Dunmore Lakes Sand Project
Annual Review
1 July 2021 – 30 June 2022

Dunmore Lakes Sand Project
Annual Review 2022

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Name of operation	Boral Dunmore Lakes Sand Project
Name of operator	Boral Resources (NSW) Pty Ltd
Development consent	DA-195-8-2004
Name of holder of development consent	Boral Resources (NSW) Pty Ltd
Water licence number	WAL24477
Name of holder of water licence	Boral Resource (NSW) Pty Ltd
Name of holder of EPL	Boral Resources (NSW) Pty Ltd
Annual Review start date	1 July 2021
Annual Review end date	30 June 2022

I, Ben Williams certify that this audit is a true and accurate record of the compliance statues of the Dunmore Lakes Sand Project for the period of the 2022 Financial Year and that I am authorised to make this statement on behalf of Boral Resources (NSW) Pty Ltd.

Note

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.

Name of authorised reporting officer	Ben Williams
Title of authorised reporting officer	Environmental Business Partner
Signature	
Date	30/09/22

Dunmore Lakes Sand Project Annual Review 2022

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Tables and Figures

List of Abbreviations

ANZECC	Australian and New Zealand Environment Conservation Council
AQMP	Air Quality Management Plan
AR	Annual Review
AS	Australian Standard
BFMP	Bushfire Management Plan
BMP	Blast Management Plan
BOS	Biodiversity Offset Strategy
CCC	Community Consultative Committee
DA 195-8-2004	The development application for the Dunmore Lakes Sand Project operated by Boral Resources (NSW) Pty Ltd
DLSP	Dunmore Lakes Sand Project
DO	Dissolved Oxygen
DPIE	Department of Planning, Industry and Environment
EPA	Environmental Protection Authority
EPA&A Act	Environmental Planning and Assessment Act 1979
EPL 11147	Environmental Protection Licence for the Dunmore Lakes Sand Project operated by Boral Resource (NSW) Pty Ltd
FFMP	Flora and Fauna Management Plan
FY21	Financial Year 2021 (1 July 2020 – 30 June 2021)
GMMP	Groundwater Monitoring Management Plan
HVAS	High Volume Air Sampler
IEA	Independent Environmental Audit
LOR	Limit of Reporting
MOD	Modifications
ML	Megalitres
NATA	National Association of Testing Authorities
NMP	Noise Management Plan
NRAR	Natural Resource Access Regulator
NTU	Nephelometric Turbidity Units
PASS	Potential Acid Sulphate Soil
PIRMP	Pollution Incident Response Management Plan
PM_{10}	Particulate Matter (10 microns in diameter)
$PM_{2.5}$	Particulate Matter (2.5 microns in diameter)

POEO Act	Protection of the Environment Operations Act 1997
RMP	Rehabilitation Management Plan
S5.C9	Used to refer to a particular condition in DA-195-8-2004 (in this case Schedule 5, Condition 9).
TSP	Total Suspended Particulates
TSS	Total Suspended Solids
VENM	Virgin Excavated Natural Materials
WMP	Water Management Plan
WQO	Water Quality Objectives
$\mu g/m^3$	Micrograms per cubic metre

1. Purpose and Scope

This Annual Review (AR) covers the operation of the Dunmore Lakes Sand Project for the period 1st July 2021 to 30th June 2022 and has been prepared in accordance with the latest Department of Planning and Environment guidelines. In addition to determining the compliance of the development with the conditions of the consent, DA 195-8-2004 Schedule 5 Condition 9 (S5.C9) requires that the Annual Review (AR) reports on key components of the operation including, environmental management initiatives and performance, a comprehensive review of monitoring results and a comparison of these results against any relevant statutory requirements or commitments as well as rehabilitation progress over the reporting period.

DA 195-8-2004 S5.C9 and all other relevant conditions required to be addressed as part of the AR are outlined in Table 1 with reference to the section of this report where each condition has been addressed. The timeframe for the annual review is the 2022 Financial Year which is 1 July 2021 – 30 June 2022.

Table 1 Consent Requirements for Annual Review

Condition	Condition Requirements	Where addressed in this report
5(9)	By the end of September each year, or other timing as may be agreed by the Planning Secretary, the Applicant must review the environmental performance of the development to the satisfaction of the Planning Secretary. This review must:	
	(a) Describe the development (including rehabilitation that was carried out in the previous financial year, and the development that is proposed to be carried out over the current financial year,	Section 4.8
	(b) Include a comprehensive review of the monitoring results and complaints records of the development over the previous financial year, which includes a comparison of these results against: • The relevant statutory requirements, limits or performance measures/criteria; • Requirements of any plan or program required under this consent; • The monitoring results of previous years; and • The relevant predictions in the documents listed in condition 2(c) of Schedule 2;	Section 4
	(c) identify any non-compliance or incident which occurred in the previous financial year, and describe what actions were (or are being) taken to rectify the non-compliance and avoid reoccurrence;	Section 1.1

	(d) evaluate and report on: • the effectiveness of the noise and air quality management systems; and • compliance with the performance measures, criteria and operating conditions of this consent;	Section 4
	(e) Identify any discrepancies between the predicted and actual impacts of the development, and analyse the potential cause of any significant discrepancies; and	Section 4
	(f) Describe what measures will be implemented over the current financial year to improve the environmental performance of the development.	Section 4
	The Applicant must ensure that copies of the Annual Review are submitted to the Planning Secretary and Council and are available to the Community Consultative Committee (see condition 6 of Schedule 5) and any interested person upon request.	
3(27)	The Applicant must ensure that the flood storage capacity of the site is no less than the pre-existing flood storage capacity at all stages of the development. Details of the available flood storage capacity must be reported in the Annual Review.	Section 4.6
3(57)	The Applicant must maximise the use of rail transport for delivery/despatch outside the Illawarra Region, to the satisfaction of the Secretary. Details of transportation modes and measures to assess and encourage rail transport must be provided in the Annual Review.	Section 2.5 and 2.6
3(64)	The Applicant must (a) manage on-site sewage treatment and disposal in accordance with the requirements of an applicable EPL, and to the satisfaction of EPA and Shellharbour Council; (b) minimise the waste generated by the development; (c) ensure that the waste generated by the development is appropriately stored, handled, and disposed of; and (d) report on waste minimisation and management in the Annual Review.	Section 4.9
3(72)	The Applicant must: (e) Provide annual production data to the MEG using the standard form for that purpose; and (f) Include a copy of this data in the Annual Review.	Section 2.5

1.1. Statement of Compliance

The statement of compliance for the current reporting period (1 July 2021–30 June 2022) is contain in Table 2 below.

Table 2 Statement of Compliance

Were all conditions of the relevant approval(s) complied with?	
DA-195-8-2004	No

There was only one non-compliance occurring during the reporting period. As described in Table 3, the water quality held within the dredge ponds exceeded the water quality objective for Turbidity. This occurred during the extended rainfall in the first half of 2022 as a result of an off shore low pressure system. This event caused widespread flooding in the Illawarra. Although the consent recognises that short term exceedances can occur due to high rainfall, this particular period saw elevated Turbidity levels for an extended period. It is worth noting that dredging ceased for most of this period and the overall water quality within the ponds was better than the receiving environment.

Table 3 Annual Review Compliance

Relevant Approval	Condition	Condition Description	Compliance Status	Comments	Section addressed
DA 195-8-2004	S3.C24	Applicant must ensure that water quality in the dredge ponds and groundwater comply with the water quality objectives (WQO) in Table 5 or other such levels as approved by the secretary. Note: The Department acknowledges that short term exceedances of these objectives may occur during natural events such as heavy rainfall or tidal saline water inflow	Low Exceedances are attributed to extensive and prolonged rainfall in the first half of 2022 which resulted in regional flooding which was outside the control of the Development.	Levels of Turbidity were elevated in the dredge ponds for most of the first half of 2022 due to heavy rainfall and flooding. During the extensive flood event, the dredge operation ceased. Water quality within the dredge ponds was similar, although often better, that the surrounding waterways. As described in Section 4.7, there were several exceedances of the groundwater quality goals as specified in the consent. Bores furthest from the operation (DG5 and DG6) had the most exceedances, largely because they are located in naturally saline groundwater, while bores located adjacent to the	Section 4.4 (see Surface Water). Section 4.7, Appendix D (see groundwater)

Relevant Approval	Condition	Condition Description	Compliance Status	Comments	Section addressed
				extraction areas (DG17, DG21, DG31, DG35 and DG36) had very few exceedances. As described in the groundwater monitoring report, this indicates that the levels are naturally occurring and not related to any activities on site. Site Specific Trigger Values for surface and groundwater are being developed as part of the updated water management plan	

Risk Level	Colour Code	Description
High	Non-compliant	Non-compliance with potential for significant environmental consequences, regardless of the likelihood of occurrence
Medium	Non-compliant	Non-compliance with: • potential for serious environmental consequences, but is unlikely to occur; or • potential for moderate environmental consequences, but is likely to occur
Low	Non-compliant	Non-compliance with: • potential for moderate environmental consequences, but is unlikely to occur; or • potential for low environmental consequences, but is likely to occur
Administrative	Non-compliant	Only to be applied where the non-compliance does not result in any risk of environmental harm (e.g. submitting a report to government later than required under approval conditions)

Copies of the AR will be submitted to the DPIE and made available to the public on the DLSP operations website:

https://www.boral.com.au/locations/boral-dunmore-operations

Key contacts associated with the management of the DLSP, environment, safety and stakeholder relationships are provided in Table 4.

Table 4 Key Contacts Associated with the Dunmore Lakes Sand Project

Contact	Position	Contact Details
Brodie Bolton	DSS Quarry Manager	(02) 4237 8414 Email: brodie.bolton@boral.com.au
Angus Shedden	Metropolitan Operations Manager NSW/ACT	(02) 4237 8414 Email: angus.shedden@boral.com.au
Sharon Makin	Environmental Business Partner	Tel: (02) 4237 8414 Email: sharon.makin@boral.com.au
Kate Woodbridge	Stakeholder Relations Manager	Tel: (02) 4237 8414 Email: kate.woodbridge@boral.com.au

2. Site Operations

The Dunmore Lakes Sand Project (DLSP) is an established dredge sand extraction operation at Dunmore, in the Illawarra region of New South Wales. It is owned by Dunmore Sand & Soil Pty Ltd, which is a wholly owned subsidiary of Boral Resources (NSW) Pty Ltd (Boral).

The project is an integral part of the NSW construction industry, as it supplies high quality construction sand products to the Illawarra and Greater Sydney regions. The DLSP has a maximum approved production rate of up to 800,000 tonnes per annum and average historical production rate of 450,000 tonnes per annum. It has historically been capable of supplying around 7.5% of the sand required for Sydney's construction industry however production during the 2022 reporting period was impacted by flooding and the transition to the new Stage 5 area.

Development Consent (DA 195-8-2004) was issued 29 June 2005 for Stages 2, 3 and 4 by the Minister for Infrastructure and Planning and in November 2020 for Stage 5. It allows Boral to produce up to 800,000 tonnes of product per year, and transport it offsite by road and rail to local and regional markets. Stage 5 commenced production during the reporting period.

The project is currently operating under development consent DA 195-8-2004, which has been modified three times as summarised below, and allows Boral to carry out sand extraction and processing operations until 2030.

- Modification 1 (granted in June 2016) which involved modifying S3.C10 of the consent to remove the requirement for the creek realignment to occur prior to commencing Stage 3 extraction. This allowed realignment to be carried out a later date, concurrent with extraction operations as per the private landowners request;
- Modification 2 (granted in November 2020) which involved establishing two new extraction areas, known as Stages 5A and 5B, within the existing approved life of the operations. These proposed extraction areas are situated on a private property located between the Princes Highway, Riverside Drive and the Minnamurra River. Production commenced in the 5A during the reporting period;
- Modification 3 (granted in March 2020) which involved permitting the processing, blending and sale of up to 120,000 tonnes per annum of sand based VENM (known as excavation sand) from ongoing building projects within the surrounding regions.

The development consent DA 195-8-2004 as it currently stands allows Boral to:

- extract, process and transport sand products, including through the:
    - extraction of up to 800,000 tonnes of sand per annum until 2030;
    - development of extraction areas for dredging in Stages 2 to 5;
    - processing of extracted sand and up to 120,000 tonnes per annum of suitable imported Virgin Excavated Natural Material (VENM) to produce construction sand products;
    - road and rail transport of product sand, primarily to the Illawarra and Greater Sydney regions;
- construct and operate a range of ancillary infrastructure at the site, including:

- a processing plant;
- product stockpiles;
- access roads; and
- supporting administrative infrastructure.

- Undertake progressive rehabilitation via the importation of VENM material for the purposes of void reclamation and revegetate as per the approved Rehabilitation Management Plan.

A layout of the site is illustrated in Figure 1.

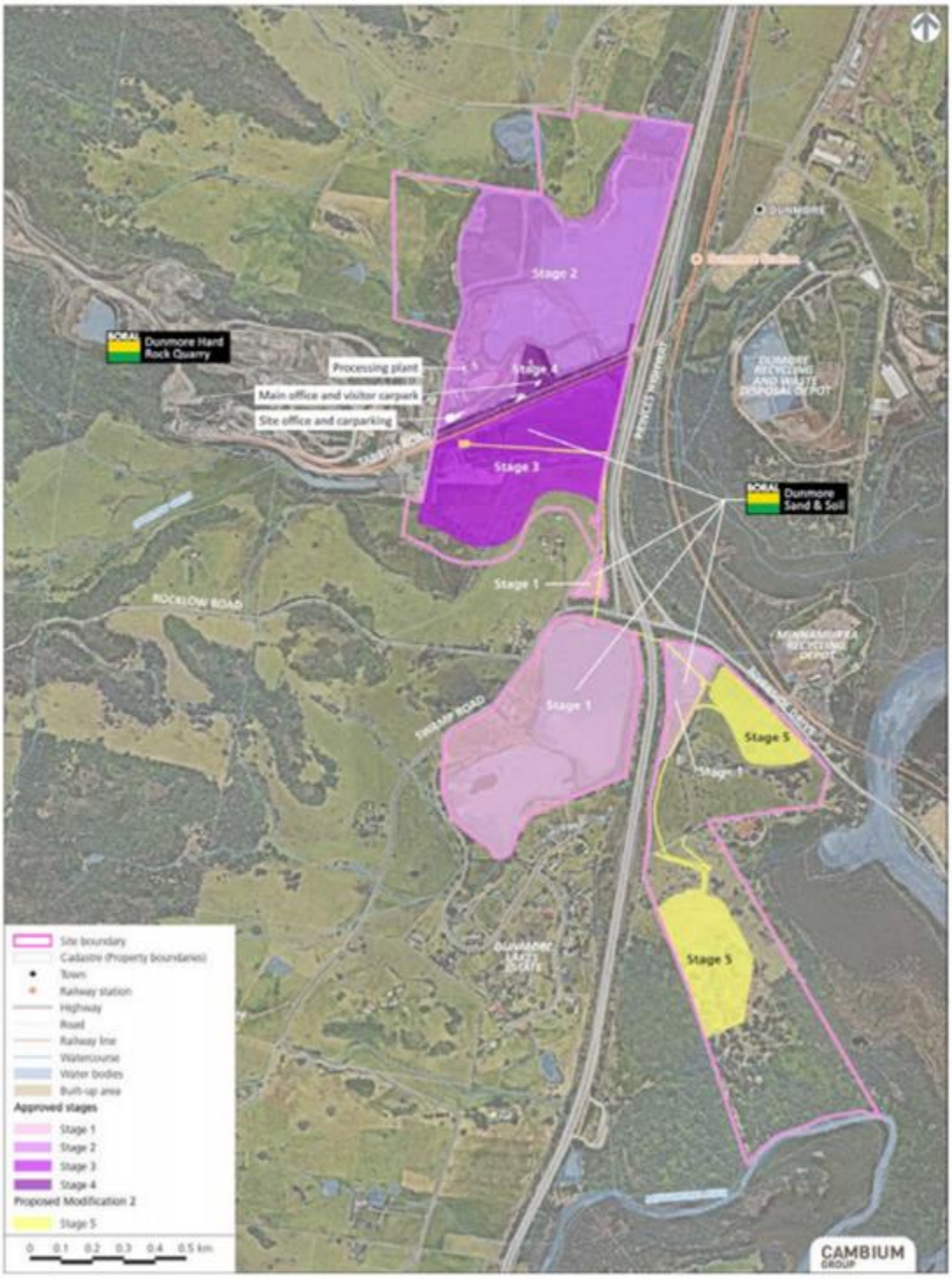

Figure 1 Dunmore Lakes Sand Project Site Layout

Please note that Stage 1 operations have ceased and rehabilitation was signed off in 2014

2.1. List of Relevant Approvals

A summary of all the relevant approvals relevant to DLSP are provided in Table 5.

Table 5 Dunmore Lakes Sand Project List of Relevant Approvals

Approval Type	Approval Authority	Approval No.	Date Granted
Development Consent	Department of Planning & Environment	195-8-2004 (as modified)	29/06/2005
Environment Protection Licence	Environment Protection Authority	11147	04/05/04
Water Extraction Licence	Natural Resource Access Regulator (NRAR)	WAL24477	01/02/2018
Controlled Activity Approval	Natural Resource Access Regulator (NRAR)	10CX123242 (10 ERM2010/1116) 10CX122266	5/08/2019 18/12/2018

2.2. Modifications Approved in the Last 12 Months

No additional modifications have been sought to the current approval over the 2022 reporting period. The current consent allows for an additional extraction area (Stage 5) to the south of the former Stage 1 extraction area which was commenced during the current reporting period. Stage 5 encompasses an area of 38 hectares (ha) and includes two separate extraction areas, Stage 5A and Stage 5B. The sand resource to be extracted from Stage 5A is estimated at 234,000 t and approximately 1,123,000 t from Stage 5B. These resource volumes are the estimated sand resource only, and additional tonnage of soil material (known as overburden) will be extracted in addition to the sand resource.

An overland transfer pipeline has been established from the Stage 5 extraction areas to the existing Stage 2 processing area. All Stage 5 material is now being processed at the existing Stage 2 processing area. The processing method remains the same and there are no changes to material handling or stockpiling arrangements. Process water drains to an existing fines pond and a secondary settling pond before being pumped back to the Stage 5A and future Stage 5B dredge ponds.

Dewatered sand is then be loaded with a front-end loader for dispatch by road and rail. Water pumped from the Stage 5 extraction areas is returned to these extraction areas via the transfer pipeline. Mobile plant and equipment will continue to be operated across both extraction areas. Extraction methods will be identical to those in Stages 2 and 3.

As a result of the modification, a number of management plans were updated as described below:

- Waste Management Plan was approved 16 June 2021

- Stage 5 Survey Plan and Extraction Limits was approved 17 June 2021
- Staging of Management Plans was approved 18 June 2021
- Air Quality Management Plan was approved 8 July 2021
- Noise Management Plan was approved 8 July 2021
- Stage 5 Soil and Water Management Plan was approved 14 July 2021
- Traffic Management Plan was approved 13 July 2021
- Flora Fauna Management Plan was approved 20 July 2021
- Heritage Management Plan was approved 20 July 2021
- Rehabilitation and Riparian Management Plan was approved 20 July 2021
- The Acid Sulphate Soils Management Plan (pending approval).

Approved management plans are available on the Dunmore website
https://www.boral.com.au/locations/boral-dunmore-operations

2.3. Operations last 12 months

Operations over the 2022 reporting period were significantly impacted by flooding caused by heavy and prolonged rainfall. Overall production of 91,125t which was only 11% of the approved limit of 800,000 tpa. Sales were higher at 124,882t due to blending and use of stockpiled material from the previous reporting period.

Production was also impacted by the exhaustion of the fine sand resource in the second quarter of the 2022 reporting period and the delay in relocating the dredge to the new Stage 5A. Weather conditions improved in the last three months of the reporting period which allowed the completion of the dredge relocation and pipeline connection to the processing plant area. At the end of the reporting period, commissioning was still underway and it is anticipated that production will progressively improve over the coming reporting period.

The relocation of the dredge to Stage 5 required the following activities:

- Construction of a separate access off Riverside Drive;
- Erection of a man-proof fence around the future extraction area;
- Laying two pipelines (dredged material and return water) between Stage 5A and the existing processing area;
- Topsoil and overburden stripping to expose the sand resource;
- Dismantle, transport and re-erect the dredge;
- Establish a pumping station, control systems and support infrastructure.

All Stage 5 material is now being processed at the existing Stage 2 processing area. The processing method remains the same and there are no changes to material handling or stockpiling arrangements. Process water drains to an existing fines pond and a secondary settling pond before being pumped back to Stage 5A.

Stage 2 rehabilitation maintenance has been ongoing with Jamberoo Native Nursery in the bird island, north east and northwest planted areas. VENM and PASS importation has continued to be emplaced in Stage 2 to create the final landform as part of ongoing progressive rehabilitation program. Backfilling and rehabilitation of Stage 3 will commence following completion of Stage 2.

2.4. Operations next 12 months

Over the next 12 months, production will continue from new Stage 5A with VENM material continuing to be received in Stage 2 and 3 for landform construction. The Stage 5A area will produce in the order of 24,000 tonnes per month of fine sand. The resource should be exhausted by June 2023 allowing the dredge to be relocated to the Stage 5B area during the 2024 reporting period.

Backfilling and rehabilitation will continue in the Stage 2 and 3 areas will be ongoing during the coming reporting periods.

Stage 5B preparation works will also continue in the next reporting period (2023) after the required offsets have been purchased and nest boxes installed in remnant vegetation areas. An access track will be constructed and vegetation within the disturbance footprint will be cleared as per the vegetation clearing protocol in the FFMP.

2.5. Production, Sales and Transport

A summary of production for the current reporting period is shown below in Table 6. The current reporting period production data as reported to the Department of Resources and Geoscience (DRG) is shown in Table 7.

Table 6 Current Reporting Period Production Data

Month	Production (t)	Sales (t)	
		Road	Rail Transfers Out
Jul-21	33,457	14,253	0
Aug-21	12,899	14,634	0
Sep-21	6,303	24,171	4,399
Oct-21	7,361	19,353	3,808
Nov-21	5,926	13,459	0
Dec-21	3,780	13,708	2,200
Jan-22	4,251	7,032	0
Feb-22	4,841	8,878	0
Mar-22	0	8,822	0
Apr-22	971	7,858	0
May-22	1,200	4,704	0
Jun-22	10,136	6,689	0
Total	**91,125**	**114,415**	**10,407**
		124,882	

Table 7 Current Reporting Period Production Data as Reported to DRG

Product	Quantity Tonnes current reporting period
Virgin Materials Crushed Coarse Aggregates	
Over 75mm	
Over 30mm to 75mm	
5mm to 30mm	
Under 5mm	18,615 (Washed Dust)
Natural Sand	
Manufactured Sand	
Construction Sand	1,934 (Compaction Sand)
Prepared Road Base & Sub Base	
Other Unprocessed Materials	
Construction Sand Excluding Industrial	22,199 (Bedding and Coarse Sand)
Industrial Sand	112,220 (Fine Sand)
Foundry, Moulding	
Glass	
Other (Specify)	3,452 (Overburden)
Total Site Production	**158,420**

2.6. Production Sales and Transport Next 12 Months

It is expected that production will increase over the next 12 months as production from Stage 5A ramps up. It is anticipated that Industrial Sand sales will continue to be strong while construction sands and blended products will improve with increased construction activities within the region.

It is possible that further disruptions to market conditions may occur over the next 12 months. The construction industry in the Illawarra was severely impacted by prolonged wet weather in the first half of 2022 and long range weather forecasts indicate that the second half of 2022 may also have higher than average rain days. Other factors include production constraints caused by further flooding.

3. Actions to be completed from the Last Annual Review

Table 8 Completed Actions (FY21 Annual Review)

Aspect	Actions Taken	Section Discussed
Continue rehabilitation monitoring of planted sections of Swamp Oak Forest and Freshwater Wetland EEC in Stage 2 and Re-aligned Western Tributary.	Rehabilitation and Maintenance of planted sections by licenced bush regenerators has continued. Progress photos are included in Appendix E.	Appendix E
Plant out a further section of Swamp Oak forest on the eastern edge of Stage 2	Stage 2 Swamp Oak was planted in November 2021. Additional plantings were planned for early spring but the work delayed due to extended wet weather. This work will continue over the coming reporting period.	Section 6
Continue backfilling and landform construction in Stage 2 3 starting with the Eastern edge and the south eastern tidal zone.	Backfilling of Stage 3 Eastern edge has continued using VENM. Stage 2 has been backfilled with a combination of VENM and PASS.	Section 4.4.2.3 and 4.9
Continue assessing salinity in the southern section of Stage 3 as per the recommendations in the DLSP EIS	This work is continuing and the data over the past three years has shown that salinity levels in Stage 3 have varied in response to natural climatic conditions	4.4.2.2
Follow up with DPIE for approval for the use of site specific trigger values as per the independent auditor recommendations. When approval is provided, update the Stage 2, 3 and 4 Water Management Plan	The Stage 5 Surface Water Management Plan has been approved with Site Specific Trigger Values (SSTV). The next reporting period will focus on collating 15 years of Stage 2-4 data to devise SSTV for Stage 2-4 and combine the management plans into one document	4.4.4
Proceed with Stage 5 operations as per the associated management plans	This represented the main achievement over the reporting period. Extraction is now occurring in Stage 5A	2.3
Review and if necessary, update management plans as per S5.C4 post Annual Review and IEA	All relevant management plans have been reviewed and updated as necessary.	2.2

4. Environmental Performance

DLSP has comprehensive management and monitoring programs, which collect information and data to enable the assessment of environmental impacts, regulatory compliance and performance against continual improvement objectives. Specific Management Plans define the framework for measuring environmental performance and compliance with statutory requirements for each relevant aspect of environmental performance

4.1. Meteorological Monitoring

An onsite weather station is located at DLSP which collects a range of meteorological parameters. This system was upgraded as part of the transition to real time air quality monitoring at Dunmore Quarry. The location of the weather station is shown in Appendix A.

There are currently no prescribed impact assessment criteria associated with the weather station monitoring data, with the meteorological monitoring used to provide background information for the management of the site. A detailed summary of the current reporting period and historical rainfall data can be found in Appendix A.

4.1.1. Meteorological Monitoring - Long Term Analysis and Trends

The current reporting period was wetter than average, with 1,978mm of rain falling over the reporting period. The highest volume month was March which experienced 256mm of rainfall over a five day period between 2 March 2022 and 7 March 2022.

Typically winds during the reporting period originated from the west and west-south-west for the majority of the year. In Summer, prevailing winds were also from the north-east. These results are mostly consistent with historic trends and generally had a greater concentrations of winds from the west and north-east.

