plantings may be beneficial to encourage native growth and to control annual weeds and invasive grasses from dominating.	

Zone 7: Littoral Rainforest Objectives (0.95 ha)

- Control weeds, particularly Lantana
- Monitor the health of the forest
- Protect the western edges of the zone from quarrying
- Ensure that the felling of trees does not impact the vegetation in this area.

Zone	Location/description	Recommendations for ongoing works 2022/23	Reference Images
Zone 7	This zone occurs along the eastern edge of the Site between zones 3 and 1.2. This zone has cultural significance, therefore only minor control of Lantana has been conducted over time.	Southern end of zone is well maintained with minimal Lantana present. Presence of Lantana increases in the Northern section of the zone. Monitor and control Lantana and Tobacco bush as necessary using the mosaic methods of weed removal (i.e. working in patches). Remove any plant guards that are no longer being used.	

3. Discussion and recommendations

The 14th annual monitoring report for the Gerroa Sand Quarry is consistent with previous reports, which detail the success of plantings across the various zones on the Site. The quarterly reports completed by Cleary Bros staff have allowed for continuous management of priority weeds and maintenance of fenced areas. Overall, the revegetation works completed throughout the Site are in good condition with evidence of continued plant growth and natural regeneration occurring.

Given the wetter weather conditions experienced in 2021/2022, some zones have been largely inaccessible and have subsequently become inundated with weed species. Some plantings were also impacted by the recent floodings and will need to be replaced, the most severely impacted being zone 2C.2 (Plate 2). Management of these zones should be undertaken immediately as access becomes available again.

Deer grazing and rubbing upon newly planted tube stock was observed in Zone 2C.2 and 2B.1 which may hinder the success of revegetation works in the area. If predation intensifies and rates of tube stock success decline, on-site deer control methods may need to be implemented to achieve successes exhibited from 'The Garden'; Zone 2C.1.

Similarly, to uniformly achieve revegetation successes, such as those exhibited in the northern portions of the Gerroa Sand Quarry, mature weeds such as Wild Tobacco bush found in Zone 2A.1, 6 and 7, Lantana stands found throughout multiple zones, and the Senna tree at the entry of the Quarry should be targeted to limit further seed dispersal given their higher fecundity. Weed removal should be undertaken using cut and paint methods for these woody weeds since it offers a higher kill rate and avoids indirect poisoning of adjacent native species.

Ongoing Lantana control throughout the Site should be undertaken in a mosaic pattern in areas up to 1000m^2 at a time to allow for fauna to disperse through adjacent habitat whilst native revegetation occurs in the targeted extent.

Continued targeting of priority weed species across the southern and eastern extent of the Site in conjunction with ongoing maintenance of planting areas will continue to improve canopy connectivity across the Site. Whilst mature native species continue to flower and fruit, ongoing revegetation will continue to increase the proportion of native flora species until new plantings become self-sustaining in years to come.

References

Kevin Mills & Associates Mills (2008). Landscape and Rehabilitation Management Plan, Extension and continuation of Gerroa Sand Quarry, Prepared for Municipality of Kiama, City of Shoalhaven, Cleary Bros (Bombo) Pty Limited. Cleary Bros (Bombo), Port Kembla, October.

Kevin Mills & Associates (2018). Tenth Annual Report, Flora and Fauna Monitoring Surveys, Gerroa Sand Quarry, Municipality of Kiama. Report prepared for Cleary Bros. (Bombo) Pty Ltd, June.

Department of Primary Industries (2022). NSW WeedWise, June.

Plates

Plate 1: Deer rubbing on *Banksia integrifolia* within subzone 2C.2 planting area. Note: the length of weedy grass species.

Plate 2: Damage to planting site from recent flooding at subzone 2C.2.

Plate 3: Old planting, remove tree guard to encourage future growth.

Plate 4: Crofton weed stands in subzone 1.2.

Plate 5: Native Common Silkpod (*Parsonisa straminea*) not to be confused with Moth Vine (*Araujia sericifera*) when targeting Moth Vine in Zones 1.2, 1.4 and 5.

Plate 6: Grass growing through tree guard and strangling planting, avoidance via more frequent mowing and hand removal to improve revegetation success.