4.1.2. Meteorological Monitoring Summaries and Opportunities for Improvement

The weather station is now capable of providing real time data via download, which is an upgrade from the previous station. The next reporting period will focus on continuing the processes established during the current reporting period.

4.2. Air Quality Monitoring

Two methods of monitoring air quality are used at DLSP. Deposited dust gauges are used to measure the value of deposited dust every 30 days (+/- 2 days). A High Volume Air Sampler (HVAS) is used to measure fine particulate matter under 10 microns (PM_{10}) every 6 days.

The locations of the compliance air quality monitoring locations are shown below. As part the Air Quality Monitoring Plan (AQMP) the site also monitors the following locations depicted in green in Figure 2 as background data for the Stage 1/Stage 5 operations.

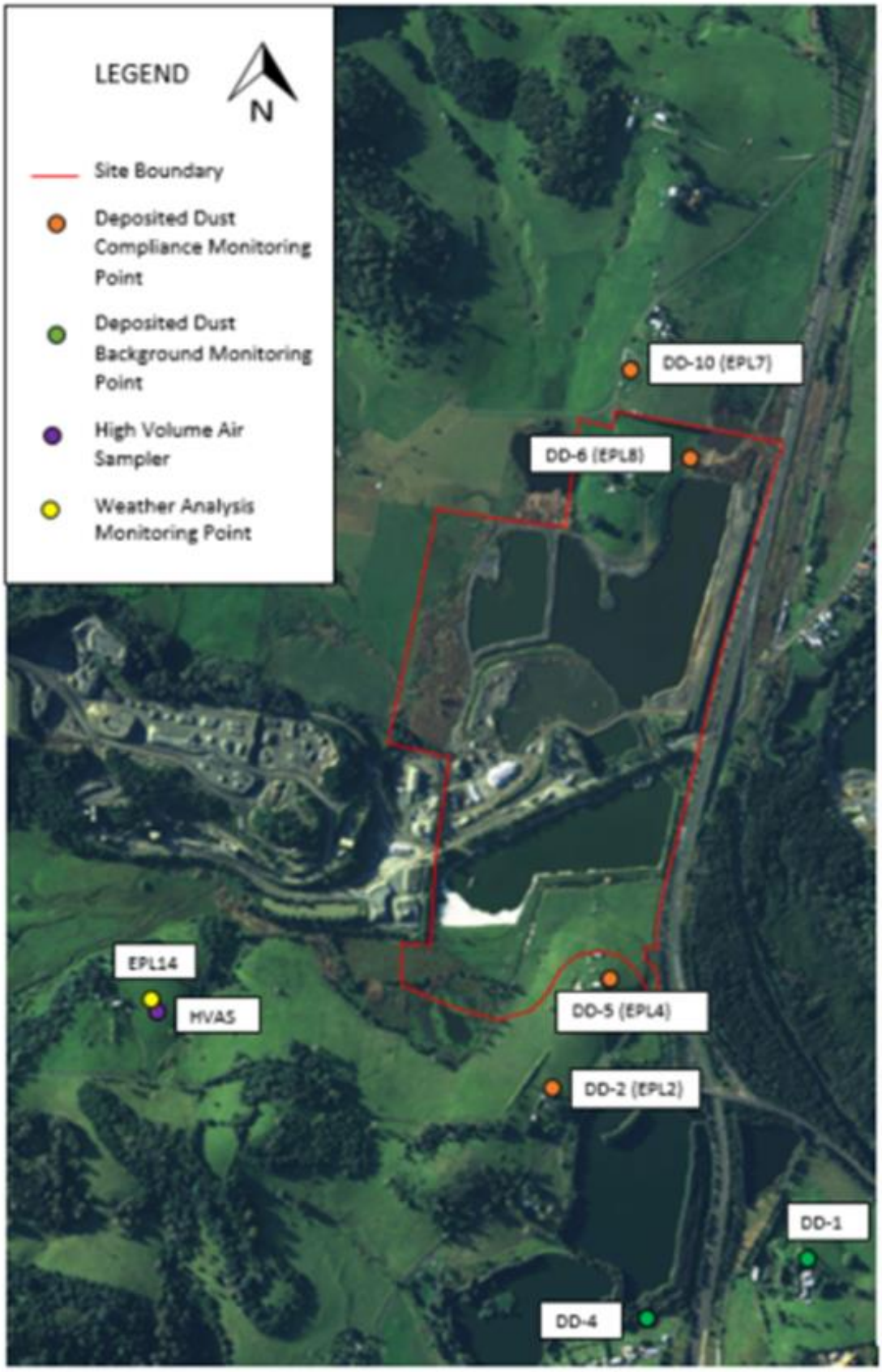

Figure 2 Air Quality Monitoring Locations

4.2.1. Deposited Dust Assessment Criteria

Deposited Dust impact criteria is assessed at a residence located on privately owned land. It is important to note that the assessment criteria refers to an annual averaging period (i.e. the rolling monthly average over the last 12 months).

The Impact Assessment Criteria is shown in Table 9.

Table 9 Deposited Dust Impact Assessment Criteria

Pollutant	Averaging Period	Criterion	
Deposited Dust[c]	Annual	2g/m^2/month[b]	4g/m^2/month[a,d]

[a] Cumulative impacts (i.e. increases in concentration due to development plus all other sources)

[b] Incremental impact (i.e. increases in concentration alone, with zero allowable exceedances of criteria over the life of the development.

[c] Deposited dust is defined as insoluble solids

[d] Excludes extraordinary events such as bushfires, prescribed burning, dust storms, sea fog, fire incidents or any other activity as agreed by the Secretary.

4.2.2. Deposited Dust Monitoring Performance Review

All air emission monitoring sites were below the required assessment criteria for dust measured as insoluble solids over the annual averaging period. All sites were also below the 4g/m^2/month for the ash fraction, which excludes the organic (combustible) components of the dust sample such as vegetation, bird droppings and insects. These organic contaminants within the sample are typically representative of the surrounding wetlands and farmland areas within which the monitors are located.

A summary of deposited dust results measure at the gauge for the four compliance monitoring points is shown in Table 10 below. Additional dust monitoring is undertaken as background and shown in Table 11.

Table 10 Deposited Dust Compliance Monitoring Summary

Month	DD-2 (EPL2) grams/m^2/month		DD-5 (EPL4) grams/m^2/month		DD-6 (EPL8) grams/m^2/month		DD-10 (EPL7) grams/m^2/month	
	Insoluble Solids	Ash	Insoluble Solids	Ash	Insoluble Solids	Ash	Insoluble Solids	Ash
FY22 average	1.25	0.65	1.54	0.92	1.79	1.05	1.64	0.85
Criteria	4	-	4	-	4	-	4	-

Table 11 Deposited Dust Background Monitoring Summary

Month	**DD-1** grams/m^2/month		**DD-4** grams/m^2/month	
	Insoluble Solids	Ash	Insoluble Solids	Ash
FY22 average	2.07	0.88	3.07	1.20
Criteria	4	-	4	-

Monitoring sites recorded similar values for insoluble solids, indicating that regional conditions are the largest contributors to measured dust levels rather than development operations at DLSP. These findings are within expectations as resource extraction at DLSP is a wet process.

The DD-4 monitoring location was again observed to be higher for insoluble solids, however possessed a similar ash fraction to other monitoring sites. Despite the higher numbers the measured value were still below 4g/m2/month for insoluble solids. This is again within expectation as the DD-4 monitor is located in the immediate vicinity of the constructed wetlands as part of the Stage 1 rehabilitation at Swamp Road. Often DD-4 has more insects and vegetation within the dust sample, which is reflective of the surrounding land use rather than the DLSP operations. It is important to note that these monitoring points are background only and not compliance monitoring points.

Measured dust as insoluble solids rose above the impact assessment criteria of 4g/m^2/month on three occasions in total over the reporting period. These measurements were at DD-1 and DD-4 monitoring locations which are not compliance monitoring points. During September 2021 and January 2022, high readings of 7.21g/m^2/month and 10.31g/m^2/month respectively, were recorded at DD-1, and 5.01g/m^2/month was recorded at DD-4. The wind direction was from the west in September 2021 and from the Northeast in January 2022 (see Figure 27 and 28 in Appendix A). These wind directions are not from the direction of DLSP operations at these monitoring locations and are likely reflective of ambient conditions rather than operations. Despite these elevated readings, monitoring results were well below impact assessment criteria and compliance thresholds.

The rolling 12 month average for insoluble solids at each monitoring location was below 4g/m^2/month, as shown by the yellow line in Figures 3 to 8. This demonstrates that operations were compliant during most stages of the reporting period despite the external influences.

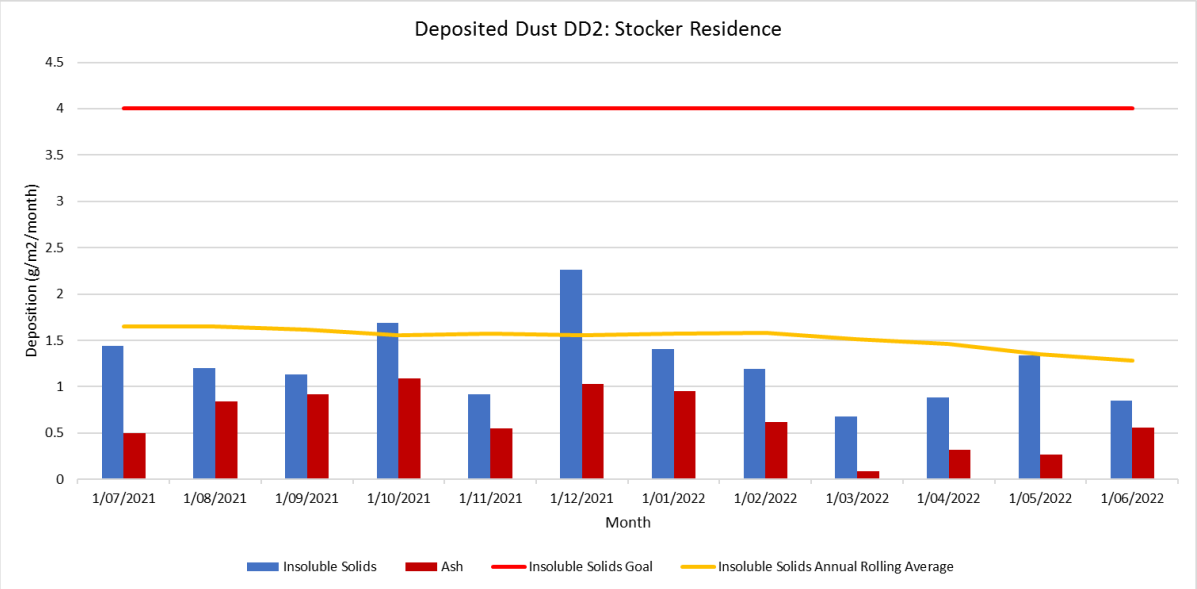

Figure 3 DD-2 Deposited Dust Monitoring Summary

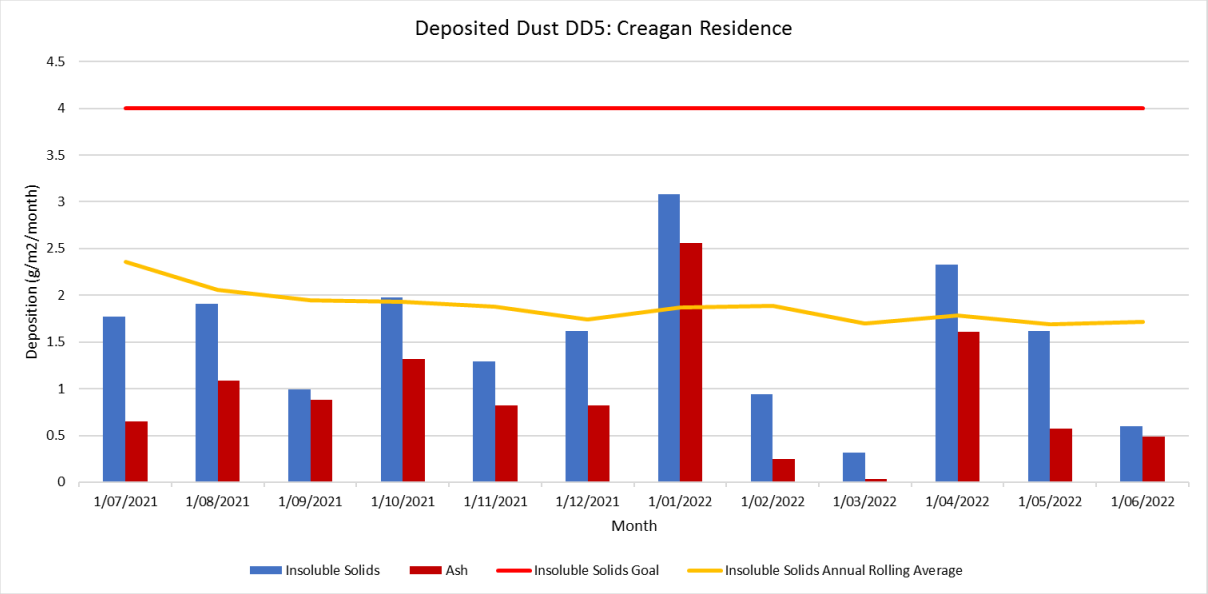

Figure 4 DD-5 Deposited Dust Monitoring Summary

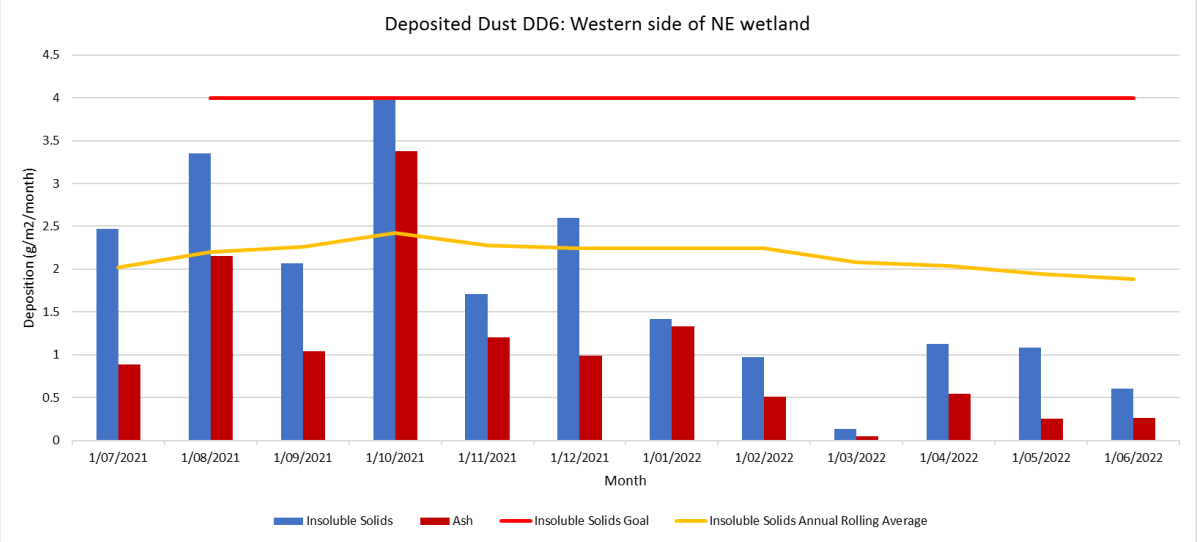

Figure 5 DD-6 Deposited Dust Monitoring Summary

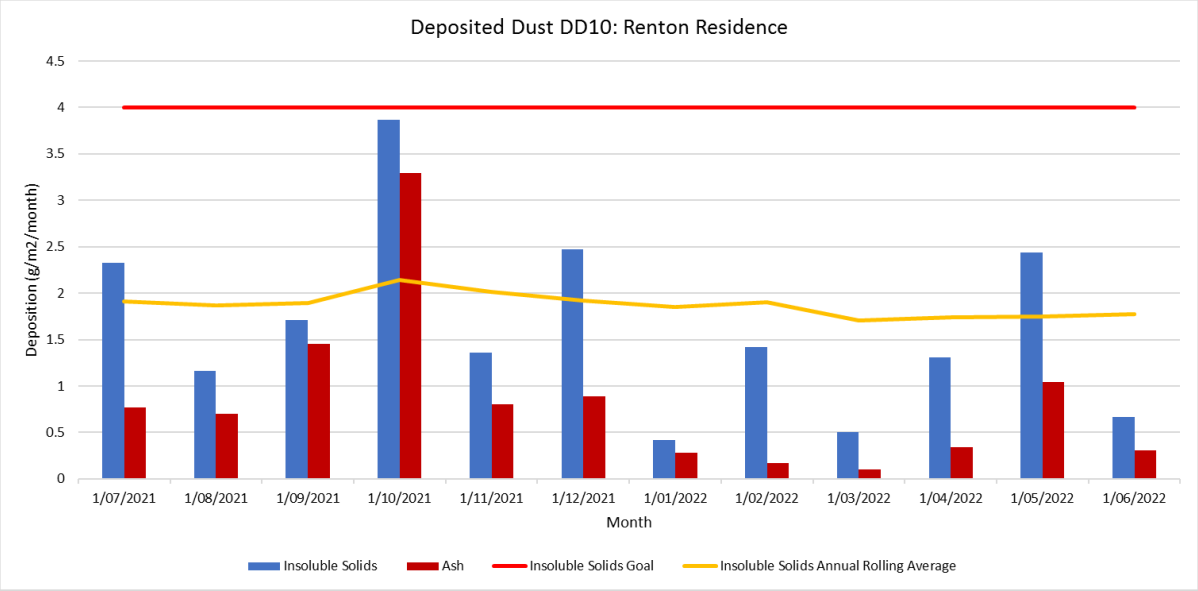

Figure 6 DD-10 Deposited Dust Monitoring Summary

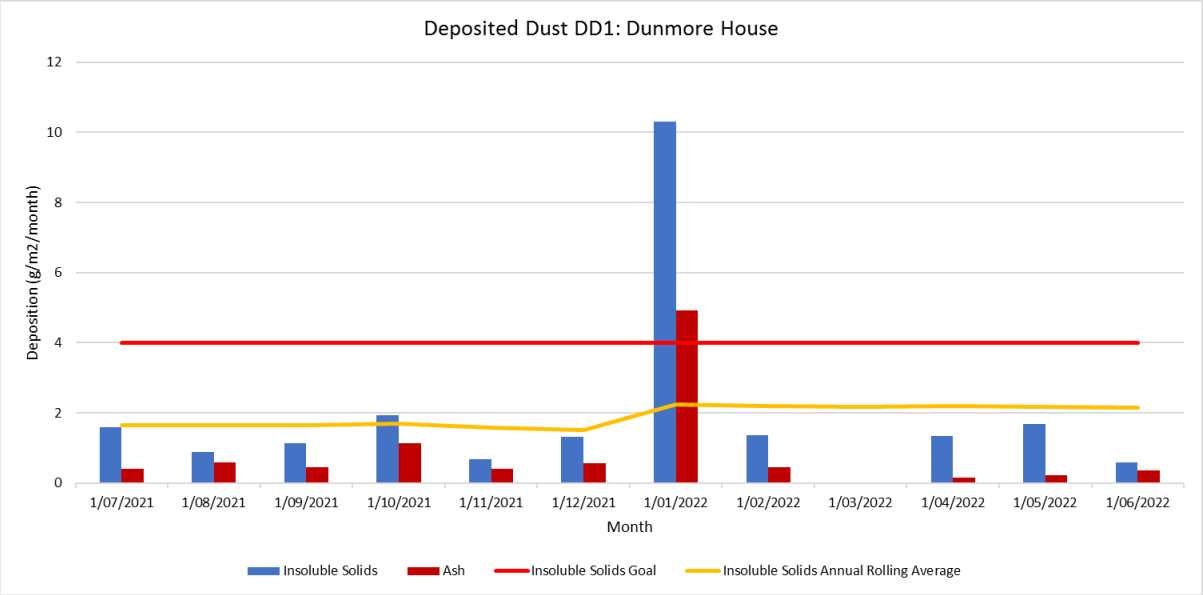

Figure 7 DD-1 Deposited Dust Monitoring Summary

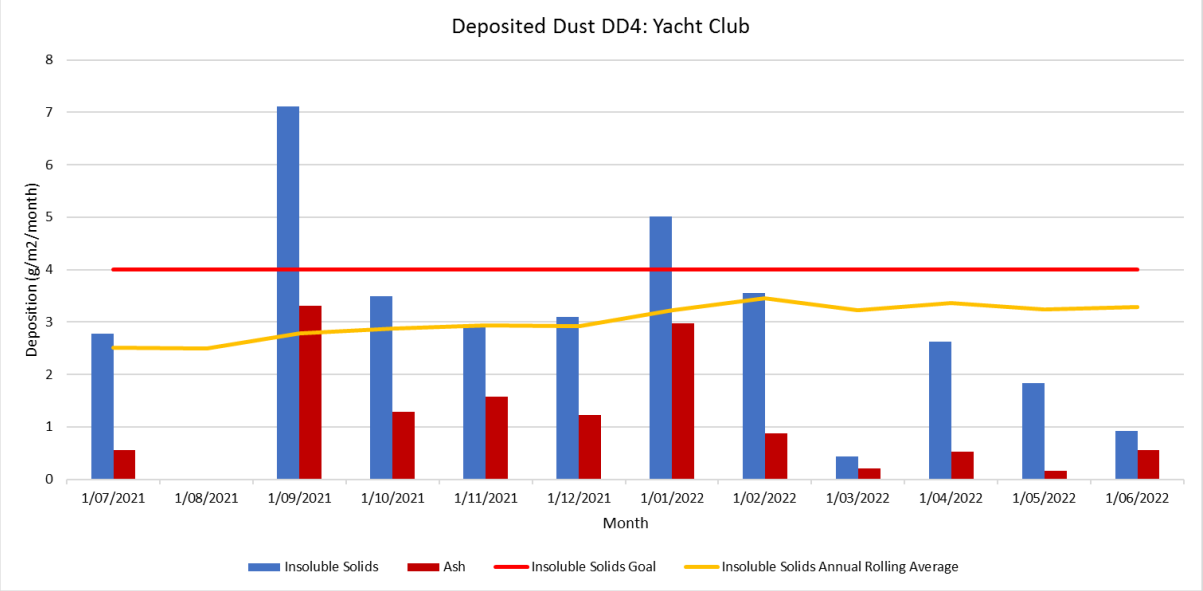

Figure 8 DD-4 Deposited Dust Monitoring Summary

4.2.3. Particulate Monitoring Assessment Criteria

The impact assessment criteria for Particulate Monitoring as per Condition S3.C19 of the consent is shown below in Table 12.

Table 12 Particulate Monitoring Assessment Criteria

Pollutant	Averaging Period	Criterion
PM_{10}	Annual	[a,d] 30 µg/m³
PM_{10}	24 hour	[b] 50 µg/m³
TSP	Annual	[a,d] 90 µg/m³

a Cumulative impacts (ie increases in concentration due to development plus all other sources) b Incremental impact (ie increases in concentration alone, with zero allowable exceedances of criteria over the life of the development. d Excludes extraordinary events such as bushfires, prescribed burning, dust storms, sea fog, fire incidents or any other activity as agreed by the Secretary

4.2.4. Particulate Monitoring Performance Review

PM_{10} readings from the current reporting period can be seen in Figure 9 below.

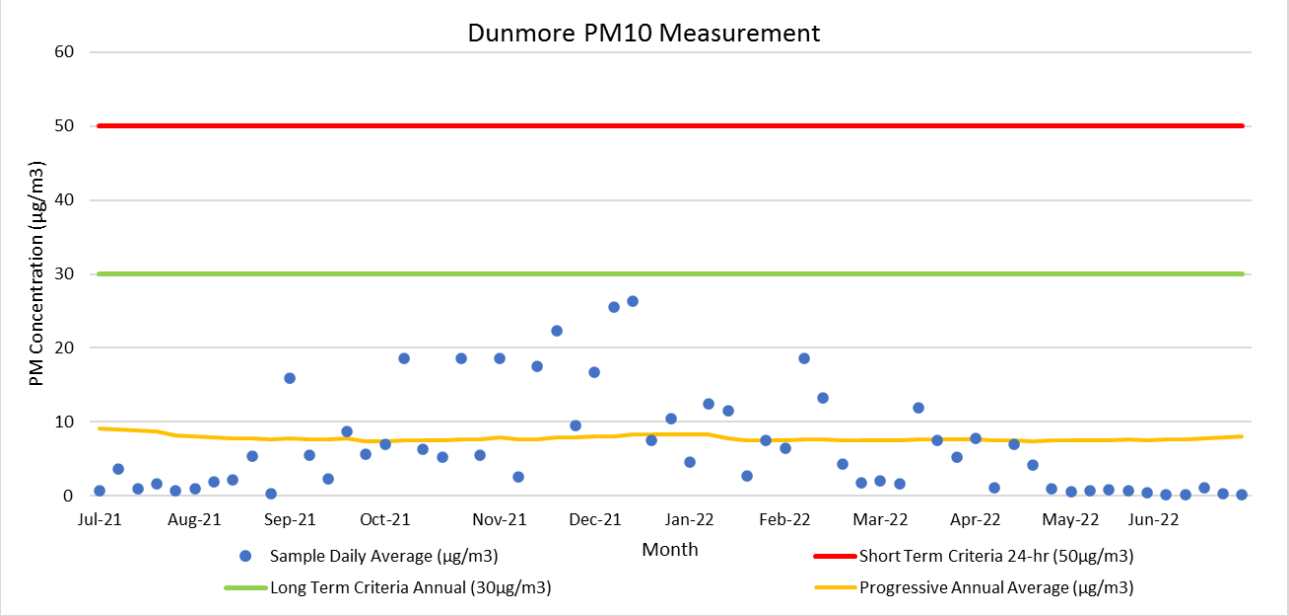

Figure 9 Dunmore PM_{10} Monitoring Summary

The annual average PM_{10} measurement for the reporting period was below the long term impact assessment criteria of 30 µg/m³ for PM_{10} and 90 µg/m³ for TSP. The PM_{10} measurements were also similar to the Albion Park South air quality monitoring station's annual averages.

There were no readings above the short term criteria for PM_{10} of 50 µg/m^3 or the long term criteria for PM_{10} of 30 µg/m^3.

TSP concentrations are not measured in the vicinity of the quarry, however annual average TSP concentrations can be derived based on typical ratios of PM_{10}:TSP. Rural areas (such as DLSP), typically experience a PM_{10}:TSP ratio of 0.4. This ratio has been applied to the annual

average PM_{10} concentrations to derive a representative TSP background concentration in µg/m³. This methodology is in-line with the method used by Ramboll in the MOD 9 Environmental Assessment for the Dunmore Quarry.

Table 13 Summary of Particulate Matter Monitoring Data

Pollutant	Dunmore Quarry current reporting period average (µg/m³)	Albion Park current reporting period average(µg/m³)	Dunmore Quarry Long Term average (µg/m³)
Measured HVAS PM_{10}	6.75	8.30	13.02
Derived TSP	16.88	20.74	32.33

4.2.5. Air Quality Monitoring Long Term Analysis and Trends

A graph of long term trends can be found in Figure 10 below and typically shows that deposited dust observed at the site has decreased over time.

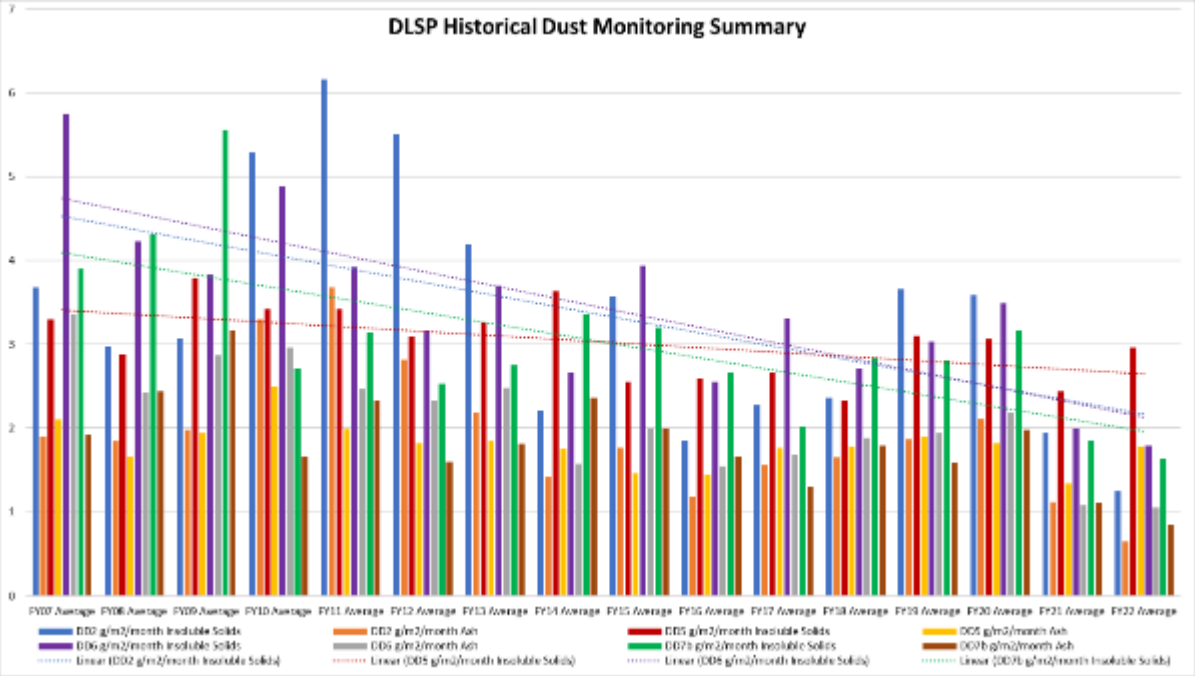

Figure 10 Historical Deposited Dust Trends

A general trend that has been observed, is that measured deposited dust is typically higher in dry summer months than winter months, which is to be expected. This trend is also confirmed by the PM_{10} measurements and is generally reflective of regional conditions as a whole.

Figure 11 shows a 90 day average in black, which illustrates a seasonal fluctuation of measured PM_{10} values. A trend can be observed whereby PM_{10} values are typically higher during summer dry periods and are lower during the winter periods.

This fluctuation is mirrored in the OEH Albion Park PM_{10} monitor available on the OEH website (https://www.dpie.nsw.gov.au/air-quality/air-quality-data-services/data-download-facility).

These trends indicate the measured PM_{10} and deposited dust values are typically influenced by ambient local conditions rather than development operations at DLSP.

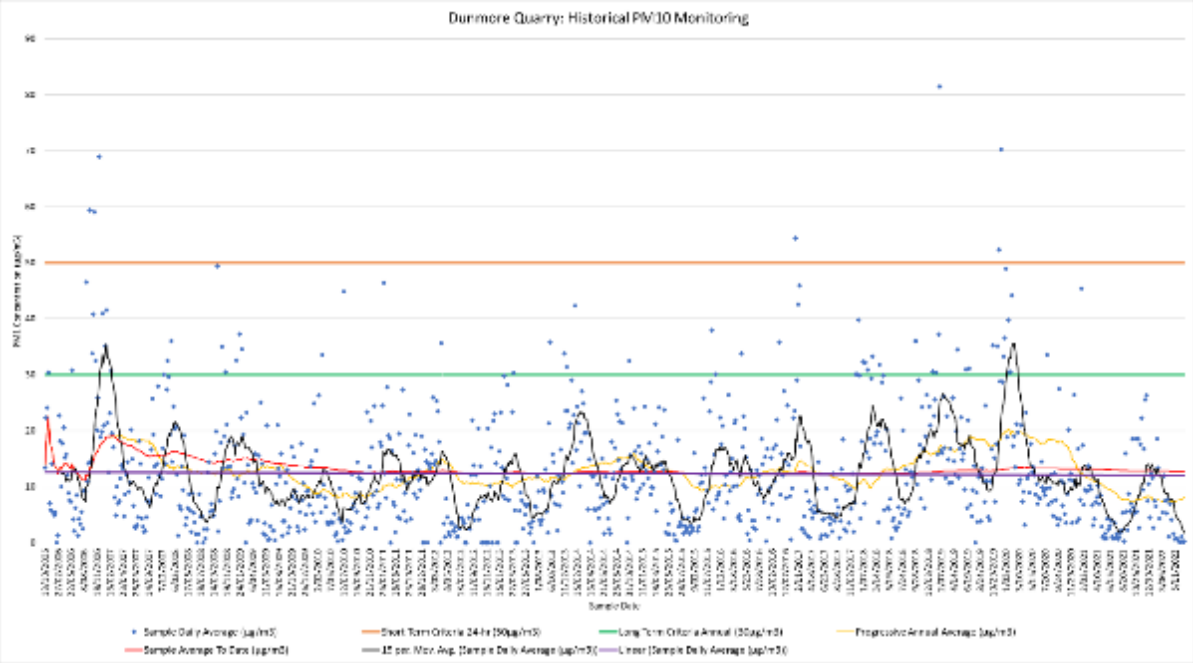

Figure 11 PM_{10} Historical Monitoring Trends

4.2.6. Air Quality Monitoring Summary and Opportunities for Improvement

Deposited dust measurements were observed to occur below the impact assessment criteria for all compliance monitoring points. Derived TSP and PM_{10} measurements were generally observed to be below the impact assessment criteria for all time periods. Analysis of long term monitoring trends typically suggest that local ambient regional conditions (especially regional bushfires) have a greater impact on air quality results than DLSP operations.

Resource extraction at DLSP occurs as a wet operation via dredging with an associated low risk of mobilising dust or particulate matter. Dust mitigation methods and controls on site have been effective at minimising any generated dust or particulate matter.

As part of the updated AQMP, DLSP will utilise the real time dust monitoring network from the adjacent Boral Dunmore Quarry operations. A monitor has been located adjacent to the Stage 5 extraction area. This will allow a proactive approach in identifying and reacting to adverse meteorological and air quality conditions as per the approved trigger action response plan which forms part of the Air Quality Management Plan.

4.3. Noise Monitoring

Annual Noise Monitoring is generally undertaken during winter each year to determine the contribution by DLSP to noise impacts experienced at nearby private residences. However, monitoring was carried out on 2 September 2021 and 3 September 2021 during this reporting period. The monitoring was delayed due to Covid-19 restrictions and the EPA and DPE were notified on the 30/7/21 via a phone meeting. Delayed monitoring was approved as NSW was entering COVID restrictions limiting travel and the site is located in Shellharbour which at the time was outside of the Sydney and surrounds restricted area.

The annual noise monitoring undertaken during the current reporting period indicated compliance with the relevant noise limits.

4.3.1. Noise Monitoring Impact Assessment Criteria

Associate noise limits extracted from L3.1 in EPL 11147 and S3.C13 from DA 195-8-2004 are reproduced below in Table 14.

Table 14 Summary of Noise Monitoring Data

Receiver Location	Noise Limits dB (A)			
	LAeq (15 minute)			
	Shoulder	Day	Evening	Night
DN-6 Renton	46	46	43	37
DN-7 Dunmore Village	47	49	44	41
DN-8 Stocker	47	49	44	38

4.3.2. Noise Monitoring Performance Review

Noise monitoring was conducted in accordance with the Noise Management Plan (V5) and in general accordance with the NSW Environment Protection Authority (EPA), Noise Policy for Industry (NPfI). The results of the monitoring are summarised within the Annual Noise Monitoring Assessment 2021, prepared by Muller Acoustic Consulting Pty Ltd and included in Appendix C.

The report includes a compliance assessment summary for each monitoring location (DN-6, DN-7, DN-8) which is excerpted in Table 15. It illustrates that annual noise monitoring data complied with project noise limits described all times.

Table 15 Annual Compliance Noise Monitoring Report

Noise Compliance Assessment Summary				
Location No.	**Period**	**DLSP Contribution dB $LA_{eq(15min)}$**	**Criteria dB $LA_{eq(15min)}$**	**Compliant**
DN-6	Day	<40	46	✓
DN-7	Day	<45	49	✓
DN-8	Day	<45	49	✓
DN-6	Evening	<40	43	✓
DN-7	Evening	<40	44	✓
DN-8	Evening	<40	44	✓
DN-6	Night	<35	37	✓
DN-7	Night	<35	41	✓
DN-8	Night	<35	38	✓
DN-6	Morning Shoulder	<45	46	✓
DN-7	Morning Shoulder	<45	47	✓
DN-8	Morning Shoulder	<45	47	✓

4.3.3. Noise Monitoring Long Term Analysis and Assessment

Attended noise readings have typically remained stable or decreased slightly in the last 10+ years as seen in Figure 12 below. Noise monitoring results were similar in the current reporting period, despite lower production volumes and operations compared to the previous reporting period. It is important to note that noise monitoring was still within the compliance limits prescribed.

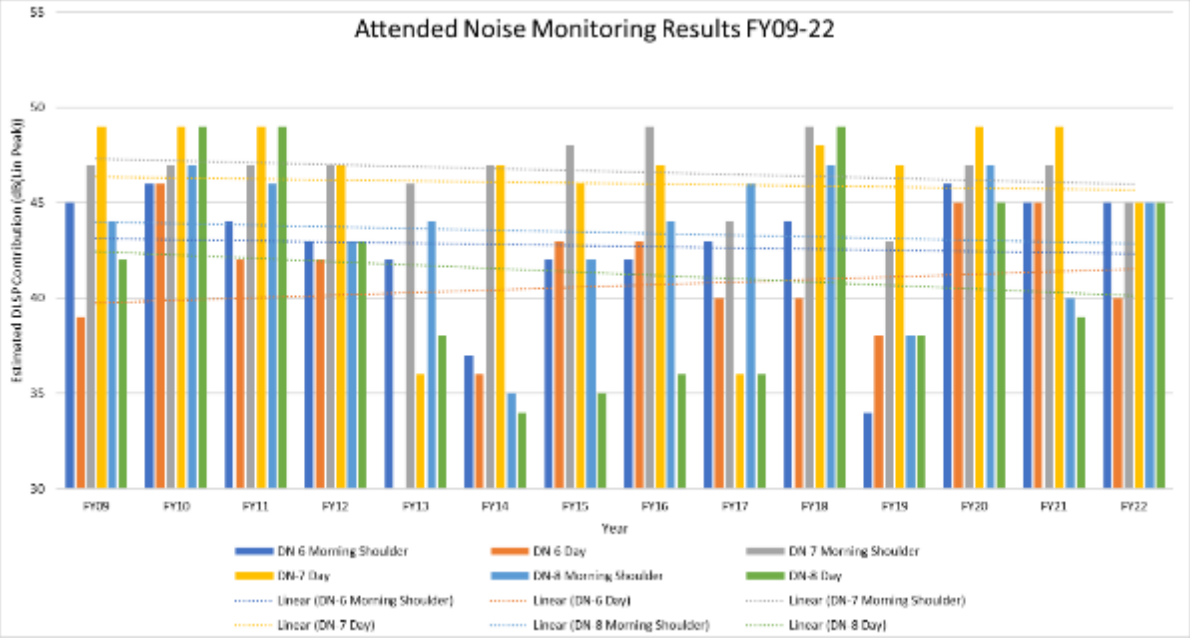

Figure 12 Noise Monitoring Historical Noise Monitoring Trends

4.3.4. Noise Monitoring Summary and Opportunities for Improvement

The noise monitoring results were within compliance limits during the current reporting period.

In the previous reporting period, the weather station was upgraded on the site to enable personnel to immediately access weather information. This has allowed the site to improve their processes in reacting to adverse meteorological conditions, which may affect noise impacts on nearby sensitive receptors, such as temperature inversions.

4.4. Surface Water Monitoring

Project related water monitoring locations are shown in shown in Figure 13. Monitoring locations denoted by "*" have a variable location due to dredging operations. Monitoring is undertaken on a monthly basis, consistent with EPL 11147 requirements.

Monitoring is also undertaken in the Stage 2 dredge pond and the fines pond during the placement of Potential Acid Sulphide Soils (PASS) for rehabilitation. The required frequency described in condition E1-E11 in EPL 11147 is daily for a period of 30 days for surface waters. Monitoring then reverts back to weekly frequency until PASS is received again. During the reporting period PASS was placed in the Stage 2 pond (placement commenced 26 June 2018) and the Fines Pond 2 (placement commenced 13 February 2020).

Discharge water quality monitoring indicated compliance with the impact criteria at the licenced discharge point of the site at DW20b (EPL9), during all periods. Additionally, monthly monitoring results for the dredge ponds were observed to align with predicted EIS results.

The WQO for most parameters within the dredge ponds were met within the reporting period. Typically, water quality within the operational ponds and discharge points were of better quality than those at upstream locations with the exception of salinity and associated parameters.

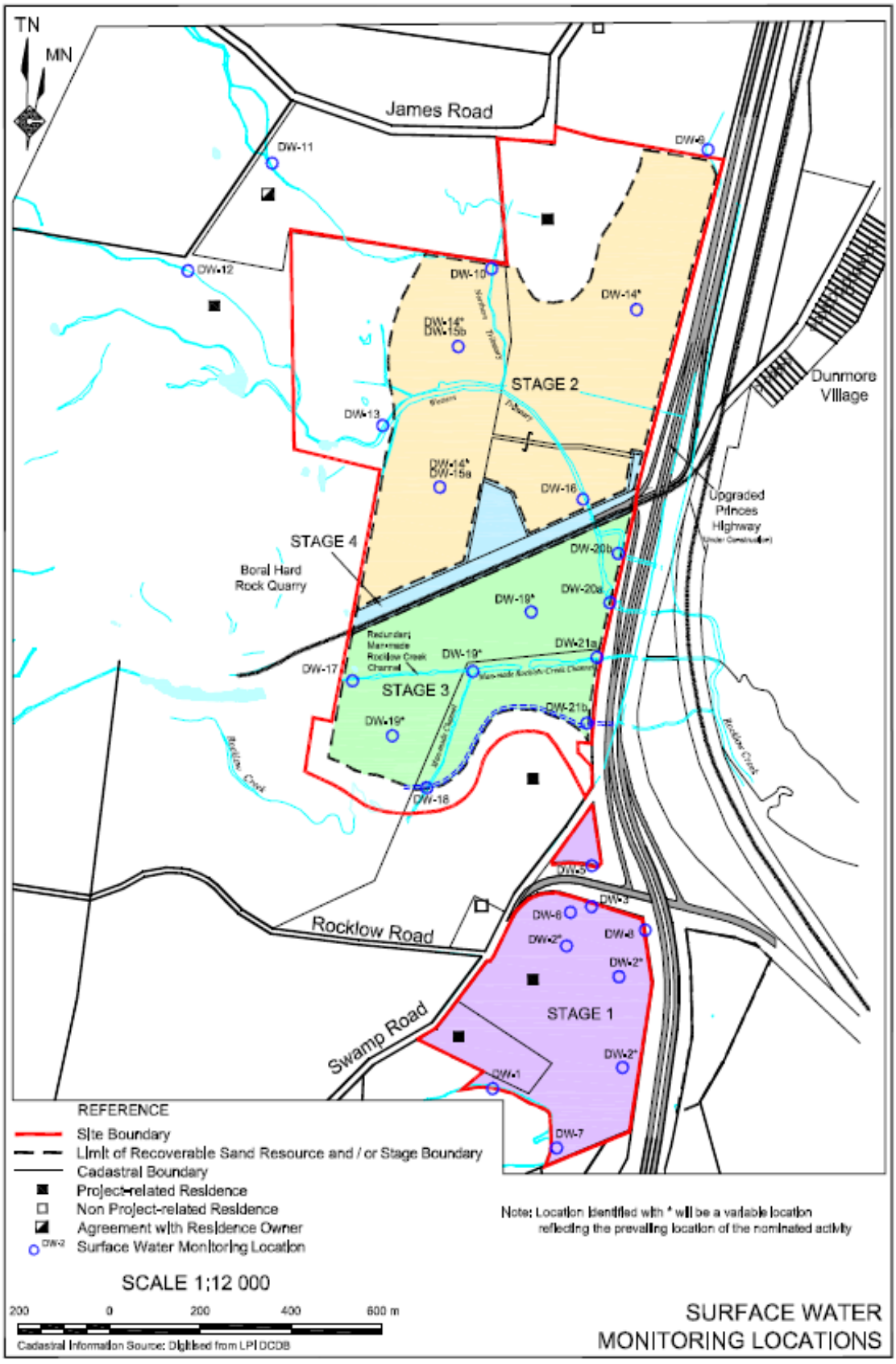

Figure 13 Surface Water Monitoring Locations

4.4.1. Surface Water Quality Impact Criteria

There are 5 compliance monitoring points listed in EPL 11147 which are reproduced below:

- DW 11 (EPL12) – Upstream of Western Tributary in Stage 2
- DW 12 (EPL11) – Upstream of Western Tributary in Stage 2
- DW 18 (EPL13) – Upstream of Rocklow Creek in Stage 3
- DW 20b (EPL9) – Licenced discharge point of DLSP via the re-aligned Western Tributary
- DW 21b (EPL13) – Secondary licenced discharge point to be activated after re-aligning Rocklow Creek. This site has not been activated as Rocklow Creek has not been re-aligned. Extraction is not expected to occur in the southern section of Stage 3 due to the landowners requests.

Discharge water quality criteria for DW20b is detailed in S3.C23 of DA-195-8-2004 and is reproduced below in Table 16.

Table 16 Water Discharge Impact Assessment Criteria

Pollutant	Unit of measure	Total Suspended Solids (mg/L)
Total Suspended Solids	mg/L	50
pH	pH	+/- 1.0 of background (6.6-8.6)

There are two water quality compliance operational monitoring points at DLSP. These are the dredge ponds in Stage 2 (DW-14) and Stage 3 (DW-19). The Water Quality Objectives (WQO) associated with the dredge ponds is detailed below in Table 17.

Table 17 Dunmore Lakes Sand Project Water Quality Objectives

Pollutant	Unit of Measure	Water Quality Objective
Turbidity	NTU	5-20
pH	pH	6.5-8.5
Salinity	µS/cm	<1,500
Dissolved Oxygen	mg/L	>6
Total phosphorous	µg/L	5-50
Total nitrogen	µg/L	100-500
Chlorophyll-a	µg/L	2-10
Faecal coliforms	Medium No./100mL	<1,000
Enterococci	Medium No./100mL	<230
Algae and blue-green algae	No. cells/mL	<15,000
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	mg/L	20

DPIE has acknowledged that short term exceedances of these objective may occur during natural events such as heavy rainfall or tidal saline water flow. This notation is important in consideration of the tidal inflow that occurs at the DLSP development, which subsequently impacts the water quality results for the site.

Additional monitoring points are collected as part of the approved Water Management Plan, to provide additional background water quality data for water entering the DLSP operational area and are summarised below:

- DW-9 Upstream of Stage 2 Eastern Tributary
- DW-10 Upstream of Stage 2 Northern Tributary
- DW-13 Upstream of Stage 2 Western Tributary
- DW 15a Fines Pond
- DW 16 Water transfer point between Stage 2 and Stage 3
- DW-21a Background monitoring for the man-made Rocklow Creek channel

4.4.2. Surface Water Monitoring Performance Review

4.4.2.1. Ambient Monthly Monitoring

A summary of the water quality monitoring points is shown below in Table 18. The dredge pond (DW-14 and DW-19) and discharge point (DW20b) are shown in grey. Parameters outside of the water quality objectives are highlighted orange. Sites in white are upstream monitoring locations and are monitored for background purposes only.

Table 18 Surface Monitoring Summary including annual averages per site

Sample ID	DW9	DW10	DW11	DW12	DW13	DW14	DW15a	DW16	DW18	DW19	DW20b	DW21a
pH	7.4	6.9	7.7	6.6	7.2	7.9	7.8	7.8	7.1	7.9	8.0	7.2
Turbidity (NTU)	69.24	15.19	14.50	19.33	68.47	35.35	129.78	23.24	26.14	22.92	22.51	14.11
TSS (mg/L)	53.17	21.67	13.38	19.50	51.10	41.50	102.33	22.75	30.25	23.92	20.75	15.55
EC (µS/cm)	350.08	328.33	860.25	276.75	536.91	657.75	978.83	671.92	385.58	1239.83	862.58	2570.82
Sulphate (mg/L)	15.2	8.2	21.0		45.7	91.3	109.7			64.3		
Chloride (mg/L)	49.4	50.5			65.8	80.3	174			286.7		
Iron (mg/L)	1.6	0.9			0.3	0.6	0.9			0.5		
Potassium (mg/L)	3.5	4.3			3.1	5.1	6.7			12.6		
Magnesium (mg/L)	6.8	7.3			10.3	12.3	14.8			15.1		
Sodium (mg/L)	26.3	24.3			45.6	50.9	63.6			69.8		
Total Phosphorous (mg/L)	0.2	0.1			0.1	0.2	0.1			0.2		
Ammonia -N (mg/L)	0.1	0.2			0.1	0.1	0.1			0.1		
Bicarbonate Alkalinity (mg/L)	77.9	79.8			131.5	112	115			89		
Total Nitrogen (mg/L)	1.2	0.8			0.6	0.9	0.6			1.0		
Dissolved Oxygen (mg/L)	8.2	7.4			7.9	8.6	8.2			8.4		
Faecal Coliforms (CFU/100mL)	25.6	35.5			32.5	11.8	10.2			38.0		
Enterococci (CFU/100mL)	44	22			198	5.3				260		
Total Algae (cells/ml)	413.4	1179.7			125	25946	2332			27770		
Chlorophyll-a (mg/m^3)	3.8	11.0			1.8	3.2	12.1			6.5		

Note: Compliance status is only required for existing dredge ponds. The other data points are provided to indicate the equivalent quality of surrounding water ways

Upstream drainage channels (DW-9, DW- 10, DW-11, DW-12, and DW-13) are ephemeral and are generally impacted by upstream agriculture land uses with cattle grazing often observed in the immediate vicinity of monitoring locations. These streams flow directly into the Stage 2 dredge pond and subsequently impact the ponds water quality.

Upstream monitoring points are located away from the tidal zone at Rocklow Creek and are typically fed by springs and run-off following rainfall events. Typically, water quality within operational ponds and discharge points are of higher quality than the upstream conditions.

4.4.2.2. Stage 3 Pond Salinity Assessment

As recommended during the EIS process, water quality monitoring of the Stage 3 pond area has continued in order to determine if there are any long term salinity issues arising. The concern related to the dredge ponds intersecting with saline tidal groundwater aquifers which could result in surface water quality deterioration and potential risk to rehabilitation sustainability.

As shown on Figure 14 below, the level of salinity has progressively declined over the past three years.

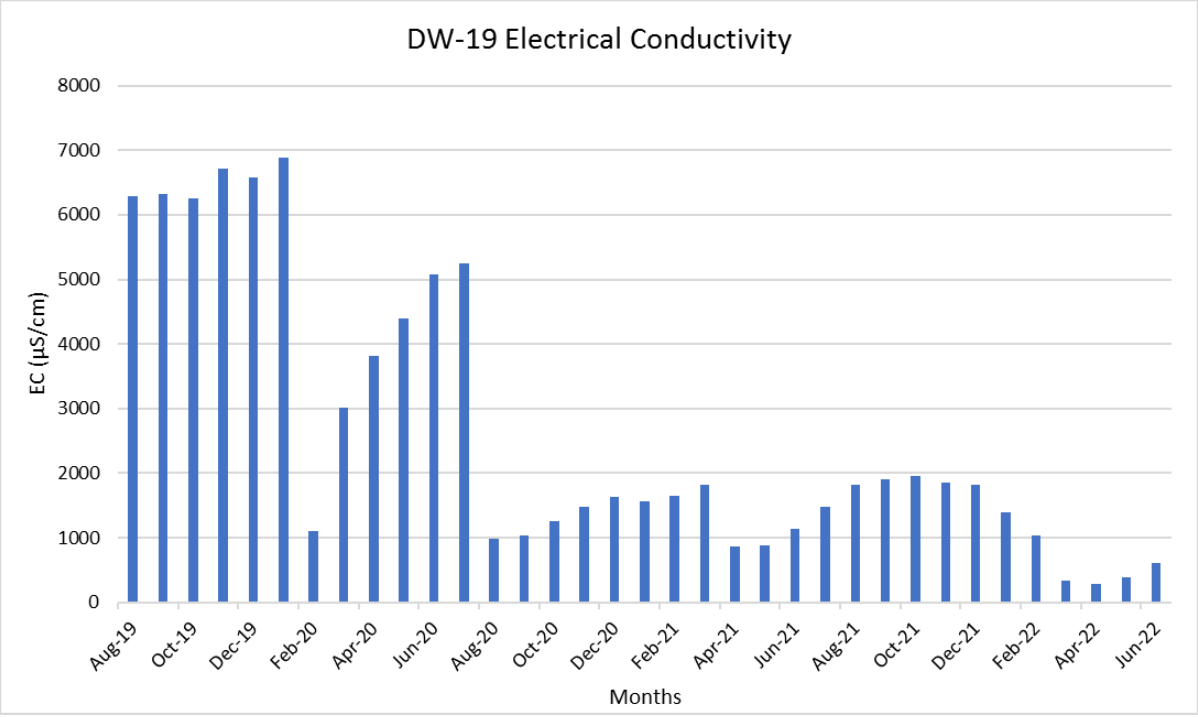

Figure 14 Stage 3 Conductivity Monitoring Trends

Although the overall salinity trend is down, there are seasonal variations that occur. Longer term variations may also be present from climatic changes. The 2019 period was extremely dry which would have resulted in a greater concentration of salts due to evaporation coupled with low rainfall and low inflows of freshwater from stormwater runoff. Conversely, in early 2022, there was a sustained increase in rainfall resulting in localised flooding which would significantly reduce salinity levels in Stage 3.