Plate 7: A fruiting Senna stand near Site entry. Stands like this should be removed and fruits bagged and disposed of correctly to avoid further seed dispersal.

Plate 8: Asparagus fern encroaching on subzone 2A.1. Control methods to be put in place to stop spread throughout the Site.

Appendix 1: Selected Conditions of Approval

"Condition 17.

The Proponent shall:

(b) ensure that within 4 years of the date of this approval, the additional plantings in the Northern Corridor and Southern Rehabilitation Area are comprised of at least 60% of the plant species recorded for the representative plant communities in the quarry extension area, such as Bangalay Sand Forest and Littoral Rainforest;

Condition 20.

The proponent shall

(a) commence Compensatory Planting and the vegetation screen along the Crooked River Road frontage north of the east-west link (as shown conceptually in Appendix 3) within 12 months of the date of this approval or when sufficient propagation material has been collected; and

(b) not sever the east-west link until it can be demonstrated to the satisfaction of the director-general that the established communities represented in the northern corridor comprise at least 60% of the native flora species as set out in Appendix 6 and the Northern Corridor is successful according to the criteria in Condition 25 to the satisfaction of the director-general."

Condition 23.

Successful establishment of the Northern Corridor shall be measured by the following criteria:

(a) presence of native flora species;

(b) a majority of the flora species recorded from the removed forest occur in the area; (e.g. 60% of flora species recorded in removed forest are present);

(c) species from all four layers have been planted and at least 50% of the projected cover has been achieved for each of the shrub and ground cover layers;

(d) self-sustaining native plant populations (e.g. regeneration of a second generation);

(e) no dominance by single flora species (e.g. Bracken);

(f) weeds are not significantly impacting on the native vegetation;

(g) weeds do not represent a majority of the flora species or a higher percentage cover than the native flora species; and

(h) impacts such as grazing are excluded from the area.

Condition 24.

Successful establishment of fauna habitat in the Northern Corridor would be measured by:

(a) presence of species;

(b) a majority of the resident species recorded from the removed forest occur in the area;

(c) fauna populations are resident in the area;

(d) pest animals are controlled and not impacting upon the fauna or its habitat; and

(e) impacts such as grazing are excluded from the area.

Condition 25.

Prior to the severance of the East-West Link the Proponent shall:

(a) determine the presence of species in both the East-West Link and Northern Corridor by conducting standard animal survey techniques at least twice in the first year (e.g. Elliot trapping for small mammals, pitfall trapping for reptiles, observational surveys for frogs and birds, and spotlighting transects for arboreal animals);

(b) determine whether a majority of animal species (particularly those determined to be likely to be impacted by fragmentation) utilising the corridor in the East-West Link are present in the conservation area and the Northern Corridor and the re-created link at the northern boundary."

Appendix 2: Priority weeds for the South East region, *Biosecurity Act 2015*

Note: this region includes the local council areas of Bega Valley, Eurobodalla, Goulburn, Mulwaree, Hilltops (eastern), Kiama, Queanbeyan-Palerang Regional, Shellharbour, Shoalhaven, Snowy Monaro Regional, Upper Lachlan, Wingecarribee, Wollongong and Yass Valley.

WARNING - ALWAYS READ THE LABEL

Users of agricultural or veterinary chemical products must always read the label and any permit, before using the product, and strictly comply with the directions on the label and the conditions of any permit. Users are not absolved from compliance with the directions on the label or the conditions of the permit by reason of any statement made or not made in this information. To view permits or product labels go to the Australian Pesticides and Veterinary Medicines Authority website www.apvma.gov.au