What the data does show is that Stage 3 has not caused a direct linkage with saline groundwater and that salinity levels have tended to vary in accordance with prevailing climatic conditions.

4.4.2.3. Discharge Water Quality Monitoring

Discharge water quality monitoring undertaken during the reporting period was within limits prescribed in condition S3.C23 of the consent during all instances of sampling. A breakdown of discharge water quality monitoring results at DW20b is summarised below in Table 19.

Table 19 Discharge Surface Water Monitoring Results

Sample Type	Date Sampled	48 hr Rainfall (mm)	pH	TSS (mg/L)
Jul Monthly	24/07/2021	25.4	8.6	7
Aug Monthly +50mm	**25/08/2021**	**71.0**	**7.9**	**30**
Sept Monthly	22/09/2021	0	ND*	ND*
Oct Monthly	26/10/2021	5.54	7.17	41
Nov Monthly	26/11/2021	30.61	8.5	7
Dec Monthly	10/12/2021	44.4	8.0	20
Jan Monthly	20/1/2022	5.4	7.7	9
Feb Monthly+50mm	**24/02/2022**	**72.2**	**7.5**	**41**
Mar 50mm	**1/03/2022**	**56.4**	**7.3**	**10**
Mar 50mm	**10/03/2022**	**167.6**	**7.2**	**18**
Mar Monthly	21/03/2022	1	7.5	3
Mar 50mm	**29/03/2022**	**67.2**	**7.1**	**21**
Mar 50mm	**31/03/2022**	**59.8**	**7.1**	**12**
Apr 50mm	**8/04/2022**	**83.4**	**7.3**	**11**
Apr Monthly	27/04/2022	2.4	7.9	14
May 50mm	**12/05/2022**	**66**	**7.1**	**18**
May Monthly +50mm	**23/05/2022**	**60.4**	**7.5**	**23**
Jun Monthly	23/06/2022	0	ND*	ND*
FY22 Average	-	-	7.7	19

*ND: No discharge

Nine (9) rainfall events throughout the reporting period triggered Special Frequency 1 water monitoring to be undertaken as per EPL 11147. Special Frequency 1 requires sampling to be undertaken within 24 hours of 50mm or more of rainfall within a 48 hour period. These events are highlighted in bold on Table 19 and are as follows:

- 24-25 August 2021 (71mm 48 hours)
- 23-24 February 2022 (72.2mm in 48 hours)
- 26-27 February 2022 (56.4mm in 48 hours)
- 8-9 March 2022 (167.6mm in 48 hours)
- 27-28 March 2022 (67.2mm in 48 hours)

- 29-30 March 2022 (59.8mm in 48 hours)
- 6-7 April 2022 (83.4mm in 48 hours)
- 10-12 May 2022 (66mm in 72 hours)
- 21-22 May 2022 (60.4mm in 48 hours)

From the 24 to 25 August, 71mm of rain fell in two days. Sampling was undertaken on 25 August 2021 in response to this event.

During 23 and 24 February, 72.2mm rain fell in 2 days. Sampling was undertaken on 24 February 2022 in response to this event.

During 26 and 27 February, 56.4mm rain fell in 2 days. The site was unable to be accessed on 26 and 27 February due to safety concerns and flash flooding, which caused site closure. As per note 2 within condition M2.3 the site notified the EPA that sampling would be delayed until it was safe to do so 1 March 2022. Dredging and backfilling operations ceased during periods of overflow of the dredge pond in accordance with the EPL 11417 conditions.

During 8 and 9 March, 167.6mm rain fell in 2 days. The site was unable to be accessed from the 4th to the 8th March due to safety concerns and flash flooding, which caused site closure. As per note 2 within condition M2.3 the site notified the EPA that sampling would be delayed until it was safe to do so 10 March 2022. Dredging and backfilling operations ceased during periods of overflow of the dredge pond in accordance with the EPL 11417 conditions.

From the 27 to the 28 March, 67.2mm rain fell in 2 days. Sampling was undertaken on 29 March 2022 in response to this event.

During 29 and 30 March, 59.8mm rain fell in 2 days. The site was unable to be accessed from the 29th to the 30th March due to safety concerns and flash flooding, which caused site closure. As per note 2 within condition M2.3 the site notified the EPA that sampling would be delayed until it was safe to do so 31st March 2022. Dredging and backfilling operations ceased during periods of overflow of the dredge pond in accordance with the EPL 11417 conditions.

During 6 and 7 April, 83.4mm rain fell in 2 days. Sampling was undertaken on 8 April 2022 in response to this event. From the 10 to the 12 May, 66mm rain fell in 3 days. Sampling was undertaken on 12 May 2022 in response to this event.

From the 21 to the 22 May, 60.4mm rain fell in 2 days. Sampling was undertaken on 23 May 2022 in response to this event.

4.4.2.4. Water Monitoring after Placement of PASS

Special Frequency 2 water monitoring is required in ponds where Potential Acid Sulphate Soils (PASS) has been placed as per E1.8 note of EPL 11147. Special Frequency 2 is required to be conducted daily during the PASS placement into water and thereafter daily during operational hours for a period of one month from the date the last load of PASS was placed under water. The pH of the water must be monitored weekly at all other times.

During the reporting period, PASS continued to be placed in the Stage 2 pond DW 14 (placement commenced 26 June 2018) and the Fines Pond 2 DW15a (placement commenced 13 February 2020). No PASS has been placed in Stage 3.

PASS material is typically received in “campaigns” and there were three periods where PASS importation had ceased for 30 days and monitoring reverted back to the weekly sampling regime.

A summary of the water quality monitoring after placement of PASS in the Stage 2 dredge pond is shown below in Figure 15 and 16.

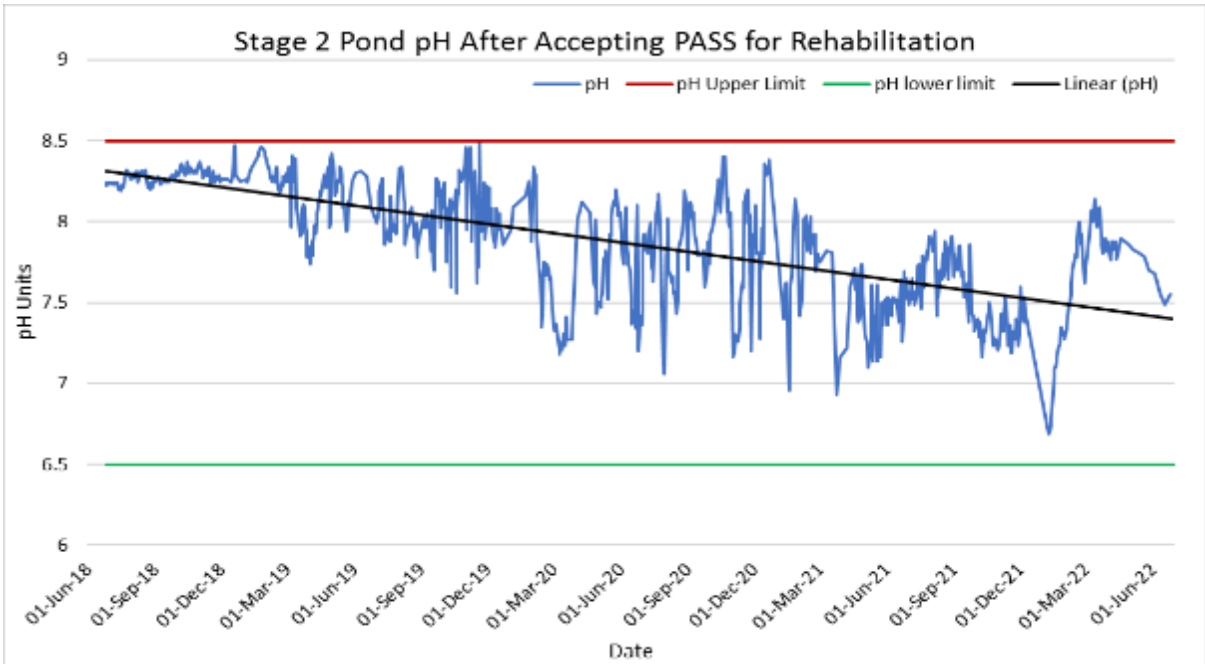

Figure 15 Stage 2 Pond pH After Accepting PASS

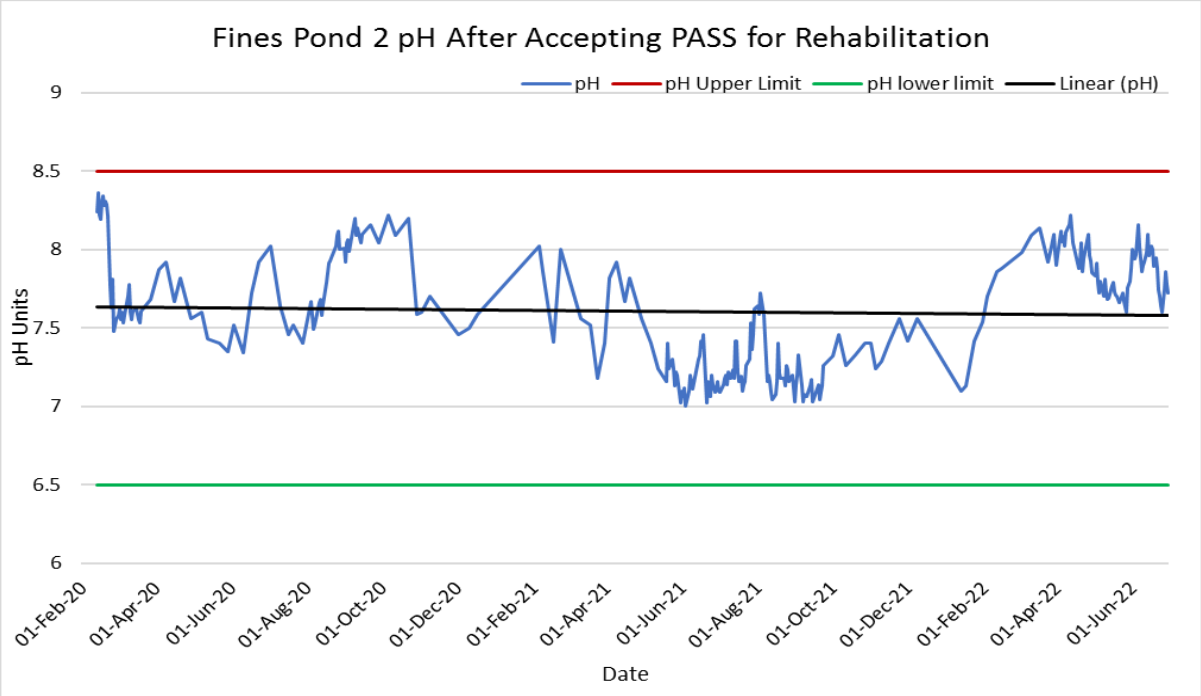

Figure 16 Fines Pond 2 After Accepting PASS for Rehabilitation

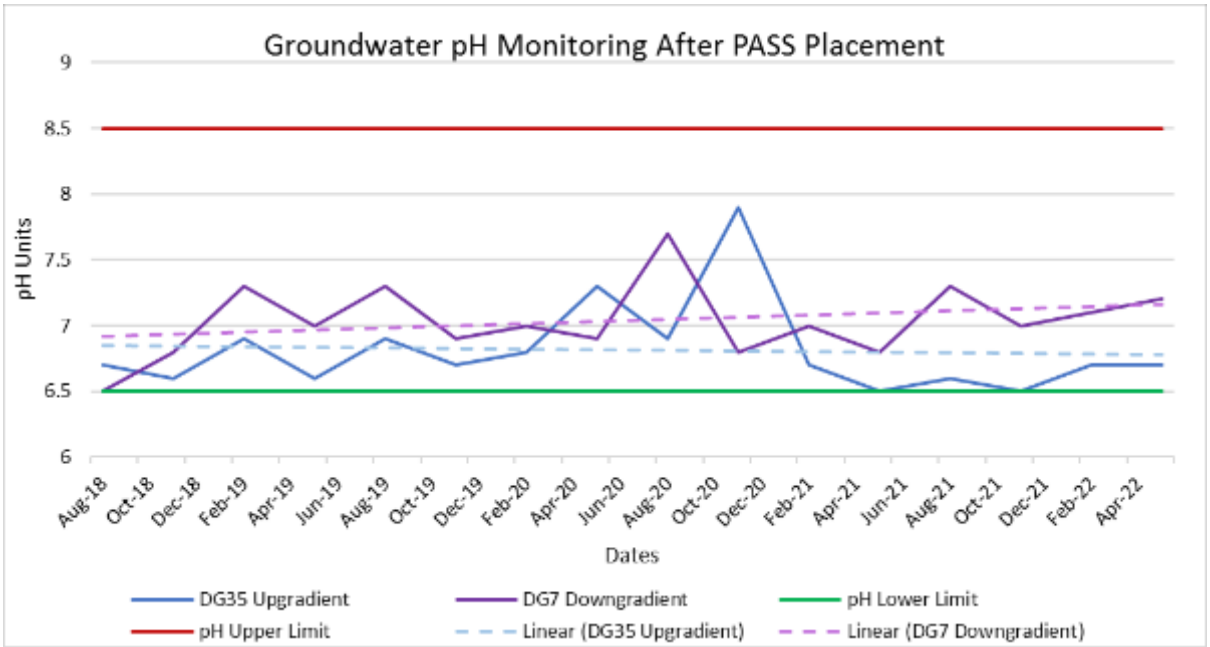

Figure 17 Groundwater pH After Accepting PASS for Rehabilitation

4.4.3. Surface Water Monitoring Long Term Assessment and Analysis

Graphs of Water Quality over time can be seen below in Figure 18 to Figure 21.

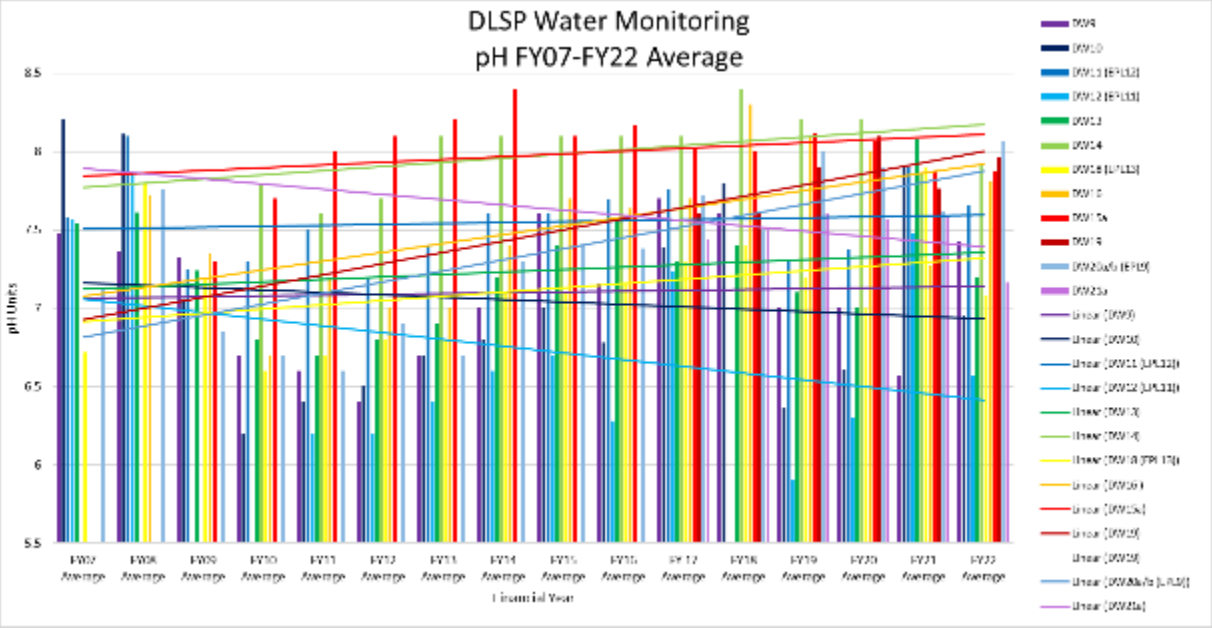

Figure 18 Surface Water pH Historical Monitoring Trends

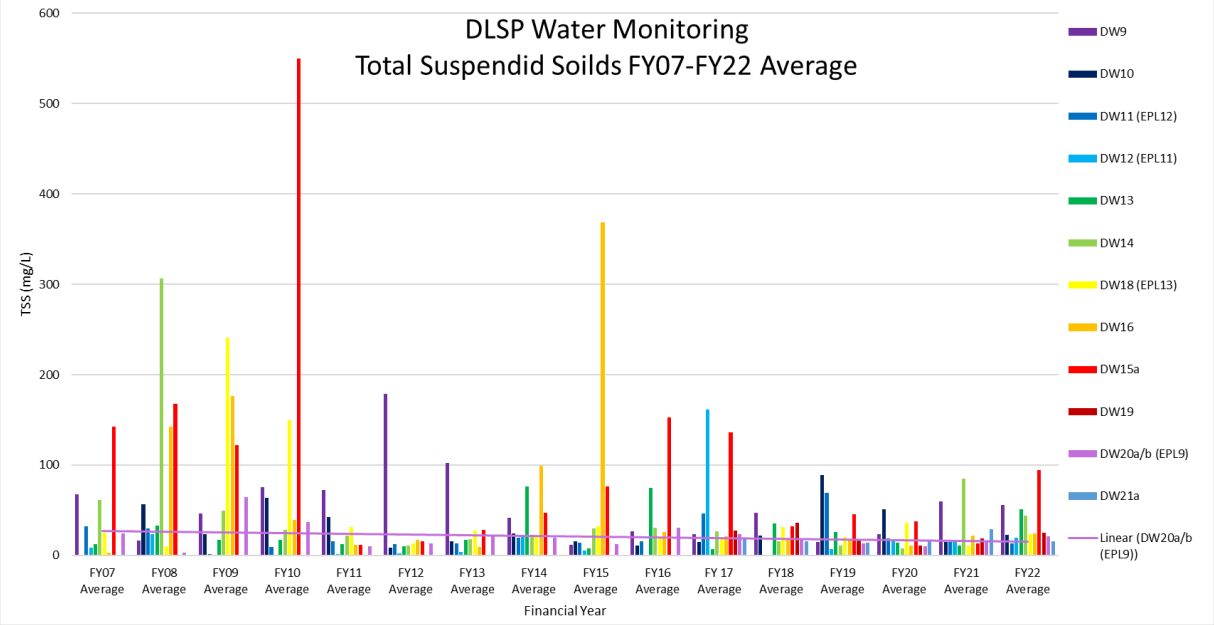

Figure 19 Surface Water TSS Historical Monitoring Trends

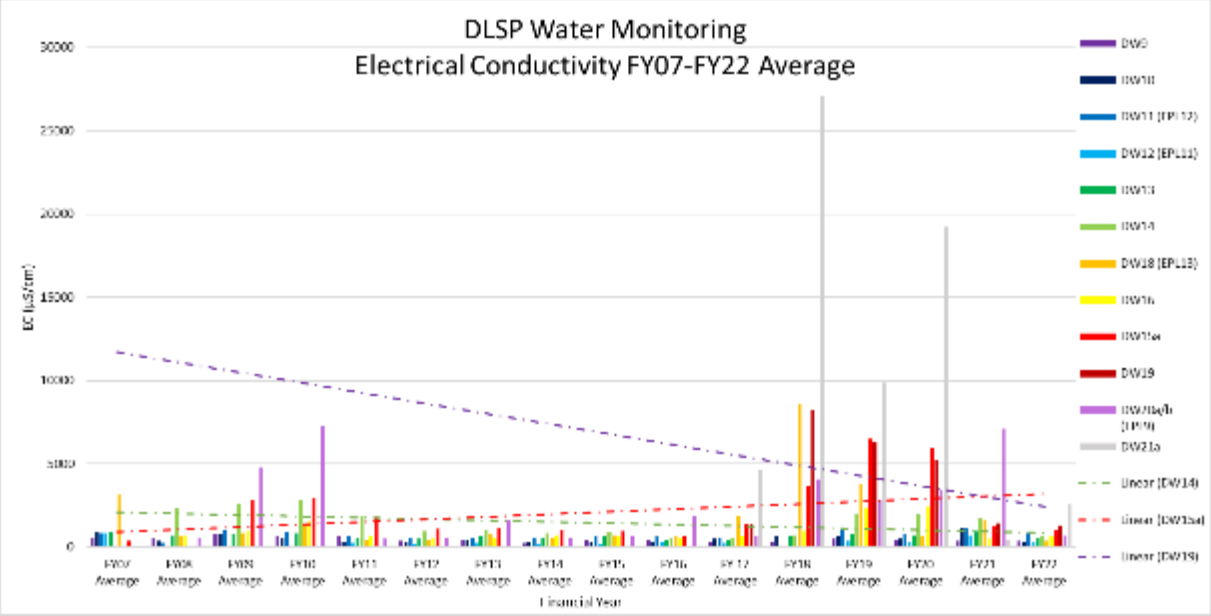

Figure 20 Surface Water Conductivity Historical Monitoring Trends

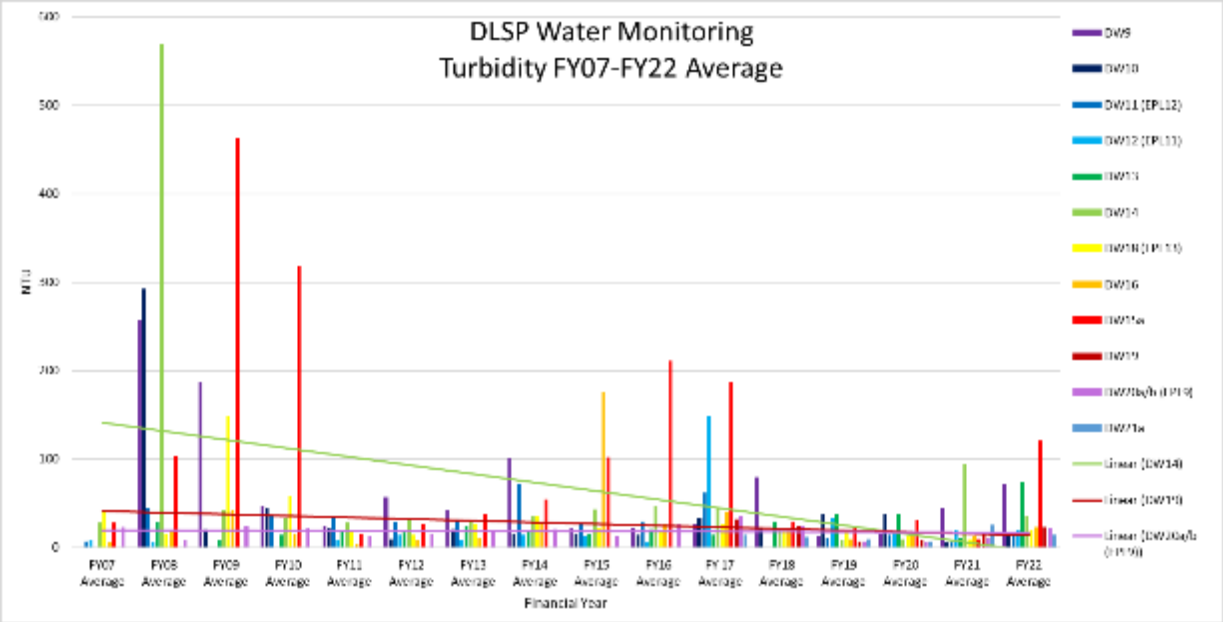

Figure 21 Surface Water Turbidity Monitoring Historical Trends

The following general trends can be observed from the above data:

- Typically upstream pH, DO and conductivity is lower when compared to the compliance monitoring locations, which aligns with observations that upstream drainage channels are ephemeral and generally only flow during periods of rainfall. These upstream sites are also impacted by upstream agriculture with cattle grazing.
- Upstream turbidity, TSS faecal coliforms and enterococci are higher at the upstream monitoring locations when compared to the compliance monitoring locations due to the impacts of cattle grazing and defecation. These inputs also contribute to increased nitrogen in the upstream water flows. The operational dredge ponds typically have lower turbidity than upstream conditions, whereby the dredge ponds act as large settling basins, which allow a reduction in turbidity and sediment load downstream of the ponds during periods of high rainfall.
- Typically the fines pond has a higher turbidity and TSS than the dredge pond, which is to be expected due to its function. The fines pond is kept offline and protected by a 3.7m AHD bund designed for protection in the event of a 1 in 100 year flood event.
- Salinity is generally higher in the southern sections of Stage 3 (DW-19) and Rocklow Creek (DW21a), which is located in close proximity to the tidal zone at Rocklow Creek. This is a predicted outcome from the EIS based on the natural conditions of the site and is discussed below.
- Algae was above WQO in the dredge ponds (DW-14 and DW-19) and upstream at DW-10. This would be attributed to the adjacent land uses that include farm and agricultural land and cattle grazing causing elevated nutrient levels such as Nitrogen.

Initial investigations from the original DLSP EIS commissioned by R.W Corkery described that the groundwater within the southern section of Stage 3 contains slightly brackish water (TDS >2,500), which corresponds to a salinity far greater than the 1,500µS/cm threshold described

in the WQO detailed in condition S3.C24 of the consent. As the dredging progresses south in Stage 3 near Rocklow Creek, the infiltration of this tidal brackish water into the Stage 3 dredge pond will be unavoidable and is to be expected based on the natural conditions present in Stage 3.

As dredging has ceased in FY22 the salinity of the pond in Stage 3 has decreased from the previous reporting period. This phenomenon is similar to what occurred for the Stage 1 and 2 dredge ponds once dredging had ceased in these areas.

The department acknowledges in condition S3.C24 of the consent, as per the note, that short term exceedance of the WQO may occur due to natural events such as tidal saline inflow, such as those identified in the south of Stage 3. Groundwater data collected in Stage 3 since 2003 describes the aquifer as having a rapid response to rainfall. This is explained in greater detail in the Groundwater Annual report in Appendix D.

4.4.4. Surface Water Monitoring Summary and Opportunity for Improvements

Monitoring will continue for all water quality parameters in the next reporting period. The program has been extended to include the new Stage 5 area. Backfilling will continue within Stage 2 and the southern and eastern section of Stage 3 over the next 12 months. It is expected that backfilling and landform construction in the southern section of Stage 3 will reduce the risk of salinity caused by tidal saline inflow.

The soil and water management plan (SWMP) was approved for Stage 5 in the reporting period. The next reporting period will result in the formulation of SSTV for Stage 2-4 using the 15 years of water data in the catchment. During this update, the Stage 5 and Stage 2-4 Water Management plans will be combined into one document.

This aligns with the recommendations of the 2020 Independent Audit.

4.5. Water Balance

Water extracted from the DLSP ponds is measured and considered in relation to the applicable groundwater licence. Water is used for dust suppression and sand processing and is sourced from the fines pond and dredge pond under a groundwater Water Access Licence (WAL24477) issued under the *Water Management Act 2000*. The licence permits the groundwater take of 77ML of water from the Sydney Basin South Groundwater Source.

4.5.1. Surface Water Flows

Both Stage 2 and 3 lie within the alluvial flood plans of Rocklow Creek. Surface runoff from three upstream catchments is generally captured in farm dams and bunding around the Stage 2 area. High flow events and floodwaters however enter Stage 2 and ultimately flow into the Stage 3 area. The main channel of Rocklow Creek has been diverted around the Stage 3 area which is joined by controlled discharge waters from the Stage 3 pond spillway. The system allows for the return of environmental flows into the Rocklow Creek catchment below the site.

During flood events, sand extraction ceases. During the reporting period, flooding occurred between March and May 2022. Inflows are assumed to be the same as outflows during overflow events. The influence of surface water on the site water balance is therefore considered to be neutral.

4.5.2. Water Use for Dust Suppression

Water contained within the extraction ponds is used for all raw water demand, including processing and dust control. A 30,000 L water cart operates on site on all operational non-rain days to reduce dust from unsealed roads, particularly the roads used by trucks delivering VENM. During the reporting period, the number of rain-days increased from 98 to 162 which, coupled with the days when the site was flooded, reduced the volume used for dust suppression to approximately 16ML.

4.5.3. Water Use from Production

Water is extracted with the sand during dredging operations, with additional water added to this during processing to make up for moisture contained within the product and evaporation.

Pumping rates and volumes of make-up water is shown in Table 20. The extracted water returns via overland flow to the fines return pond (i.e. flows back into the system) so is excluded from the water balance calculations and reported for information only.

During the reporting period, two pipelines were constructed between the processing plant and Stage 5. One is used to deliver the dredged sand slurry to the processing plant while the second is used for return water.

Table 20 Dredge and Spray Pump Rates

Processing Steps	Pumping Rate (L/s)	Water Required (ML/8hr day)
Dredge pump (combined water and sand)	250	7.2
Pump to sand wash bin for dust washing	150	4.33
Pump for oversize screen sprayers	50	1.47
Total	N/A	12.96
This 12.96 ML is returned to the Stage 3 pond via the fines return pond and is therefore excluded from the water balance calculation.		

- However, some residual water is exported from the site along with the sold sand product (approximately 8% of exported sand product by weight is water).
- Current reporting period production was 91,125 tonnes.
- Water loss from sand production is calculated as 8.5 ML.

Total water use is therefore calculated as water use for dust suppression (16ML) plus water loss from sand production (8.5ML).

The calculated total water use volume is 24.5ML, which is within the volumes of groundwater take of WAL24477 of 77ML/year.

4.6. Flood Storage Capacity

The site is located at the confluence of three tributaries of the Minnamurra River. Given the proximity of groundwater to the surface there is potential for flooding even under relatively minor rainfall events. Water backing up along Rocklow Creek from the Minnamurra River is also a major contributor to on-site flooding. This is exacerbated by the fact that the site is just above the tidal reach of the Minnamurra River which reduces the ability of the catchment below the site to accept floodwaters from the Rocklow Creek catchment above the site.

Previous flooding studies have determined the following flood levels for the site:

- 100 year Average Recurrence Interval (ARI): 3.6m AHD
- 20 year Average Recurrence Interval (ARI): 3.3m AHD
- 10 year Average Recurrence Interval (ARI): 3.2m AHD.

To protect the site from floods, up to and including the 1 in 100 year event, the processing and stockpile area have been constructed above 3.6m AHD and site bunds are generally at 3.7 metres AHD. The fines pond is bunded to a minimum 3.7m AHD as shown in the surveyed points in Figure 22 below.

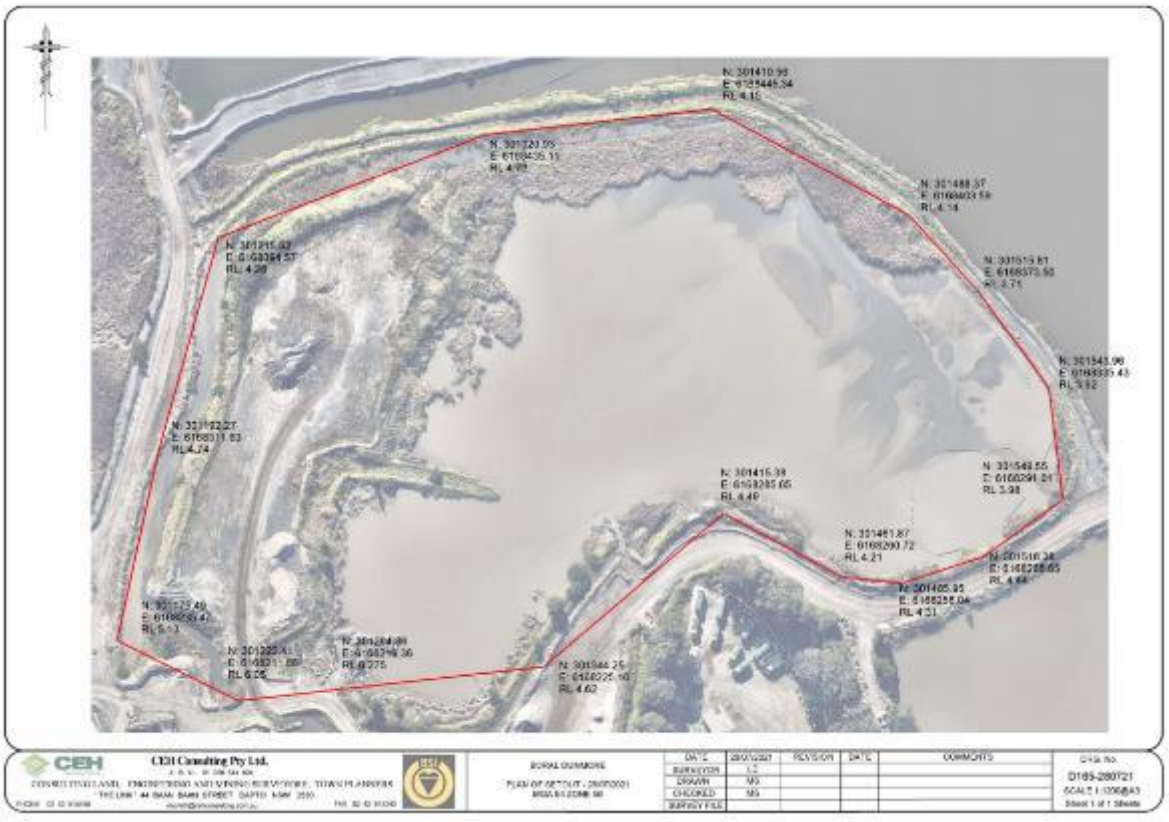

Figure 22 Surveyed Fines Pond Bund

The majority of the access road off Tabbita Road is also above 3.6 metres AHD; however, the ramp abutting Tabbita Road was constructed by RMS below 3.6 metres AHD due to the presence of overhead powerlines and potential safety risks to heavy vehicles.

Condition S3.C27 of the consent requires that the flood storage capacity of the site is no less than the pre-existing flood storage capacity at all stages of the development, unless otherwise approved in writing by the Planning Secretary. Total historic extraction volumes within both Stage 2 and Stage 3 area are significantly higher than total backfilling volumes to date which has created an overall increase in flood storage capacity. During the reporting period, extraction moved to the new Stage 5 area while backfilling will continue in Stage 2 and 3 which will result in a gradual reduction in flood capacity. However, the final site rehabilitation plan includes unfilled pond area and freshwater wetlands which provide an overall increase in flood retention capacity compared to the pre-mining floodplain.

4.7. Groundwater Monitoring

Environment Earth Sciences (EES) have been commissioned to undertake analysis of the groundwater aquifer at Dunmore Lakes since 2003. The full Groundwater Annual Report is located in Appendix D and relevant sections have been reproduced below.

4.7.1. Groundwater Monitoring Impact Assessment Criteria

EES have devised site specific trigger values, derived from monitoring the aquifer in Stage 2 and Stage 3 since 2003 and prior to the commencement of operations in Stage 2 and 3. These site specific trigger values have been adopted in the approved Water Management Plan and are reproduced below in Table 21.

Table 21 Groundwater Impact Assessment Criteria

Analyte	Units	Trigger Value		
		DA Criteria	Western Bores[1]	Eastern Bores[2]
pH	-	6.5-8.5	6.5-8.5	6.5-8.5
Electrical Conductivity (EC)	µS/cm	<1,500	1,500	33,000
Phosphorous (PO_4)[3]	µg/L	5-50[3]	4.0	0.7
Total Nitrogen	µg/L	100-500	-	-
Sodium (Na)	mg/L	400	560	5,500
Potassium (K)	mg/L	50	50	170
Magnesium (Mg)	mg/L	50	90	420
Chloride (Cl)	mg/L	300	1,400	6,900
Sulphate (SO_4)	mg/L	250	300	1,170
Bicarbonate (HCO_3)	mg/L	750	400	420
Dissolved Iron (Fe)	mg/L	6	3.0	4.0
Ammonium (NH_4)	mg/L	20	1.0	3.0

Notes:

1. Western bores: BHA-BHF; DG17, DG21, DG31, DG36, DG59, DG60 are those located west of the Princess Highway
2. Eastern Bores: DG1 to DG7 are those generally located east of the Princess Highway
3. Note value is for total phosphorous not phosphate (multiply by 3.06 when reported as phosphorous)

The location of the groundwater monitoring points and groundwater flow direction is shown in Figure 23.

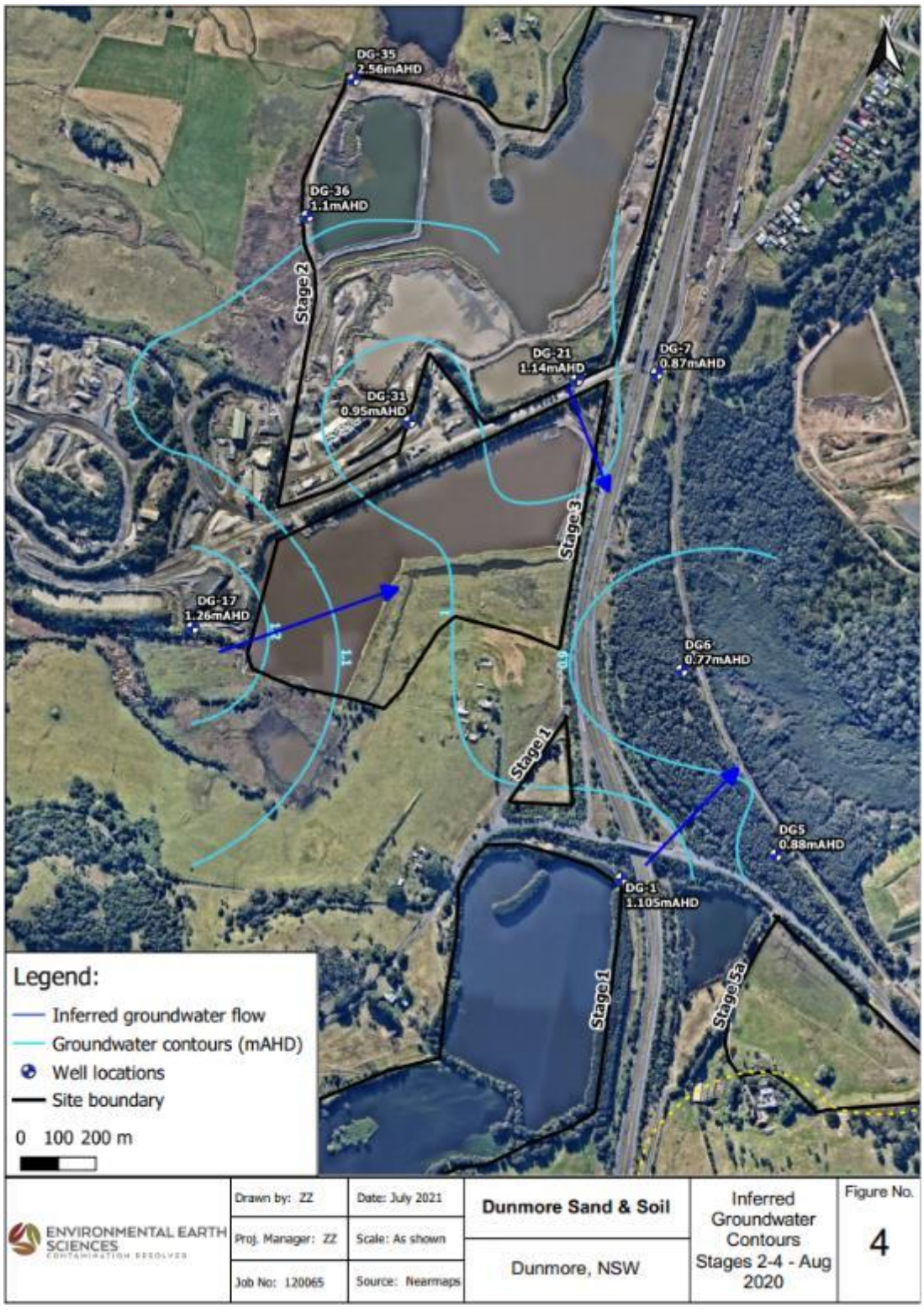

Figure 23 Groundwater Monitoring Locations and Derived Flow

4.7.1. Groundwater Monitoring Current Reporting Period Performance Review

A summary of the groundwater quality data for monitoring bores located west and east of the highway is shown Table 22 and Table 23, respectively.

Table 22 Groundwater Monitoring Summary West of Princes Highway

Analyte	Units	Trigger Value		DG1s				DG17				DG21				DG31s				DG35				DG36			
		DA[1]	GMMP[2]	Aug-21	Nov-21	Feb-22	May-22	Aug-21	Nov-21	Feb-22	May-22	Aug-21	Nov-21	Feb-22	May-22	Aug-21	Nov-21	Feb-22	May-22	Aug-21	Nov-21	Feb-22	May-22	Aug-21	Nov-21	Feb-22	May-22
pH	-	**6.5-8.5**	**6.5-8.5**	7.3	7.2	7.3	7.4	7.2	7.1	7.1	7.1	6.5	6.4	6.5	6.6	6.9	6.8	6.9	7	6.6	6.5	6.7	6.7	7.2	6.6	7	6.9
EC	µS/cm	**<1,500**	**1,500**	543	540	573	647	2710	1091	2010	1714	923	15100	1228	919	1171	1638	1091	258	1034	1107	1137	979	1036	1112	990	1135
Tot N	mg/L	**100-500**	**-**	1.33	0.97	1.67	0.8	1.51	0.57	1.54	1.58	0.11	0.28	0.01	0.49	0.83	3.85	0.57	0.35	0.96	1.4	1.12	1.01	0.19	1.37	0.01	0.36
Na	mg/L	**400**	**560**	19	27	36	40	95	80	240	240	45	80	147	117	40	68	94	14	38	46	93	88	38	45	87	106
K	mg/L	**50**	**50**	3.1	3.2	3.3	3.5	31	23	45	76	1	7.1	1.7	1.7	6.8	10	7	2	10	10	12	11	17	9.9	19	21
Mg	mg/L	**50**	**90**	2.1	7.4	11	14	14	27	55	71	2.9	15	18	16	5.6	21	21	6.2	6.2	20	33	35	5.9	19	26	38
Cl	mg/L	**300**	**1,400**	40	40	43	48	434	191	280	242	162	155	233	114	128	203	129	14	61	58	58	59	91	58	83	100
Ca	mg/L	**-**	**-**	19	35	49	75	29	37	54	68	13	28	28	45	31	57	54	28	24	42	57	68	22	42	42	96
F	mg/L	**-**	**-**	0.1	0.2	0.2	0.2	0.64	0.3	< 0.05	0.68	< 0.05	0.05	0.07	0.08	< 0.05	0.05	0.07	0.07	0.05	0.09	0.1	0.1	0.2	0.1	0.4	0.4
Fe	mg/L	**6**	**3**	0.05	0.2	0.13	0.03	0.07	0.06	0.35	0.01	0.36	0.17	0.4	0.18	0.08	0.53	0.67	0.06	0.32	0.3	0.1	0.02	0.04	0.28	0.09	0.02
NO_3	mg/L	**-**	**-**	0.47	0.86	0.57	0.63	0.17	0.57	1.06	0.76	0.08	0.24	<0.01	0.22	0.42	0.53	0.07	0.29	0.23	0.44	0.61	0.23	0.19	0.44	<0.01	0.16
SO_4	mg/L	**250**	**300**	1.2	2.9	1.6	2.9	4.1	51	23	15	42	98	83	63	193	370	223	36	149	257	98	210	74	252	98	137
PO_4	mg/L	**5-50**	**4**	0.04	0.07	<0.01	0.03	2.47	1.38	1.73	1.81	0.17	0.13	0.2	0.25	0.01	0.05	0.02	0.03	0.03	0.01	<0.01	0.01	0.02	0.01	<0.01	0.01
HCO_3	mg/L	**750**	**400**	217	217	226	259	857	510	690	589	138	146	134	192	117	184	134	71	238	259	309	268	293	255	284	326
NH_3N	mg/L	**20**	**1**	0.1	< 0.01	0.04	<0.01	0.3	< 0.01	0.01	< 0.01	< 0.01	< 0.01	0.01	< 0.01	0.12	< 0.01	0.02	< 0.01	< 0.01	0.69	0.01	0.22	0.06	0.69	0.01	< 0.01

Notes:

1. DA Criteria is not site-specific and outlined under the Development Consent 195-8-2004 (2004), issued on 29 June 2005 for The Dunmore Lakes Sand Project (Stages 2-4).
2. GMMP Criteria are site-specific criteria for groundwater quality and a sub-plan to the WMP (Arcadis, 2016). Elevated concentrations are highlighted in red.

Table 23 Groundwater Monitoring Summary East of Princes Highway

Analyte	Units	Trigger Value		DG5-S				DG5-D				DG6-S				DG6-D				DG7			
		DA[1]	GMMP[2]	Aug-21	Nov-21	Feb-22	May-22	Aug-21	Nov-21	Feb-22	May-22	Aug-21	Nov-21	Feb-22	May-22	Aug-21	Nov-21	Feb-22	May-22	Aug-21	Nov-21	Feb-22	May-22
pH	-	**6.5-8.5**	**6.5-8.5**	7.6	7.3	7.3	7.5	7.4	7.4	7.4	7.4	6.4	6.4	6.3	6.4	6.8	6.7	6.7	6.7	7.3	7	7.1	7.2
EC	µS/cm	**<1,500**	**33,000**	1170	1091	1097	1029	15360	15100	15570	14920	20800	20200	19960	16060	29800	996	29200	28000	897	497	821	584
Tot N	mg/L	**100-500**	**-**	0.2	1.07	0.12	0.32	1.38	4.06	8.58	10.27	2	5.94	11.48	12.66	16.33	23.5	26.91	23.56	1.57	4.15	1.84	2.64
Na	mg/L	**400**	**5,500**	40	51	70	101	1399	313	2290	2383	2068	357	3272	3798	2751	399	4987	5224	42	52	75	73
K	mg/L	**50**	**170**	9.2	8.3	9.1	7.3	123	139	117	163	189	184	172	244	262	221	248	288	3.4	2.7	2.8	2.5
Mg	mg/L	**50**	**420**	3.8	10	17	20	14	80	127	393	17	65	141	144	21	68	146	827	2.8	12	16	13
Cl	mg/L	**300**	**6,900**	163	138	198	123	5686	5287	5501	5588	7464	8429	7800	5826	10982	11201	11443	11117	121	80	81	48
Ca	mg/L	**-**	**-**	36	59	73	131	53	54	117	235	57	57	103	239	59	66	196	385	19	38	49	56
F	mg/L	**-**	**-**	0.3	0.2	0.2	0.2	< 0.05	0.74	1.27	1.74	0.08	0.3	< 0.05	1.56	< 0.05	< 0.05	< 0.05	1.02	0.5	0.3	0.4	0.5
Fe	mg/L	**6**	**4**	0.44	1.6	0.86	0.02	0.78	1.4	0.54	0.03	0.76	0.84	1.8	1	0.2	2.2	0.82	0.02	0.29	0.56	0.86	1
NO_3	mg/L	**-**	**-**	0.2	0.45	0.12	0.11	0.81	2.92	7.01	8.1	1.86	5.23	11.3	10.7	16.3	23.2	26.9	23.2	0.59	1.34	1.34	2.15
SO_4	mg/L	**250**	**1,170**	91	164	146	167	441	698	699	757	802	1017	1072	821	1154	1388	1585	1589	45	59	48	33
PO_4	mg/L	**5-50**	**1**	0.08	0.16	0.04	0.01	0.17	0.27	0.06	0.06	0.09	0.06	0.04	0.1	0.02	0.01	<0.01	0.01	0.08	0.09	0.08	0.17
HCO_3	mg/L	**750**	**420**	213	222	217	213	276	276	318	272	276	305	360	297	372	397	360	376	211	276	255	209
NH_3N	mg/L	**20**	**3**	0.07	< 0.01	0.03	< 0.01	1.23	< 0.01	0.02	< 0.01	0.12	< 0.01	0.01	< 0.01	0.34	< 0.01	0.01	< 0.01	< 0.01	< 0.01	0.03	< 0.01

Notes:

3. DA Criteria is not site-specific and outlined under the Development Consent 195-8-2004 (2004), issued on 29 June 2005 for The Dunmore Lakes Sand Project (Stages 2-4).
4. GMMP Criteria are site-specific criteria for groundwater quality and a sub-plan to the WMP (Arcadis, 2016). Elevated concentrations are highlighted in red.

4.7.2. Groundwater Long Term Assessment and Analysis

The data obtained from the data loggers installed in bores DG1, DG5, DG6, DG7, DG17, DG21, DG31, DG35, and DG36 indicate that over the current reporting period natural fluctuations in water levels were occurring in response to rainfall and tidal influences, as illustrated in Appendix A. This is consistent with previous findings dating back to 2003.

All data obtained from the monitored bores strongly indicated the following:

- Influences on groundwater levels are related to recharge from rainfall and minor tidal influx (this finding is supported by chemical monitoring of tidal seawater intrusion from Rocklow Creek);
- Reductions in groundwater levels are related to periods of low rainfall where the aquifer is slowly draining from Rocklow Creek and the south-east aquifer boundary; and
- Water-table fluctuations are therefore naturally occurring and cannot be seen to be impacted by dredging activities in the area, except in immediate proximity to the dredge pond.

4.7.3. Groundwater Summary and Opportunities for Improvement

Based on the data collected to date, DLSP will continue to:

- Monitor SWL in all bores with downloads and manual measurements at quarterly intervals;
- Continue to determine water quality trends and verify natural variations in water quality, particularly the influence of the deep saline aquifer to the east of the highway;
- Continue to monitor groundwater quality in all active bores at quarterly intervals.

4.8. Rehabilitation and Flora and Fauna Management Review

Rehabilitation has been ongoing since operations began and includes landform construction, revegetation and maintenance of previous planting campaigns.

4.8.1. Rehabilitation Assessment Criteria

Condition S4.C42 of the consent outlines that the applicant must progressively rehabilitate the site to the satisfaction of the secretary in a manner generally consistent with the concept final landform in the EIS (Appendix 2 of DA 195-8-2004) and in accordance with the DA consent.

S3.C37 outlines that the site must establish and conserve:

- 6 hectares of Freshwater Wetlands on Coastal Floodplains (which may include areas of associated wetland pondage) and;

- 3 hectares of Swamp Oak Floodplain forest;

The final landform planned for the DLSP will exceed these areas. This is in order to provide suitable visual screening and to adequately integrate a compensatory habitat with existing similar habitats located on or near the site.

4.8.2. Rehabilitation and Flora and Fauna Management Performance Review

During the 2022 reporting period, rehabilitation works concentrated along the north western area of Stage 2 with progressively infilling with VENM. Once final levels are reached, further planting of Swamp Oak Forest and Freshwater Wetlands in Coastal Floodplains community types will occur to complement the 6,300 native plants previously planted in the north eastern area of Stage 2.

Jamberoo Native Nurseries have been contracted to undertake planting of completed areas as they become available as well as general revegetation maintenance and weed management on site. The extensive flooding in March to April 2022 caused some minor damage to previously revegetated areas which are progressively being repaired by Jamberoo Native Nurseries who work on site on a weekly basis.

As shown in photographs in Appendix E, the bird island constructed on the northern side of Stage 2 is progressing well. Weed spraying and replacement plantings occur as required.

The banks of the realigned Western Tributary channel in Stage 3 were completed in previous reporting periods and is now subject to ongoing maintenance. The 2022 flooding caused some siltation of the outer banks however natural colonisation of native reeds and wetland species continues to provide adequate cover and stabilisation.

Existing tree screens and older revegetation areas are progressing well and are now subject to ongoing maintenance and weed spraying as required. The location of rehabilitation areas can be seen below in Figure 24.

Figure 24 Rehabilitation Area Locations

4.8.3. Rehabilitation Long Term Analysis and Assessment

Planted sections have progressed well with many specimens now over 3m tall. So far approximately 2.4 hectares of Swamp Oak Forest and Freshwater Wetland communities have been planted. Comparison photos over the last four reporting periods are shown in Appendix E.

4.8.4. Rehabilitation and Flora and Fauna Summary and Opportunities for Improvement

Maintenance of planted areas will continue during the next reporting period. Backfilling works and landform construction will continue in the next reporting period.

4.9. Waste Management

Operational waste associated with the project includes management of production fines generated by the processing plant and VENM received for backfilling of ponds and rehabilitation. Both of these materials will be used to progressively rehabilitate previously extracted areas to create wetlands and flood-free land for the final landform. Stage 2 and Stage 3 is currently being backfilled with fines from the processing of material from the Stage 5 area as well as imported VENM.