Common name	Scientific name	Duty under *Biosecurity Act* 2015	Action
African Lovegrass	*Eragrostis curvula*	**Regional Recommended Measure** Land managers reduce impacts from the plant on priority assets.	Spot spray new growth if any arise with a 360g/L Glyphosate based herbicide at a diluted rate of 10ml/Litre of water.
Asparagus fern	*Asparagus aethiopicus*	**General Biosecurity Duty** All plants are regulated with a **general biosecurity duty** to prevent, eliminate or minimise any biosecurity risk they may pose. Any person who deals with any plant, who knows (or ought to know) of any biosecurity risk, has a duty to ensure the risk is prevented, eliminated or minimised, so far as is reasonably practicable. **Prohibition on certain dealings** Must not be imported into the state, sold, bartered, exchanged or offered for sale.	Main methods of control include excluding plants from uninfested areas, physical removal of all plants parts, and herbicide application. Spot spraying is most successful when completed between flowering and berries forming. Spot spray using 360g/L Glyphosate based herbicide at a rate 1 part glyphosate to 50 parts water.
Bitou bush	*Chrysanthemoides monilifera* subsp. *rotundata*	**Biosecurity Zone** The Bitou Bush Biosecurity Zone is established for all land within the State except land within 10 kilometres of the mean high water mark of the Pacific Ocean between Cape Byron in the north and Point Perpendicular in the south. Within the Biosecurity Zone this weed must be eradicated where practicable, or as much of the weed destroyed as practicable, and any remaining weed suppressed. The local control authority must be	Mature bitou bush plants can be slashed, whilst seedlings can be hand-pulled to remove the entire root system. Plants are liable to resprout after slashing alone, but applying herbicide to stems immediately after cutting should prevent regrowth. Use cut and paint methods or spot spray using 360g/L Glyphosate based herbicide at a diluted rate of 5 or 10ml/Litre of water.

Common name	Scientific name	Duty under *Biosecurity Act* 2015	Action
		notified of any new infestations of this weed within the Biosecurity Zone.	
Blackberry	*Rubus fruticosus* species aggregate	**Prohibition on dealings** Must not be imported into the State or sold, bartered, exchanged or offered for sale. *All species in the Rubus fruiticosus species aggregate have this requirement, except for the varietals Black Satin, Chehalem, Chester Thornless, Dirksen Thornless, Loch Ness, Murrindindi, Silvan, Smooth Stem, and Thornfree.*	Not to be mulched with native species to reduce spread. A combination of slashing or hand removal and spot spraying with a 360g/L Glyphosate based herbicide at a diluted rate of 10ml/Litre of water.
Cassia	*Senna pendula* var. *glabrata*	**General Biosecurity Duty** All plants are regulated with a **general biosecurity duty** to prevent, eliminate or minimise any biosecurity risk they may pose. Any person who deals with any plant, who knows (or ought to know) of any biosecurity risk, has a duty to ensure the risk is prevented, eliminated or minimised, so far as is reasonably practicable.	Spot spraying is recommended for seedlings and plants less than 2 m tall in dense infestations. Cut and paint methods should be used on taller or individual plants. Dried seed pods can be burnt in a hot fire. Contact your local council for further advice on how to dispose of seed pods. For spot spray and cut and paint methods use 360g/L Glyphosate at a diluted rate of 20 ml/Litre of water.
Coral tree	*Erythrina crista-galli*	**General Biosecurity Duty** All plants are regulated with a **general biosecurity duty** to prevent, eliminate or minimise any biosecurity risk they may pose. Any person who deals with any plant, who knows (or ought to know) of any biosecurity risk, has a duty to ensure the risk is prevented, eliminated or minimised, so far as is reasonably practicable.	Seedlings can be removed by hand or be dug out. Cut stump method or stem injection is recommended for mature plants. This involves cutting the trunk or making an injection into the trunk and applying herbicide within 15 seconds. For chemical control use 360g/L Glyphosate at a rate of 1 part glyphosate and 1.5 parts water.
Crofton weed	*Ageratina adenophora*	**General Biosecurity Duty** All plants are regulated with a **general biosecurity duty** to prevent, eliminate or minimise any biosecurity risk they may pose. Any person who deals with any plant, who knows (or ought to know) of any biosecurity risk, has a duty to ensure the risk is prevented, eliminated or minimised, so far as is reasonably practicable.	Crofton weed can be controlled using a combination of methods, in conjunction with pasture and grazing management practices, aimed at creating an unfavourable environment for weed invasion. Small infestations can be manually removed. For larger infestations a combination of slashing and chemical application is used. When spraying Crofton weed use 360g/L Glyphosate based herbicide at a rate of 5 ml/Litre of water.