4.9.1. VENM Verification Acceptance and Disposal

In January 2018, the site began accepting Virgin Excavated Natural Material from external sources for the purposes of backfill to support site rehabilitation. VENM is classified as an 'inert' non-liquid waste under Schedule 1 Part 3 of the Protection of the Environment Operations Act 1997 and defines VENM as being:

"Virgin excavated natural material (e.g. clay, gravel, sand, soil and rock) that is not mixed with any other waste and that:

(a) has been excavated from areas that are not contaminated, as a result of industrial, commercial, mining or agricultural activities, with manufactured chemicals and that does not contain sulphidic ores or soils, or

(b) consists of excavated natural materials that meet such criteria as may be approved by the EPA."

Approximately 5 million tonnes of VENM will be required to create the final landform detailed in the Rehabilitation Management Plan. The vast majority of this material will be VENM within the meaning of part (a) above. A small portion of the backfilling materials for the project will consist of VENM within the meaning of part (b) above.

EPL 11147 contains specific conditions relating to VENM verification and acceptance including provisions to accept VENM (b) material that satisfies all the requirements for classification as VENM, except that it contains Potential Acid Sulfate Soil (PASS). After placement of the first load of PASS special frequency water monitoring of Stage 2 surface water and groundwater is triggered. The results of this monitoring is detailed in Section 4.4.2.

Volumes of external VENM received for the current reporting period are detailed below in Table 24.

Table 24 VENM and PASS Backfilling Volumes

Month	VENM (a) received (t)	VENM (b) PASS received (t)	Excavated Sand VENM received (t)
Jul-21	249	2,773	0
Aug-21	817	9,970	0
Sep-21	8,700	10,819	0
Oct-21	8,151	6,656	0
Nov-21	4,744	7,472	0
Dec-21	425	1,189	0
Jan-22	169	5,651	0
Feb-22	0	7,948	0
Mar-22	0	0	0
Apr-22	0	8,675	0
May-22	6,575	5,277	0
Jun-22	2,286	6,595	0
Total	**32,115**	**73,025**	**0**

4.9.2. Waste Minimisation and Tracking

Boral is committed to ensuring its extraction and processing activities produce minimal waste material. Approximately 85-90% of the sand processed at Dunmore Sand and Soil becomes washed sand for internal and external sales.

The remaining 10-15% of by-product created during the washing process is considered as fines material or oversized material. The fines material is washed into the fines ponds, which is used in the creation of the wetlands area, while the oversized product is used in site rehabilitation.

Boral is committed to non-production waste minimisation in accordance with the waste hierarchy and minimising the amount of waste sent to landfill. To achieve this, all liquid and solid wastes are classified and sorted so they can be appropriately re-used or recycled. Table 26 outlines the total waste and waste types generated by DLSP over the reporting period. In the current reporting period, a considerable focus was placed on increasing recycling volumes. Please note that items like filter bins/oily rags and scrap metal are sent to the workshop at Dunmore Quarry and are included in the Dunmore Quarry Waste Tracking Register.

Table 25 Waste Tracking Register

	General Waste (t)	Cardboard (t)	Commingle Recycling (t)	Oil/Oily Waters (t)	Effluent (t)	Solvent (t)
Jul-21	0.2125	0.06	0.03327	0	0	
Aug-21	0.2425	0.105	0	0	0	
Sep-21	0.1815	0	0.03027	0	0	
Oct-21	0.3765	0.07	0	0	0	
Nov-21	0.1995	0	0.031	0	0	
Dec-21	0.2985	0.14	0.02927	0	0	
Jan-22	0.276	0.1	0	5.74	3.6	
Feb-22	0.2275	0	0	0	0	
Mar-22	0.286	0.11	0.03427	0	0	
Apr-22	0.4015	0	0	0	0	
May-22	0.286	0	0	0	2.68	
Jun-22	0.2605	0.17	0.03127	0	0	
Total	3.2485	0.755	0.18935	5.74	6.28	0

4.9.3. Waste Minimisation Long Term Trends and Analysis

The long term analysis of the waste tracking over the last 6 years is shown below in Table 26.

Table 26 Historical Waste Tracking Summary

Waste Classification		FY17	FY18	FY19	FY20	FY21	FY22
Solid Waste	General Waste (t)	4.731	4.466	2.605	1.842	1.301	3.249
	Cardboard (t)	0.636	0.948	0.274	0.678	0.354	0.755
	Comingle (t)	0.36	0.345	0.33	0.208	0.114	0.189
Liquid Waste	Oil/Oily Water (t)	0	1.531	4.99	2.95	0.35	5.74
	Effluent Litres (t)	3.73	0.589	0.245	0.36	0.7	6.28
	Other (t)	0	0	0	0	0.6	0

*all liquid waste volumes have been converted to tonnages in the FY21 and FY22 register.

General Waste volumes are comparable with previous reporting periods but have now been combined with Dunmore Quarry. This has caused an increase in the allocation of waste generation to the DSS operation, particularly the liquid wastes which are generated by the hardrock quarry workshop.

The office is serviced by an underground aerated waste water treatment system (AWTS) which does not require effluent pump out. This system is regularly serviced and maintained by Bio-septic.

4.9.4. Waste Management Summary and Opportunities for Improvement

Education on efficient waste re-use will continue in the next reporting period. VENM will continue to be utilised from Dunmore Quarry and external sources. Further work will continue with subcontractors to optimise the record keeping for waste collection. A new national contract has been started with Cleanaway which will allow more efficient and centralised waste tracking. A particular focus will be increasing the ratio of comingle waste recycling, which did decrease compared to the last reporting period.

4.10. Incident and Emergency Response Management

The following management actions were undertaken in regard to incident and emergency response.

- The Pollution Incident Response Management Plan was updated in May 2022. The current version is available online on the Boral Dunmore Operations website.
- A Site Emergency Response Plan is available onsite in order to outline procedures in the case of emergency authorities being required on the site.
- A vehicle pedestrian safety upgrades were completed during the reporting period. Car park and traffic areas were refurbished to minimise pedestrian and vehicle interactions wherever possible.

4.11. Dangerous and Hazardous Goods Storage

Storage of dangerous goods and hazardous material have continued as per established operations. All dangerous goods and chemicals are handled and transported in accordance with the AS1940 and AS25956 and the Dangerous Goods Code and condition S3.C70.

4.12. Community

The DLSP Community Consultative Committee (CCC) continues to serve as a valuable dialogue between Boral and the local community with input and feedback being provided by the community regarding quarry operations and plans. The CCC is run as per condition S5.C6 and the Department of Planning, Industry and Environment's *Community Consultative Committee Guidelines for State Significant Developments* (2016).

Members include:

- An independent chairperson
- At least 2 representatives from Boral (typically the environmental co-ordinator and quarry manager)
- A member from Shellharbour City Council
- Five local community representatives

Members are informed of the environmental performance of the site, provided with an update on operations and given a chance to tour the site and ask questions they may have regarding the operation. CCC members have also been diligent in disseminating the information from the meetings to other interested community members in the local area. The minutes of each meeting is published in the Boral website.

https://www.boral.com.au/locations/boral-dunmore-operations

The CCC met twice during the current reporting period (September 2021 and February 2022).

4.12.1. Environmental Complaints Management

DLSP maintains a complaints register that identifies actions required to resolve issues and concerns raised by the community. The complaints register is also published on the Boral website.

Two complaints were received during the reporting period.

On 7th July 2021 a complaint was made by a member of the public through the EPA complaints line that Rocklow Creek is very heavily clouded just downstream of DLSP and that the water at the bike path was turbid where the creek discharges into the Minnamurra River. DLSP confirmed that there was no discharge from DLSP or from Dunmore Quarry, however the groundwater table is quite high so water is present in the realigned tributary. Responsive sampling was undertaken at DW20b (EPL9) and downstream of the discharge culvert on the bike path at the location specified in the report. The results for TSS from water samples taken at the bike path location are 32 mg/L and turbidity was measured at 67.2 NTU. These results are below the Quarry TSS limit of 50mg/L.

On the 31st January 2022 DLSP was contacted by a member of Dunmore Lakes regarding an algal bloom in Stage 1. Sampling was undertaken which confirmed the presence of Algae and NSW Water was notified. An Environmental Checklist has been updated to state that Stage 1 is to be inspected monthly for algal presence. On 31/1/2022 no algae was visibly present.

Figure 25 provides an overview of the noise, vibration and dust complaints received since 2007. There have been minimal complaints received over the history of the project.

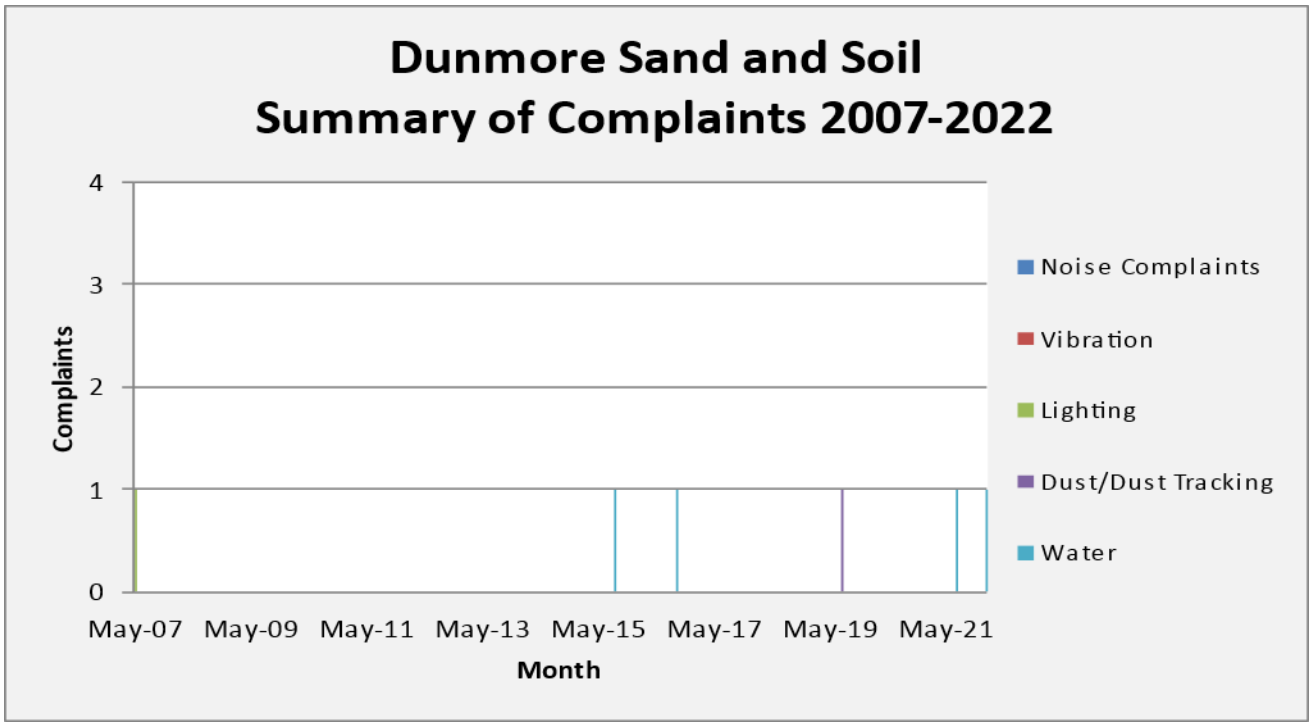

Figure 25 Summary of Historical Complaints

4.13. Independent Environmental Audit

The Independent Environmental Audit (IEA) was completed in in accordance with Schedule 5, Condition 10 and 11 of DA 195-8-2004. The audit site visit was completed on 14 October 2020 and the audit report was finalised on 23 November 2020. The next audit is due in late 2023.

The audit report is available under the public reporting tab on the Dunmore operations website https://www.boral.com.au/locations/boral-dunmore-operations

A summary of the audit recommendations are included below and have been incorporated into the update suite of management plans and site procedures.

Table 27 Audit recommendations and actions

Ref	Recommendation	Action
IEA1	The water quality goals listed in Table 7 of Condition 24 of Schedule 3 be reviewed and updated with appropriate Site Specific Trigger Values (SSTVs) based on long term ambient monitoring data that is now available. There is an opportunity to do this with the new planning consent anticipated for the Stage 5 project.	The need for SSTV has been discussed with DPIE within the draft conditions for MOD 2. The conditions issued for MOD 2 continue to include the previous WQO objectives described in condition 24 of MOD 3 (refer to Table 4). It is proposed that, as suggested by the auditor, SSTVs will be determined by appropriately qualified consultants who complete the Water Management Plan based on ambient monitoring data. It is requested that these SSTV sit outside the consent and are instead included in the approved Water Management Plan as approved by the Secretary. This provides the ability for the criteria to be updated in response to changing site conditions and environments without requiring a modification to the consent. Dunmore Sand and Soil is still awaiting confirmation from the DPIE that such an arrangement is acceptable. In the interim, the Stage 5 Soil and Water Management Plan has been prepared and approved with site specific trigger values.
IEA2	Rehabilitation monitoring should be expanded to include measures which could be used to verify the achievement of the completion criteria. These could be incorporated into the next review of the	Completion criteria of active rehabilitation areas was included in the updated Rehabilitation Management plan which was approved in July.

	management plans post approval of Stage 5.	
IEA3	Woody weeds such as lantana should be treated on an annual basis until effective control is achieved.	Weeding and maintenance of regeneration areas is continuing with the contracted bush regenerator. An inspection was undertaken to assess woody weeds throughout the active extraction area. A contractor was engaged to remove woody weeds The removal of the woody weeds will be incorporated into expanded works for the new contract with the bush regenerator.
IEA4	VENM inspection and verification systems should be upgraded and strengthen to include regular testing of foreign materials	The waste management plan was updated and the VENM Verification Procedure contact specific instruction and references for foreign materials. The plan was approved June 2021.
IEA5	Consideration should be given to upgrading the current Long Term Management Strategy (LTMS) to an Environmental Management Strategy (EMS)	The Long Term Management Strategy is currently under draft and consultation with the CCC and council. After the management plans associated with MOD 2 are approved, a separate EMS will be completed.

4.14. Summary of Regulator Notifications

There were no regulator notifications for the reporting period.

5. Conclusion

DLSP continues to focus on ensuring the environment and the neighbouring community are not adversely impacted by site operations.

Throughout this reporting period, extraction and processing of sand materials was below average compared to previous years, as a result of excessive rainfall and flooding of the site between March and May 2022 and construction activities associated with new Stage 5 area. Production should increase in the coming reporting period.

This reporting period saw the continuation of rehabilitation within the Stage 2 area, which will remain a strong focus during the next reporting period. Rehabilitation will continue in Stage 2 and 3 while the remaining resource is extracted.

The focus on the next 12 months will be continuing operational compliance and utilising remaining resource reserves. Dredging has ceased in the Stage 2 and 3 areas and extraction will now concentrate on the Stage 5 area in accordance with the MOD2 approval.

6. Activities to be completed by the Next Reporting Period

The next reporting period will contain a strong focus on maintaining regulatory compliance and optimising management actions established in the current reporting period.

A list of actions to be completed by the next reporting period is provided below.

- Continue rehabilitation monitoring of planted sections of Swamp Oak Forest and Freshwater Wetland EEC in Stage 2 and Re-aligned Western Tributary;
- Continue Swamp Oak Forest planting along the edge of Stage 2 and undertake flood repair work as required.
- Continue backfilling and landform construction in Stage 2 and 3;
- Plant out a further section of Swamp Oak forest on the eastern edge of Stage 2;
- Continue assessing salinity in the southern section of Stage 3 as per the recommendations in the DLSP EIS;
- Update Stage 2-4 Water Management for the use of site specific trigger values as per the independent auditor recommendations and to align with Stage 5 Soil and Water Management Plan. The updated plans will be combined into a one Soil and Water Management Plan;
- Purchase and finalise offsets prior to commencement of Stage 5B vegetation clearing;
- Install nest boxes in Stage 5B prior to vegetation clearing in Stage 5B;
- Review and if necessary, update management plans as per S5.C4 post Annual Review and IEA.

Appendix A Meteorological Monitoring

The location of the onsite weather station is shown below.

Figure 26 Weather Station Location

A monthly review of weather data is undertaken by the environmental co-ordinator. Important meteorological conditions that are assessed include rainfall, wind speed direction and atmospheric stability.

Rainfall data has been collected since FY2003. A summary of the rainfall measured from the Dunmore Quarry weather station is shown below in Table 28. Historical trends are shown in Table 29 and in red are the months where rainfall was above the regional average.

Table 28 Dunmore Rainfall Summary

Rainfall (mm)			
Month	**Current Reporting Period**	**Site Average**	**Regional Average**
July	14.8	63.3	49
August	73.4	71	53.5
September	46.37	47.7	42.7
October	61.85	72.5	64.5
November	164.1	89.9	83.1
December	78.36	84.3	67
January	151	85.4	72.9
February	295.8	144.7	140.5
March	670.6	140.9	122.3
April	216.8	84.3	73.8
May	202.8	72.2	55.8
June	1.8	114.7	93.7
Total	1978	1070.4	925.6

Table 29 Dunmore Historical Rainfall

	Rainfall (mm)																					
Month	**FY03**	**FY04**	**FY05**	**FY06**	**FY07**	**FY08**	**FY09**	**FY10**	**FY11**	**FY12**	**FY13**	**FY14**	**FY15**	**FY16**	**FY17**	**FY18**	**FY19**	**FY20**	**FY21**	**FY22**	**Site Average**	**Regional Average**
July	20	23.5	54.2	41	96	30.5	63.5	35.5	78	194	39	61.7	5	48	97.5	25	6	20.5	264.2	14.8	60.9	49
August	13.5	38.5	23	3	42.5	58.5	39	0.5	72	85.5	4.5	17	252	327	76	39	31	39	187.1	73.4	71.1	53.5
September	14	7.5	40.6	33	101	39	56	19.5	145.5	58.5	11.5	85.5	48.7	82	51	1	41.5	59.5	11.3	46.37	47.6	42.7
October	6.5	49	245.4	48	0	17	79	125.5	126	124.5	83.5	6.5	102.5	36.5	32	14.5	128	38.5	114.4	61.85	72.0	64.5
November	17	149.5	126.8	144.5	39.5	161.5	46.5	65	198	163.5	25	173	24	48	33	85	92	25.5	83	164.1	93.2	83.1
December	70	40.5	136.2	36.5	54	120	112.5	80.5	147.5	63	32	70.5	233.5	116.5	58	53	90.5	2.5	83.8	78.36	84.0	67
January	68	30.5	128.8	90	0	65.5	9.5	79	59.5	50.5	183	43.5	192.5	155.5	32.5	36	143.5	65	189.3	151	88.7	72.9
February	112	70	180.4	87.1	186.5	351.5	107.5	197.5	48	257.5	142.5	59	112.5	29.5	283	128.5	35.5	272.5	88.4	295.8	152.3	140.5
March	121	84	118	43.5	67.5	36.5	39	74	362.5	196	23.5	326	57	145	441	41.5	156.5	65.5	278.5	670.6	167.4	122.3
April	91.5	200	24.4	8	145	90.5	106	63	37.4	87.5	136	64.5	305	37.5	40.5	26.1	48.5	85	5.9	216.8	91.0	73.8
May	427.5	43.5	85.6	65.5	23	8	20	80.5	58.3	9.5	81	13	53.5	35.5	51.5	44	13.5	52	206.1	202.8	78.7	55.8
June	74.5	42	84.4	124	318.5	85.5	67	52	92	89	239	34	76	429	57	133.5	103	35	44	1.8	109.1	93.7
Total	1036	778.5	1248	724.1	1074	1064	745.5	872.5	1425	1379	1001	954.2	1462	1490	1253	627.1	889.5	760.5	1556	1978	1115.8	925.6

Monthly wind roses and seasonal wind roses are shown below in Figure 27 to Figure 38. Please note calm is defined as winds averaging less than 0.3m/s over the averaging period.

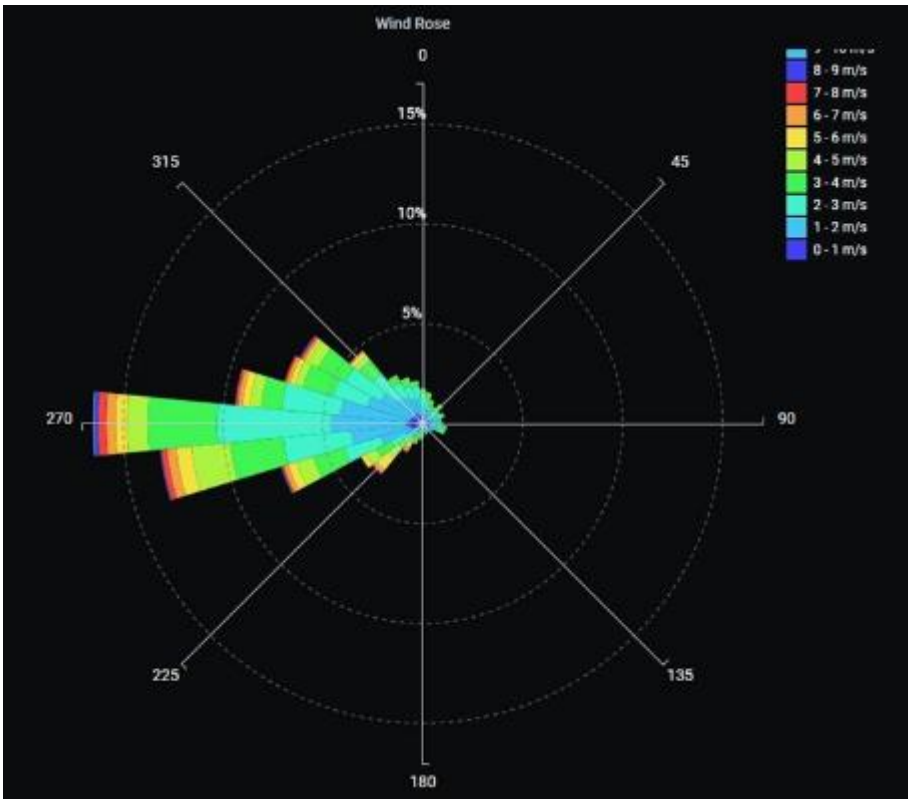

Figure 27 July 2021 Wind Rose

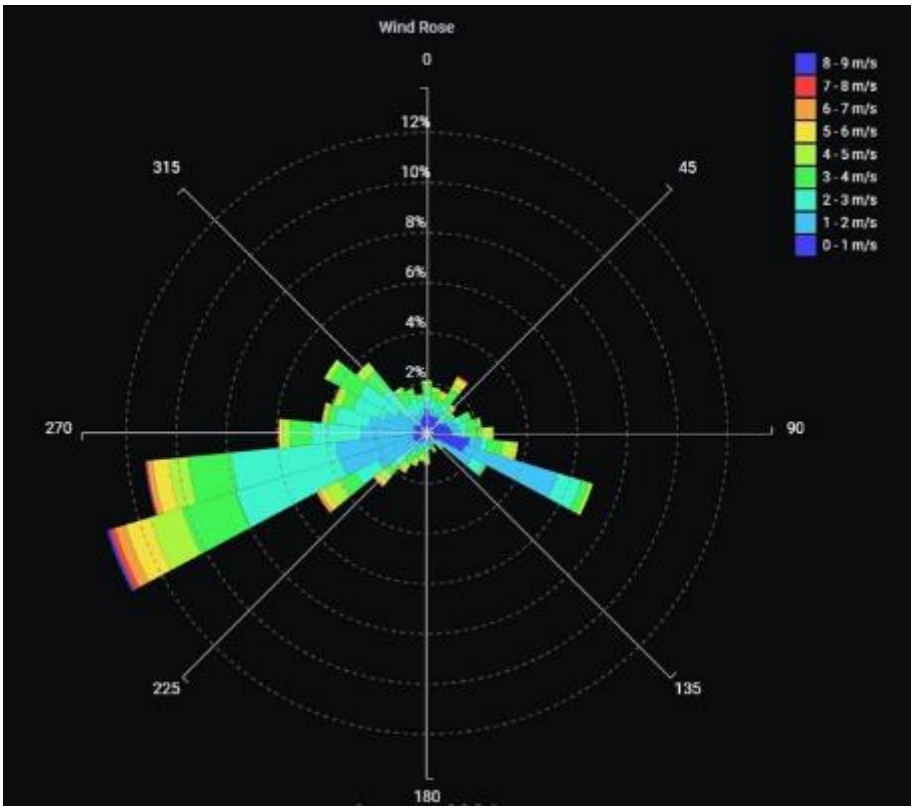

Figure 28 August 2021 Wind Rose

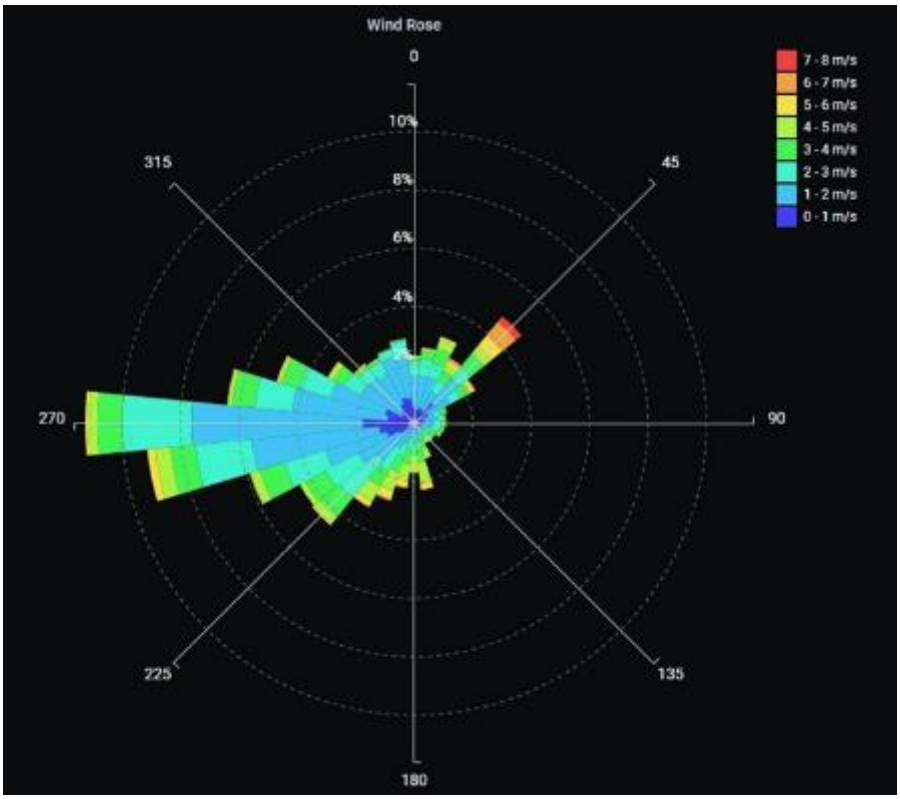

Figure 29 September 2021 Wind Rose

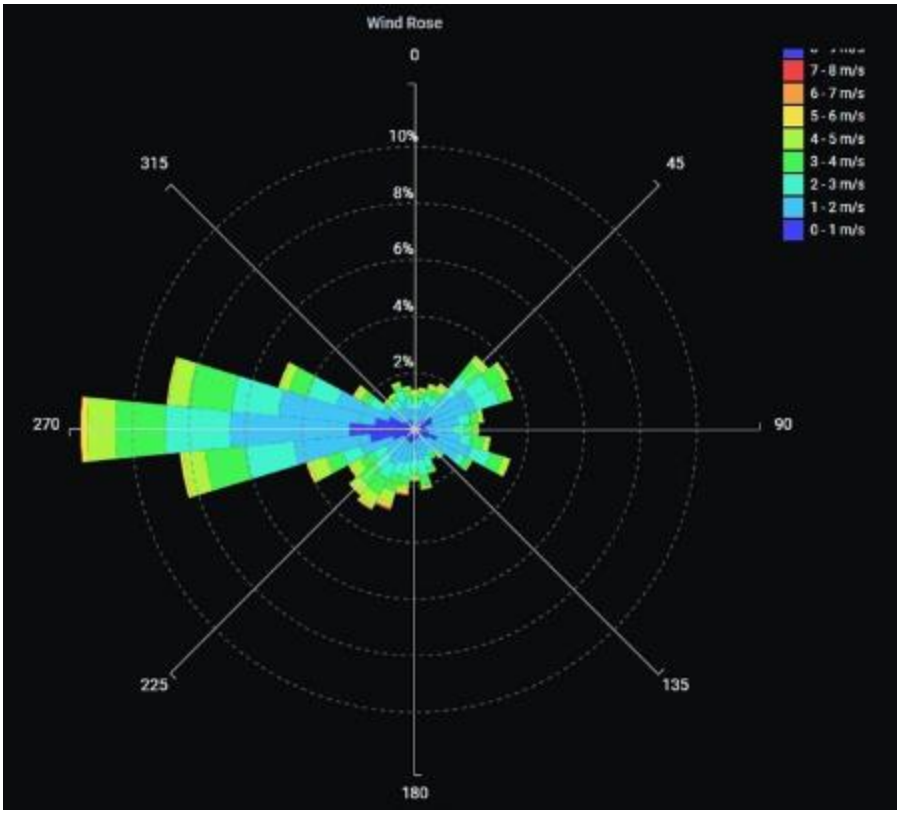

Figure 30 October 2021 Wind Rose

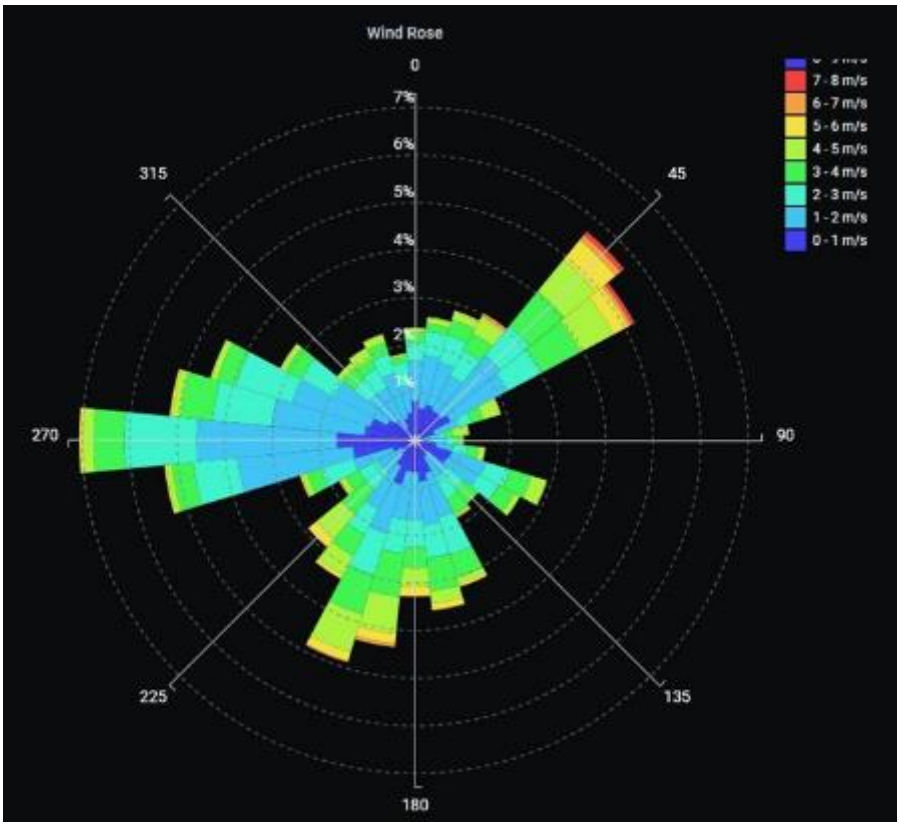

Figure 31 November 2021 Wind Rose

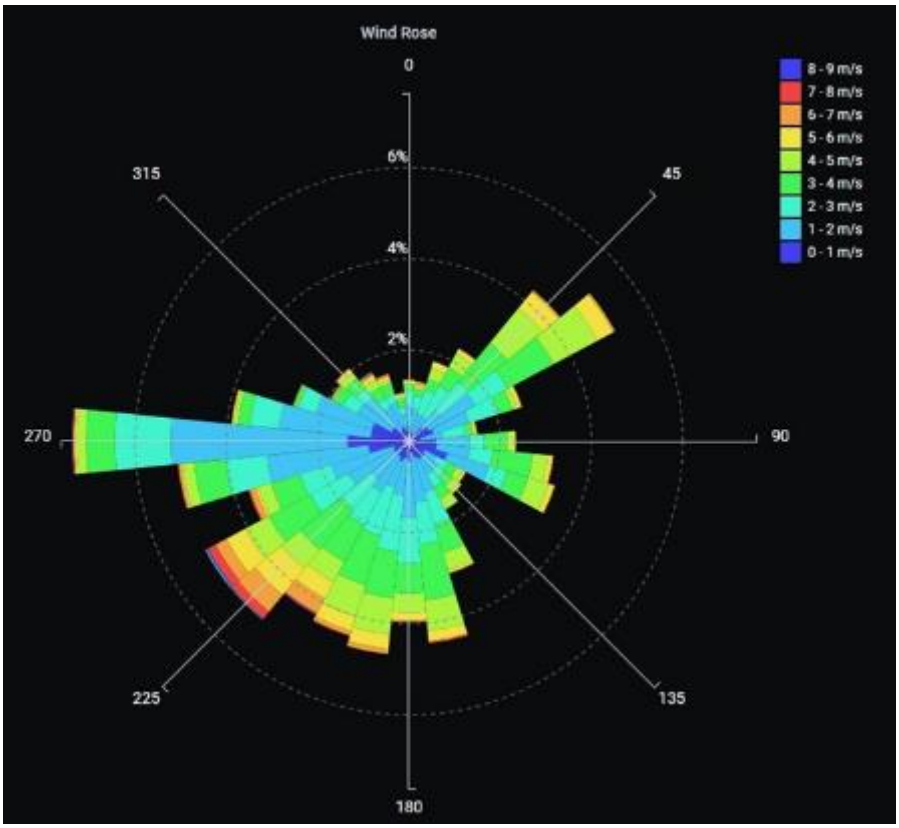

Figure 32 December 2021 Wind Rose

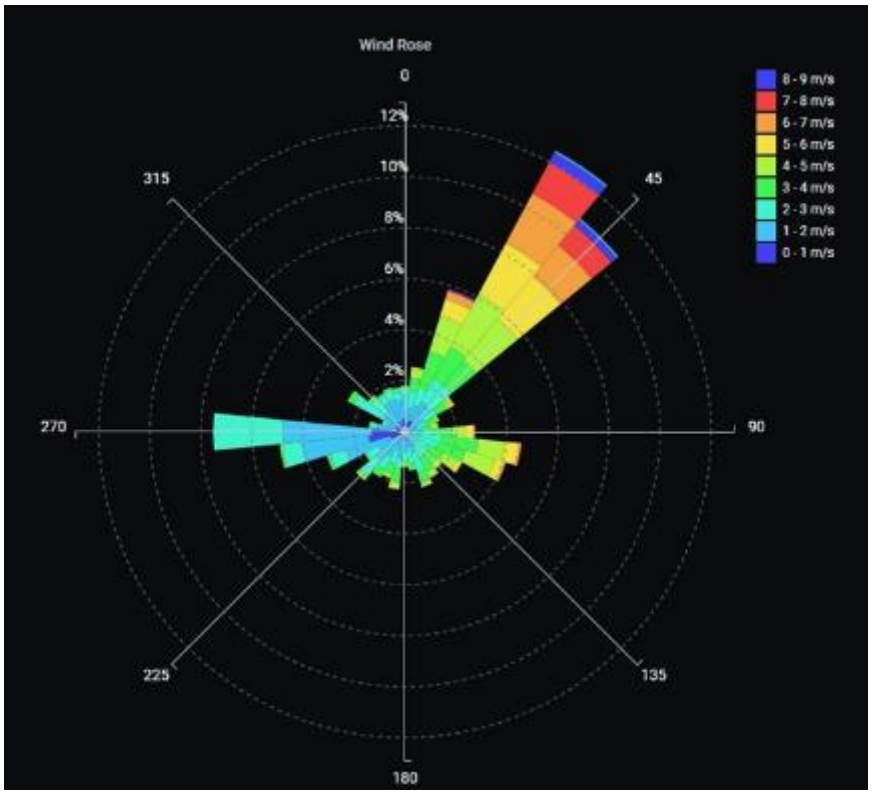

Figure 33 January 2022 Wind Rose

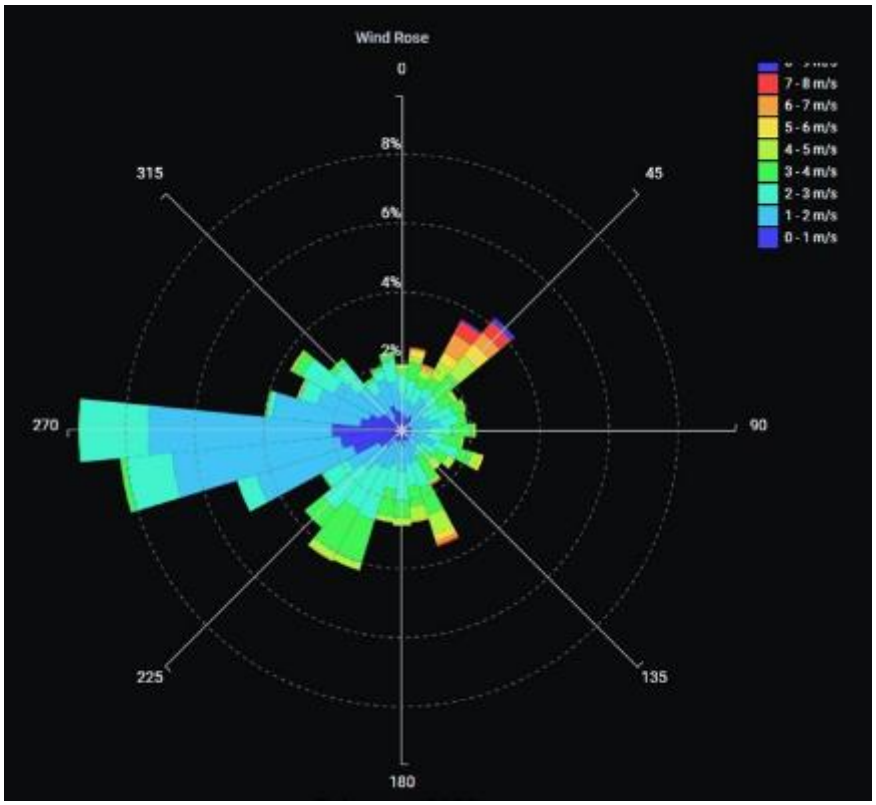

Figure 34 February 2022 Wind Rose

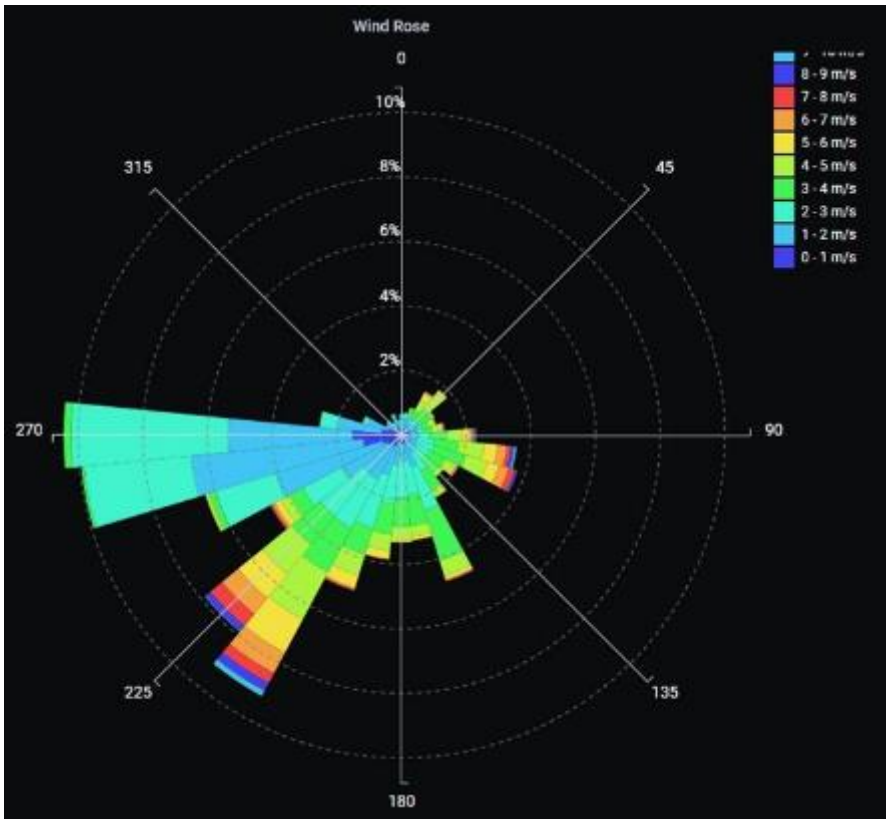

Figure 35 March 2022 Wind Rose

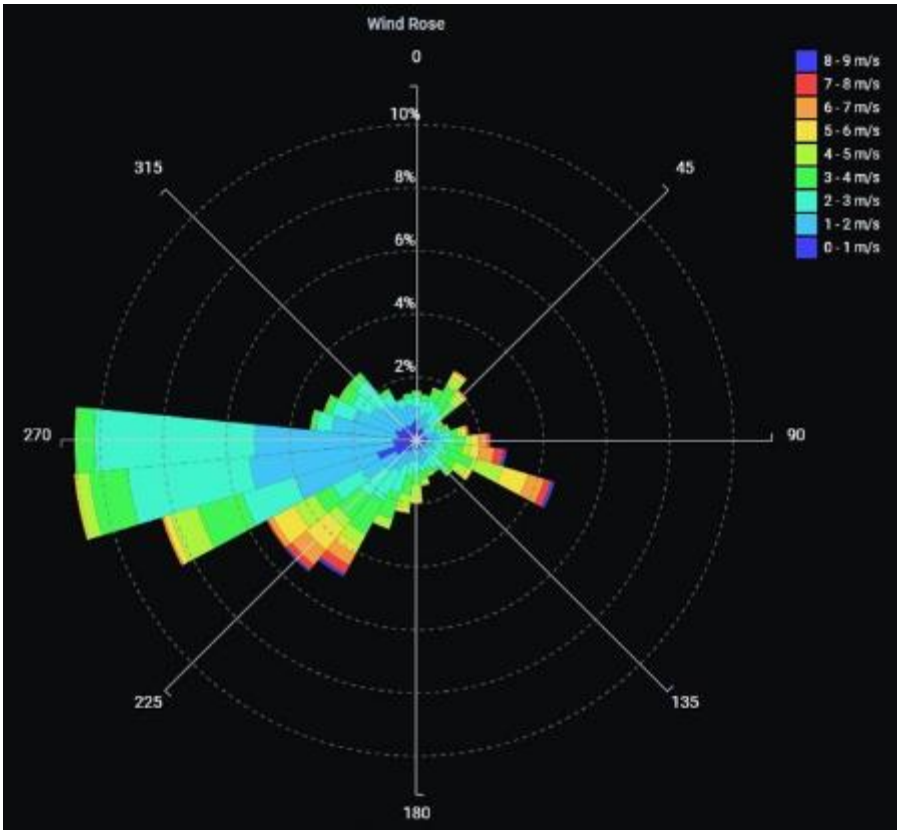

Figure 36 April 2022 Wind Rose

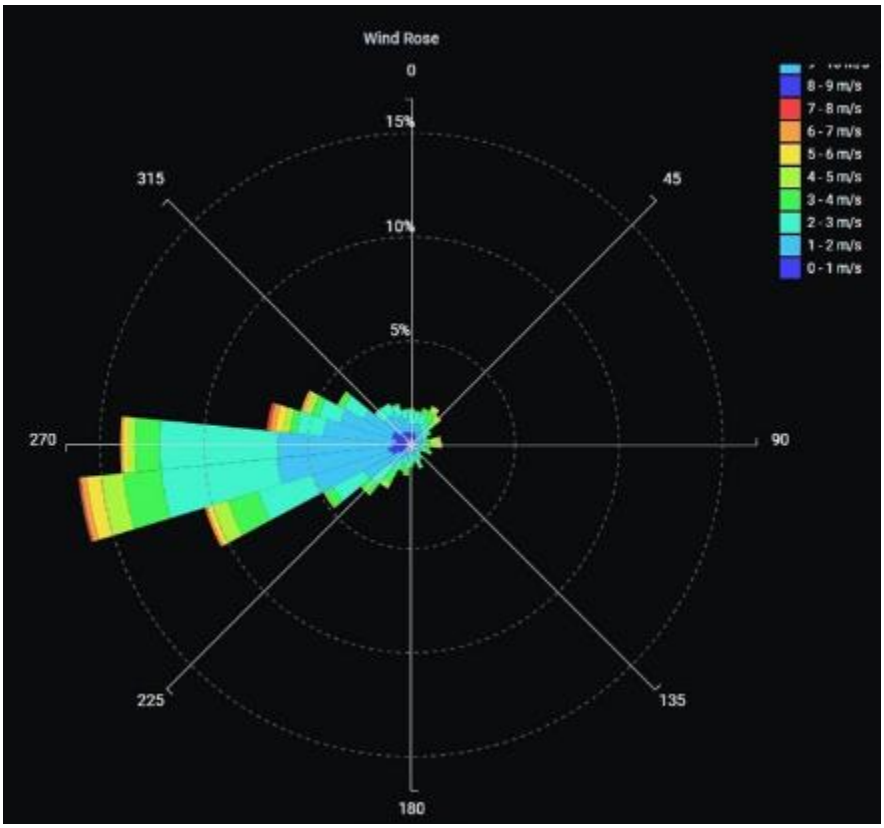

Figure 37 May 2022 Wind Rose

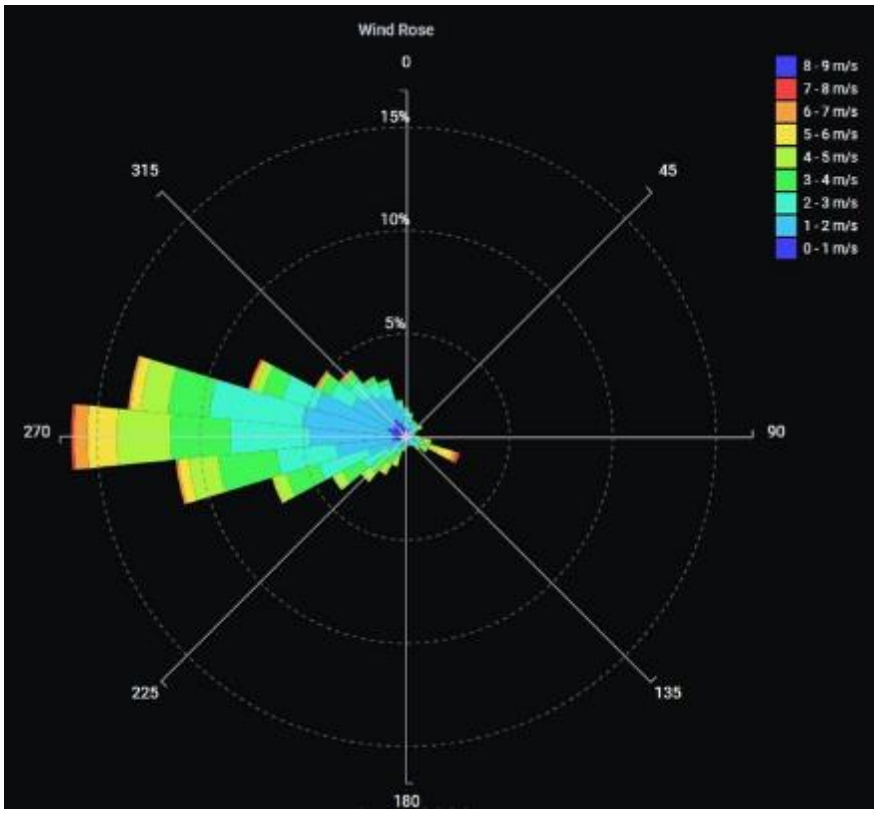

Figure 38 June 2022 Wind Rose

Figure 39 Dunmore Seasonal Wind Rose Data

Appendix B Air Quality Additional Data and Graphs

A monthly breakdown of deposited dust monitoring is shown in the Table 30 below. Dominant wind directions and production data are also shown within Table 30.

Table 30 Detail Summary of Historical Dust Data

Month	DD2 grams/m²/month		DD5 grams/m²/month		DD6 grams/m²/month		DD7b/10 grams/m²/month		Deposited Dust Goal	Dominant Wind Direction	Direction of Strongest Winds	Production Tonnes
	Insoluble Solids	Ash	Insoluble Solids	Ash	Insoluble Solids	Ash	Insoluble Solids	Ash				
FY07 Average	3.68	1.9	3.3	2.1	5.75	3.36	3.9	1.92	4			
FY08 Average	2.97	1.84	2.88	1.66	4.23	2.43	4.31	2.44	4			
FY09 Average	3.07	1.98	3.79	1.94	3.83	2.87	5.55	3.17	4			
FY10 Average	5.29	3.3	3.42	2.5	4.88	2.96	2.71	1.66	4			
FY11 Average	6.16	3.68	3.42	1.99	3.92	2.47	3.15	2.33	4			
FY12 Average	5.51	2.82	3.09	1.82	3.17	2.32	2.53	1.6	4			
FY13 Average	4.19	2.19	3.26	1.84	3.7	2.48	2.75	1.81	4			
FY14 Average	2.21	1.42	3.63	1.76	2.67	1.58	3.36	2.36	4			
FY15 Average	3.57	1.77	2.55	1.46	3.94	2	3.2	2	4			
FY16 Average	1.85	1.19	2.59	1.44	2.55	1.55	2.66	1.66	4			
FY17 Average	2.28	1.56	2.67	1.77	3.31	1.68	2.01	1.3	4			
FY18 Average	2.36	1.65	2.32	1.78	2.71	1.88	2.84	1.79	4			
FY19 Average	3.66	1.87	3.1	1.9	3.03	1.94	2.81	1.59	4			
FY20 Average	3.59	2.11	3.06	1.82	3.49	2.18	3.16	1.98	4			
FY21 Average	1.94	1.12	2.44	1.34	2	1.08	1.85	1.11	4			
FY22 Average	2.07	0.88	1.54	0.92	1.79	1.05	1.21	1.64	4			
Jul-21	1.6	0.41	1.77	0.65	2.47	0.89	1.02	2.33	4	W (19%)	W	33457
Aug-21	0.88	0.58	1.91	1.09	3.35	2.15	1.13	1.16	4	WSW (14%)	WSW	12899
Sep-21	1.13	0.45	0.99	0.88	2.07	1.04	1.16	1.71	4	W (12%)	W	6303
Oct-21	1.93	1.14	1.98	1.32	3.99	3.38	1.34	3.87	4	W (12%)	W	7361
Nov-21	0.68	0.4	1.29	0.82	1.71	1.2	1.36	1.36	4	W (7%)	NE	5926
Dec-21	1.32	0.57	1.62	0.82	2.6	0.99	1.34	2.47	4	N (12%)	S	3780
Jan-22	10.31	4.93	3.08	2.56	1.42	1.33	1.36	0.42	4	NE (13%)	NE	4251
Feb-22	1.35	0.44	0.94	0.25	0.97	0.51	1.33	1.42	4	W (10%)	NE	4841
Mar-22	ND	ND	0.32	0.03	0.13	0.05	1.23	0.5	4	W (12%)	SW	0
Apr-22	1.34	0.16	2.33	1.61	1.13	0.54	1.15	1.31	4	W (11%)	SW	971
May-22	1.67	0.22	1.62	0.57	1.08	0.25	1.11	2.44	4	W (20%)	WSW	1200
Jun-22	0.58	0.35	0.6	0.49	0.6	0.26	1.04	0.67	4	W (18%)	W	10136
FY22 Average	2.07	0.88	1.54	0.92	1.79	1.05	1.21	1.64	4			91125

A detailed breakdown of the particulate monitoring via the HVAS can be seen in Table 31 below.