Common name	Scientific name	Duty under *Biosecurity Act* 2015	Action
Fireweed	*Senecio madagascariensis*	**Regional Recommended Measure** **Exclusion zone:** whole of region except the core infestation area of Wollongong, Kiama, Shellharbour, Eurobodalla, Shoalhaven, Bega Valley and Wingecaribee councils. **Whole region**: Land managers should mitigate the risk of new weeds being introduced to their land. The plant should not be bought, sold, grown, carried or released into the environment. **Exclusion zone:** The plant should be eradicated from the land and the land kept free of the plant. **Core area:** Land managers reduce impacts from the plant on priority assets.	Herbicides are most effective in combination with healthy, competitive pastures. The best time to treat fireweed with herbicide is late autumn. This controls the peak numbers of seedlings and young plants. Spot spray with a 600g/kg Metsulfuron-methyl (Brush off), a broad leaf selective herbicide to avoid harming native grasses, at a diluted rate of 1g/10L of water.
Giant Reed	*Arundo donax*	**General Biosecurity Duty** All plants are regulated with a **general biosecurity duty** to prevent, eliminate or minimise any biosecurity risk they may pose. Any person who deals with any plant, who knows (or ought to know) of any biosecurity risk, has a duty to ensure the risk is prevented, eliminated or minimised, so far as is reasonably practicable.	Cut and paint using 360g/L Glyphosate at a diluted rate of 1 part glyphosate to 1.5 parts of water.
Lantana	*Lantana camara*	**Regional Recommended Measure** **Exclusion zone**: whole region excluding the core infestation area of Eurobodalla, Kiama, Shellharbour, Wollongong and the Shoalhaven local government area north of the Lantana Containment Line at 35'11"42 S **Whole region**: Land managers should mitigate the risk of new weeds being introduced to their land. The plant should not be bought, sold, grown, carried or released into the environment. **Exclusion zone:** The plant should be eradicated from the land and the land kept free of the plant. Core area: Land managers reduce impacts from the plant on priority assets.	Gradually control sections of large infestations, starting at the edges. Dry or frosty periods are good times to work on mature lantana plants, treat regrowth or seedlings before they are 1 m high and control young plants before they are a year old to prevent new fruit and seeds. **Chemical control:** Cut stems off at about 15 cm from the ground. Apply herbicide to the cut surface of the stump within 15 seconds. Treat every cut stem because lantana regrows vigorously from untreated stems or a variety of spot spray especially on new growth if any arise with a 360g/L Glyphosate based herbicide at a diluted rate of 10ml/Litre of water.

Common name	Scientific name	Duty under *Biosecurity Act* 2015	Action
Maderia Vine	*Anredera cordifolia*	**General Biosecurity Duty** All plants are regulated with a **general biosecurity duty** to prevent, eliminate or minimise any biosecurity risk they may pose. Any person who deals with any plant, who knows (or ought to know) of any biosecurity risk, has a duty to ensure the risk is prevented, eliminated or minimised, so far as is reasonably practicable. **Prohibition on dealings** Must not be imported into the State or sold.	Successful control of Madeira vine requires all the tubers and bulbils to be removed or killed. Control activities are long-term, and require regular follow-up for many years. Single control activities generally cause disturbance that results in vigorous regrowth and can lead to worse infestation levels unless dedicated follow-up occurs.
Moth Vine	*Araujia sericifera*	**General Biosecurity Duty** All plants are regulated with a **general biosecurity duty** to prevent, eliminate or minimise any biosecurity risk they may pose. Any person who deals with any plant, who knows (or ought to know) of any biosecurity risk, has a duty to ensure the risk is prevented, eliminated or minimised, so far as is reasonably practicable.	Cut and paint using 360g/L Glyphosate at a diluted rate of 20 ml/Litre of water.
Tobacco Bush	*Solanum mauritianum*	**General Biosecurity Duty** All plants are regulated with a **general biosecurity duty** to prevent, eliminate or minimise any biosecurity risk they may pose. Any person who deals with any plant, who knows (or ought to know) of any biosecurity risk, has a duty to ensure the risk is prevented, eliminated or minimised, so far as is reasonably practicable.	Cut and paint using 360g/L Glyphosate at a diluted rate of 20 ml/Litre of water.