Table 31 Detailed Summary of PM_{10} Monitoring Data

Date	Sample Daily Average (µg/m$^{3)}$	Short Term Criteria 24-hr (50µg/m$^{3)}$	Long Term Criteria Annual (30µg/m$^{3)}$	Progressive Annual Average (µg/m3)	Comments
7/3/2021	0.71	50	30	9.06	
7/9/2021	3.57	50	30	8.96	
7/15/2021	0.95	50	30	8.84	
7/21/2021	1.6	50	30	8.7	
7/27/2021	0.65	50	30	8.15	
8/2/2021	1.01	50	30	8.06	
8/8/2021	1.84	50	30	7.93	
8/14/2021	2.2	50	30	7.76	

Date	Sample Daily Average (µg/m$^{3)}$	Short Term Criteria 24-hr (50µg/m$^{3)}$	Long Term Criteria Annual (30µg/m$^{3)}$	Progressive Annual Average (µg/m3)	Comments
8/20/2021	5.35	50	30	7.73	
8/26/2021	0.24	50	30	7.65	
9/1/2021	15.92	50	30	7.71	
9/7/2021	5.53	50	30	7.67	
9/13/2021	2.26	50	30	7.64	
9/19/2021	8.73	50	30	7.73	
9/25/2021	5.64	50	30	7.37	
10/1/2021	7.01	50	30	7.41	
10/7/2021	18.54	50	30	7.54	
10/13/2021	6.36	50	30	7.53	
10/19/2021	5.23	50	30	7.44	
10/25/2021	18.6	50	30	7.67	
10/31/2021	5.53	50	30	7.7	
11/6/2021	18.6	50	30	7.86	
11/12/2021	2.61	50	30	7.57	
11/18/2021	17.53	50	30	7.68	
11/24/2021	22.28	50	30	7.84	
11/30/2021	9.51	50	30	7.94	
12/6/2021	16.76	50	30	8.04	
12/12/2021	25.55	50	30	8.02	
12/18/2021	26.32	50	30	8.28	
12/24/2021	7.49	50	30	8.35	
12/30/2021	10.46	50	30	8.24	
1/5/2022	4.52	50	30	8.25	
1/11/2022	12.42	50	30	8.33	
1/17/2022	11.56	50	30	7.76	
1/23/2022	2.67	50	30	7.52	

Date	Sample Daily Average (µg/m$^{3)}$	Short Term Criteria 24-hr (50µg/m$^{3)}$	Long Term Criteria Annual (30µg/m$^{3)}$	Progressive Annual Average (µg/m3)	Comments
1/29/2022	7.49	50	30	7.53	
2/4/2022	6.48	50	30	7.48	
2/10/2022	18.54	50	30	7.63	
2/16/2022	13.31	50	30	7.7	
2/22/2022	4.31	50	30	7.54	
2/28/2022	1.8	50	30	7.5	
3/6/2022	2	50	30	7.46	
3/12/2022	1.6	50	30	7.44	
3/18/2022	11.94	50	30	7.59	
3/24/2022	7.49	50	30	7.65	
3/30/2022	5.29	50	30	7.62	
4/5/2022	7.72	50	30	7.61	
4/11/2022	1.07	50	30	7.45	
4/17/2022	6.95	50	30	7.45	
4/23/2022	4.13	50	30	7.38	
4/29/2022	1	50	30	7.46	
5/5/2022	0.6	50	30	7.47	
5/11/2022	0.65	50	30	7.46	
5/17/2022	0.76	50	30	7.46	
5/23/2022	0.7	50	30	7.58	
5/29/2022	0.42	50	30	7.51	
6/4/2022	0.1	50	30	7.6	
6/10/2022	0.11	50	30	7.69	
6/16/2022	1.13	50	30	7.76	
6/22/2022	0.24	50	30	7.88	
6/28/2022	0.18	50	30	8.03	

Appendix C Annual Noise Monitoring Compliance Report

Annual Noise Monitoring Assessment 2021

Dunmore Lakes Sand Project
Dunmore, NSW
September 2021.

Prepared for: Boral Resources (NSW) Pty Ltd
September 2021
MAC180747-02RP3

Muller Acoustic Consulting

Document Information

Annual Noise Monitoring Assessment 2021

Dunmore Lakes Sand Project, Dunmore, NSW

September 2021

Prepared for: Boral Resources (NSW) Pty Ltd

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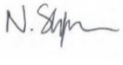
Document ID	Status	Date	Prepared By	Signed	Reviewed By	Signed
MAC180747-02RP3	Final	14 September 2021	Nicholas Shipman		Rod Linnett	

CONTENTS

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1 Introduction

Muller Acoustic Consulting Pty Ltd (MAC) has completed a Noise Monitoring Assessment (NMA) on behalf of Boral for Dunmore Lakes Sand Project (DLSP), at Dunmore, NSW.

The monitoring has been conducted in accordance with the Dunmore Lakes Sand Project Noise Management Plan (NMP, 2017) and in general accordance with the Noise Policy for Industry (NPI). This assessment has been undertaken during September 2021 and forms the annual noise monitoring program to address conditions outlined in the Development Consent (DA 195-8-2004). Typically, the NMA is completed during the winter months where temperature inversion conditions are more likely, however, due to COVID-19 restrictions, the NMA was delayed to September 2021.

This report summarises the operator-attended noise monitoring results measured at three receivers in comparison to the relevant noise limits contained in the Development Consent and NMP.

The assessment has been conducted in accordance with the following documents:

- NSW Environment Protection Authority (EPA), Noise Policy for Industry (NPI), 2017;
- Dunmore Lakes Sand Project Noise Management Plan V5 (NMP), 2017;
- Discussion Paper - Validation of Inversion Strength Estimation Method (EPA) 2014; and
- Australian Standard AS 1055:2018 - Acoustics - Description and measurement of environmental noise.

A glossary of terms, definitions and abbreviations used in this report is provided in **Appendix A**.

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2 Noise Criteria

The DLSP Noise Management Plan (NMP), outlines the applicable noise criteria for residential receivers surrounding the operation, and are presented in **Table 1.**

Table 1 Noise Limits

Description	Address	Day (7am - 6pm)	Evening (6pm - 10pm)	Night (10pm - 12am)	Morning Shoulder (6am - 7am)
		dB $LA_{eq(15min)}$	dB $LA_{eq(15min)}$	dB $LA_{eq(15min)}$	dB $LA_{eq(15min)}$
Renton	James Road	46	43	37	46
Dunmore Village	31 Shellharbour Road	49	44	41	47
Stocker	Swamp Road	49	44	38	47

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3 Methodology

3.1 Locality

DLSP is located at Dunmore near Shellharbour, NSW. Receivers in the locality surrounding DLSP are primarily rural and residential. Highway traffic is a dominant noise source for receivers as they are situated within 500m of the Princes Highway. The representative monitoring locations with respect to DLSP are presented in the locality plan in **Figure 1. Table 2** presents the relevant noise criteria for each assessed receiver.

Table 2 Attended Monitoring Locations and EPL Noise Criteria

ID	Description	Day[1]	Evening[1]	Night[1]	Morning Shoulder[1]
		dB $L_{Aeq(15min)}$	dB $L_{Aeq(15min)}$	dB $L_{Aeq(15min)}$	dB $L_{Aeq(15min)}$
DN-6	Renton	46	43	37	46
DN-7	Dunmore Village	49	44	41	47
DN-8	Stocker	49	44	38	47

Note 1: Day - the period from 7am to 6pm Monday to Saturday or 8am to 6pm on Sundays and public holidays; Evening - the period from 6pm to 10pm; Night - the remaining periods and the morning shoulder period is from 6am to 7am.

3.2 Assessment Methodology

The attended noise measurements were conducted in general accordance with the procedures described in Australian Standard AS 1055:2018, "Acoustics - Description and Measurement of Environmental Noise" and the DLSP NMP. Noise measurements of 15 minutes in duration were conducted at three locations (DN-6, DN-7, DN-8) using Svantek Type 1, 971 noise analysers on Thursday 2 September 2021 to satisfy the requirements of the NMP. The acoustic instrumentation used carries current NATA calibration and complies with AS IEC 61672.1-2019-Electroacoustics - Sound level meters - Specifications. Calibration of all instrumentation was checked prior to and following measurements. Drift in calibration did not exceed ±0.5dBA.

To understand meteorological conditions during the morning shoulder period of Thursday 2 September 2021, direct measurement of temperature profile was undertaken at DN-8 (Stocker) at 2m above ground level and at 60m above ground level using a weather balloon. The results of the temperature measurements were used to determine the temperature lapse rate in general accordance with the Validation of Inversion Strength Estimation Method (2014). These measurements, in combination with the on-site weather station provide a reference to validate the relevant meteorological conditions under which compliance is assessed.

Extraneous noise sources were excluded from the analysis to determine the $LA_{eq(15min)}$ DLSP noise contribution for comparison against the relevant criteria. In the event of quarry attributed noise being above criteria, prevailing meteorological conditions for the monitoring period are sourced from the onsite meteorological station and analysed in accordance with Fact Sheet A4 of the NPI to determine the stability category present at the time of each attended measurement.

Where DLSP is not audible, the contribution is estimated to be at least 10dBA below the ambient noise level.

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FIGURE 1

PROJECT LAYOUT

REF: MAC180747

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4 Results

A summary of the operator attended measurements at location DN-6 to DN-8 are presented **Table 3** to **Table 5** and provide the following information:

- Monitoring location.
- Date, time and assessment period.
- Observed Wind Speed (WS, m/s), Wind Direction (WD) and Temperature (Temp) in °C at 1.5m above the ground measured at the monitoring location.
- Measured Temperature (Temp) in °C at 2.0m and 60.0m above ground level at a representative location.
- Average Wind Speed (WS, m/s), Wind Direction (WD) and Temperature (Temp) in °C at 10m above ground level at the on-site weather station.
- Atmospheric stability class derived from the on-site weather station.
- Calculated temperature inversion strength.
- Ambient measured noise levels $LA_{eq(15min)}$ and $LA_{90(15min)}$ in dB re 20µPa.
- DLSP $LA_{eq(15min)}$ and $LA_{1(1min)}$ noise level contribution.
- Noise Limit $LA_{eq(15min)}$ and $LA_{1(1min)}$.

Results of the attended noise survey identified that the DLSP was audible for short durations during the measurements, however extraneous sources such as distant traffic, insects, livestock and birds were audible during the survey period and dominated the results. Temperature data indicated that inversion strengths calculated from on-site measurements during the morning shoulder of Thursday 2 September 2021 were outside the development consent conditions (ie greater than 6°C/100m), although DSLP noise contributions were within the EPL noise limits. It is noted that temperate inversion data was unavailable during the evening and night periods due to increased wind speeds and unstable conditions.

Table 3 DN-6 - Attended Noise Monitoring Summary

Date & Period	Time (hrs)	1.5m WS WD Temp	Descriptor		EPL Limits 15min	Observed Meteorology							Description and SPL, dBA
			L_{Aeq}	L_{A90}		WS (m/s)[1]	WD[1]	2m Temp˚C	60m Temp˚C	Delta Temp˚C	Lapse Rate ˚C/100m[2]	Stability Class[1]	
02/09/2021 Morning Shoulder	06:09	0.2m/s N 14˚C	56	52	46	0.2	N	10.5	15.6	5.1	10.13	G	Traffic 48-63 Birds 45-62 DLSP Not Audible
DLSP Contribution													<45dB LAeq(15min)
02/09/2021 Day	07:41	0.3m/s W 16˚C	47	42	46	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Birds 40-62 Traffic 40-67 Livestock 40-44 DLSP Not Audible
DLSP Contribution													<40dB LAeq(15min)
02/09/2021 Evening	20:22	0.6m/s NE 18˚C	59	57	43	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Traffic 40-64 Insects 40-60 Wind in trees <40 DLSP Not Audible
DLSP Contribution													<40dB LAeq(15min)
02/09/2021 Night	22:25	0.2m/s N 6˚C	45	41	37	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Insects 40-44 Traffic 45-48 Livestock 45-58 DLSP Not Audible
DLSP Contribution													<35dB LAeq(15min)

Note 1: Data from on-site weather station.

Note 2: Calculated from 2m and 60m temperature.

Table 4 DN-7 - Attended Noise Monitoring Summary

Date & Period	Time (hrs)	1.5m WS WD Temp	Descriptor		EPL Limits 15min	Observed Meteorology							Description and SPL, dBA
			L_{Aeq}	L_{A90}		WS (m/s)[1]	WD[1]	2m Temp˚C	60m Temp˚C	Delta Temp˚C	Lapse Rate ˚C/100m[2]	Stability Class[1]	
02/09/2021 Morning Shoulder	06:33	0.2m/s N 13˚C	65	62	47	0.2	N	10.5	15.6	5.1	10.13	G	Dog 50-62 Traffic 60-74 Birds 55-67 Train 63-65 DLSP Not Audible
DLSP Contribution													<45dB LAeq(15min)
02/09/2021 Day	08:12	0.2m/s W 16˚C	63	58	49	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Traffic 50-72 DLSP Not Audible
DLSP Contribution													<45dB LAeq(15min)
02/09/2021 Evening	20:49	0.5m/s NE 18˚C	48	37	44	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Traffic 40-62 Wind in trees <40 Insects 45-51 DLSP Not Audible
DLSP Contribution													<40dB LAeq(15min)
02/09/2021 Night	22:01	0.1m/s N 15˚C	53	40	41	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Traffic 58-62 Insects <40 DLSP Not Audible
DLSP Contribution													<35dB LAeq(15min)

Note 1: Data from on-site weather station.

Note 2: Calculated from 2m and 60m temperature.

Table 5 DN-8 - Attended Noise Monitoring Summary

Date & Period	Time (hrs)	1.5m WS WD Temp	Descriptor		EPL Limits 15min	Observed Meteorology							Description and SPL, dBA
			L_{Aeq}	L_{A90}		WS (m/s)[1]	WD[1]	2m Temp°C	60m Temp°C	Delta Temp°C	Lapse Rate °C/100m[2]	Stability Class[1]	
02/09/2021 Morning Shoulder	06:25	0.2m/s WNW 15°C	61	57	47	0.2	N	10.5	15.6	5.1	10.13	G	Traffic 53-66 Birds 56-71 DLSP Not Audible
DLSP Contribution													<45dB LAeq(15min)
02/09/2021 Day	07:00	0.2m/s WNW 15°C	59	55	49	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Traffic 51-64 Birds 51-67 DLSP Not Audible
DLSP Contribution													<45dB LAeq(15min)
02/09/2021 Evening	21:16	0.3m/s NE 17°C	53	41	44	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Traffic 48-50 Train 40-59 Insects 40-46 DLSP Not Audible
DLSP Contribution													<40dB LAeq(15min)
02/09/2021 Night	22:06	0.6m/s N 16°C	48	38	38	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Traffic 35-66 Insects 35-37 DLSP Not Audible
DLSP Contribution													<35dB LAeq(15min)

Note 1: Data from on-site weather station.

Note 2: Calculated from 2m and 60m temperature.

5 Noise Compliance Assessment

The compliance assessment summary for each monitoring location (DN-6, DN-7, DN-8) is presented in **Table 6** and for the three assessment periods.

Table 6 Noise Compliance Assessment Summary

Location No.	Period	DLSP Contribution	Criteria	Compliant
		dB $LA_{eq(15min)}$	dB $LA_{eq(15min)}$	
DN-6	Day	<40	46	✓
DN-7	Day	<45	49	✓
DN-8	Day	<45	49	✓
DN-6	Evening	<40	43	✓
DN-7	Evening	<40	44	✓
DN-8	Evening	<40	44	✓
DN-6	Night	<35	37	✓
DN-7	Night	<35	41	✓
DN-8	Night	<35	38	✓
DN-6	Morning Shoulder	<45	46	✓
DN-7	Morning Shoulder	<45	47	✓
DN-8	Morning Shoulder	<45	47	✓

Note: Day - the period from 7am to 6pm Monday to Saturday or 8am to 6pm on Sundays and public holidays; Evening - the period from 6pm to 10pm; Night - the remaining periods and the morning shoulder period is from 6am to 7am.

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6 Discussion

6.1 Discussion of Results - Location DN-6

The noise monitoring survey identified that the acoustic environment at this location is dominated by road traffic noise from the Princes Highway, approximately 350m to the east. DLSP noise was inaudible during all measurement periods with the noise contribution calculated (during short breaks in traffic) to be below the relevant noise criteria for all periods. Extraneous sources audible during the survey included traffic, birds, livestock, wind in trees and insects.

6.2 Discussion of Results - Location DN-7

The noise monitoring survey identified that the acoustic environment at this location is dominated by road traffic noise from the Princes Highway, approximately 350m to the west. DLSP noise was not audible during the measurement periods and the noise contributions were calculated (during short breaks in traffic) to be below the relevant noise criteria for all periods. Extraneous sources audible during the survey included dogs, traffic, birds, train, wind in trees and insects.

6.3 Discussion of Results - Location DN-8

The noise monitoring survey identified that the acoustic environment at this location is dominated by road traffic noise from the Princes Highway, approximately 350m to the east. DLSP noise remained inaudible during the measurement periods with the noise contribution calculated (during short breaks in traffic) to be below the relevant noise criteria for all periods. Extraneous sources audible during the survey included traffic, birds, trains and insects.

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7 Conclusion

Muller Acoustic Consulting Pty Ltd (MAC) has completed a Noise Monitoring Assessment (NMA) on behalf of Boral for Dunmore Lakes Sand Project (DLSP), Dunmore, NSW.

Attended noise monitoring was undertaken on Thursday 2 September 2021 at three representative monitoring locations. The assessment has identified that noise emissions generated by DLSP was inaudible during all assessment periods. DSLP contributed noise emissions were below the relevant noise criteria at all locations during all measurement periods thus satisfying the relevant noise limits.

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Appendix A - Glossary of Terms

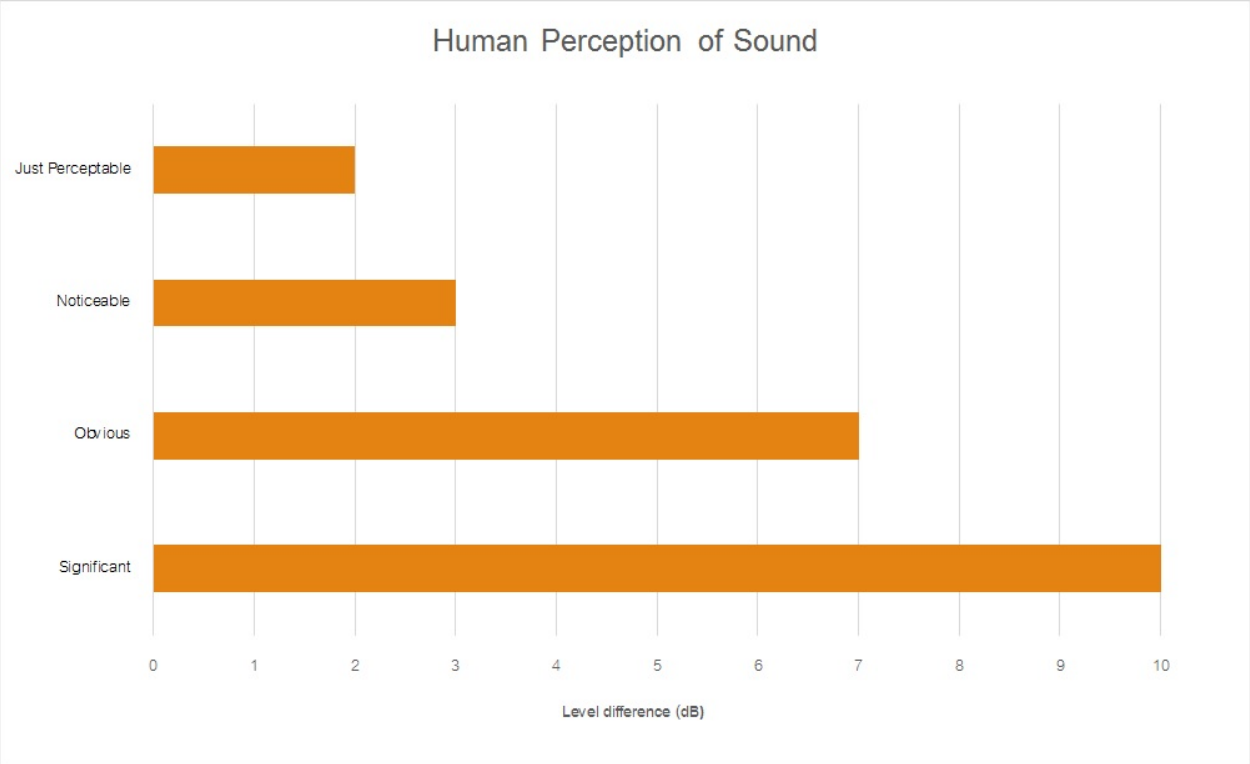
Table A1 provides a number of technical terms have been used in this report.

Table A1 Glossary of Terms	
Term	Description
1/3 Octave	Single octave bands divided into three parts
Octave	A division of the frequency range into bands, the upper frequency limit of each band being twice the lower frequency limit.
ABL	Assessment Background Level (ABL) is defined in the NPI as a single figure background level for each assessment period (day, evening and night). It is the tenth percentile of the measured LA90 statistical noise levels.
Adverse Weather	Weather effects that enhance noise (that is, wind and temperature inversions) that occur at a site for a significant period of time (that is, wind occurring more than 30% of the time in any assessment period in any season and/or temperature inversions occurring more than 30% of the nights in winter).
Ambient Noise	The noise associated with a given environment. Typically a composite of sounds from many sources located both near and far where no particular sound is dominant.
A Weighting	A standard weighting of the audible frequencies designed to reflect the response of the human ear to noise.
dBA	Noise is measured in units called decibels (dB). There are several scales for describing noise, the most common being the 'A-weighted' scale. This attempts to closely approximate the frequency response of the human ear.
dB(Z), dB(L)	Decibels Linear or decibels Z-weighted.
Hertz (Hz)	The measure of frequency of sound wave oscillations per second - 1 oscillation per second equals 1 hertz.
LA10	A noise level which is exceeded 10 % of the time. It is approximately equivalent to the average of maximum noise levels.
LA90	Commonly referred to as the background noise, this is the level exceeded 90 % of the time.
LAeq	The summation of noise over a selected period of time. It is the energy average noise from a source, and is the equivalent continuous sound pressure level over a given period.
LAmax	The maximum root mean squared (rms) sound pressure level received at the microphone during a measuring interval.
RBL	The Rating Background Level (RBL) is an overall single figure background level representing each assessment period over the whole monitoring period. The RBL is used to determine the intrusiveness criteria for noise assessment purposes and is the median of the ABL's.
Sound power level (LW)	This is a measure of the total power radiated by a source. The sound power of a source is a fundamental location of the source and is independent of the surrounding environment. Or a measure of the energy emitted from a source as sound and is given by : = 10.log10 (W/Wo) Where : W is the sound power in watts and Wo is the sound reference power at 10-12 watts.

Table A2 provides a list of common noise sources and their typical sound level.

Table A2 Common Noise Sources and Their Typical Sound Pressure Levels (SPL), dBA	
Source	Typical Sound Level
Threshold of pain	140
Jet engine	130
Hydraulic hammer	120
Chainsaw	110
Industrial workshop	100
Lawn-mower (operator position)	90
Heavy traffic (footpath)	80
Elevated speech	70
Typical conversation	60
Ambient suburban environment	40
Ambient rural environment	30
Bedroom (night with windows closed)	20
Threshold of hearing	0

Figure A1 – Human Perception of Sound



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Appendix D Annual Groundwater Monitoring report

Appendix E Rehabilitation Progress Monitoring

FY17 Re-aligned Western Tributary Rehabilitation Progress

FY18 Re-aligned Western Tributary Rehabilitation Progress

FY19 Re-aligned Western Tributary Rehabilitation Progress

FY20 Re-aligned Western Tributary Rehabilitation Progress

FY21 Re-aligned Western Tributary Rehabilitation Progress

FY22 Re-aligned Western Tributary Rehabilitation Progress

FY17 NW Stage 2 Swamp Oak Forest Rehabilitation Progress

FY18 NW Stage 2 Swamp Oak Forest Rehabilitation Progress

FY19 NW Stage 2 Swamp Oak Forest Rehabilitation Progress

FY20 NW Stage 2 *Swamp Oak Forest Rehabilitation Progress*

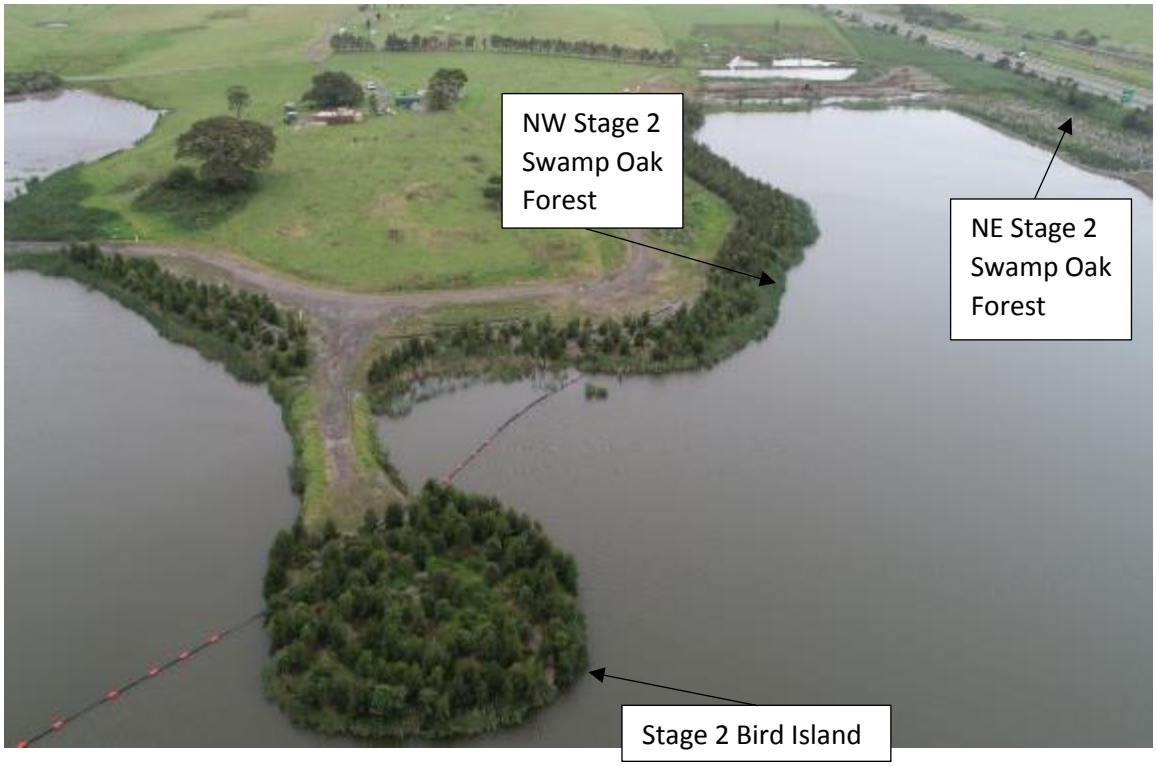
FY21 NW Stage 2 Swamp Oak Forest Rehabilitation Progress

FY22 NW Stage 2 Swamp Oak Forest Rehabilitation Progress

FY20 NE Stage 2 Swamp Oak Forest Rehabilitation Progress

FY21 NE Stage 2 Swamp Oak Forest Rehabilitation Progress

FY22 NE Stage 2 Swamp Oak Forest Rehabilitation Progress



Dunmore Bird Island and Stage 2 Rehabilitation Area December 2020