ANNUAL REVIEW
1 April 2020 – 31 March 2021

Northern Dune Extension

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Appendix 1 – Project Approval MP-09-0091

Appendix 2 – Nest Box Monitoring, Amphibian Monitoring and Koala Monitoring Report
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Appendix 4 – Groundwater Quality Trend Hydrographs (Quality vs. Trigger Values)
Appendix 5 – Rehabilitation Monitoring Report

SITE DETAILS

Name of operation	Northern Dune Extension
Name of operator	Holcim (Australia) Pty Ltd
Development consent / project approval #	MP 09_0091
Name of holder of development consent / project approval	Holcim (Australia) Pty Ltd
Annual Review start date	April 1, 2020
Annual Review end date	March 31, 2021
I, certify that this audit report is a true and accurate record of the compliance status of Northern Dune Extension for the period of April 1, 2020- March 31, 2021 and that I am authorised to make this statement on behalf of Holcim (Australia) Pty Ltd. *Note.* *a) The Annual Review is an 'environmental audit' for the purposes of Division 9.4) of the Environmental Planning and Assessment Act 1979. Division 9.42 provides that a person must not include false or misleading information (or provide information for inclusion in) an audit report produced to the Minister in connection with an environmental audit if the person knows that the information is false or misleading in a material respect. The maximum penalty is, in the case of a corporation, $1 million and for an individual, $250,000.* *b) The Crimes Act 1900 contains other offences relating to false and misleading information: section 192G (Intention to defraud by false or misleading statement—maximum penalty 5 years imprisonment); sections 307A, 307B and 307C (False or misleading applications/information/documents—maximum penalty 2 years imprisonment or $22,000, or both).*	
Name of authorised reporting officer	Peter Radzievic
Title of authorised reporting officer	Quarry Manager
Signature of authorised reporting officer	
Date	26 June 2021

1 STATEMENT OF COMPLIANCE

See **Table 1** for statement of commitments for the 2019/20 reporting period for Northern Dune Extension Quarry.

Table 1: Statement of Commitments

Were all conditions of the relevant approval(s) complied with?	
MP 09_0091	Yes
Hunter Water (Special Areas) Regulations 2010 – Approval under Clause 10(1)	Yes
EPL No. 11633	Yes

No incidents or non-compliances were recorded during this AR period.

2 INTRODUCTION

Holcim (Australia) Pty Ltd (Holcim) operates Northern Dune Extension (NDE), a sand quarry located in Tanilba Bay, within the Port Stephens Local Government Area. The site operates under Project Approval (MP-09-0091) approved by the then New South Wales (NSW) Department of Planning and Environment (DPE) (now Department of Planning, Industry and Environment (DPIE)) on 8 March 2013.

This Annual Review (AR) has been prepared for the Tanilba Northern Dune Extension Project to report on mining activities undertaken during the past 12 month reporting period from 1st April 2020 to 31st of March 2021. This report addresses the site's present compliance obligations and status, activities undertaken at the site during the reporting period and proposed activities for the following 12 month period.

This AR encompasses the annual reporting requirements required by Project Approval MP 09_0091 issued by the Department of Planning and Environment on 8 March 2013 for the Tanilba Northern Dune Extension Project (attached as Appendix 1).

This AR will be distributed to DPIE, Hunter Water Corporation (HWC) and Port Stephens Council (PSC) and will also be made publicly available on Holcim's website

The site also operates in accordance with Environment Protection License (EPL) No. 11633 issued by the Environmental Protection Authority (EPA). A location figure and aerial view of the site are outlined in Figure 1 below.

Project Application MP 09_0091 was approved under Section 75J of the *Environmental Planning and Assessment Act 1979* for Sibelco Australia to conduct mining activities on Lots 11, 12 and 13 on DP601306, Lot 408 on DP1041934, and Lots 1 and 2 on DP408240. Project Approval MP 09_0091 has been attached as Appendix 1.

The Annual Review required by approval MP 09_0091 is detailed in Schedule 5, Condition 3 of the approval whereby it is stated:

"Within 12 months of the commencement of quarrying operations, and annually thereafter, the Proponent shall review the environmental performance of the project to the satisfaction of the Director-General. This review must:

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

Mining commenced within Lots 11 – 13 of the Extension area in 2016 and ceased on 18 December 2018. As such, **no clearing or extraction occurred during the reporting period**.

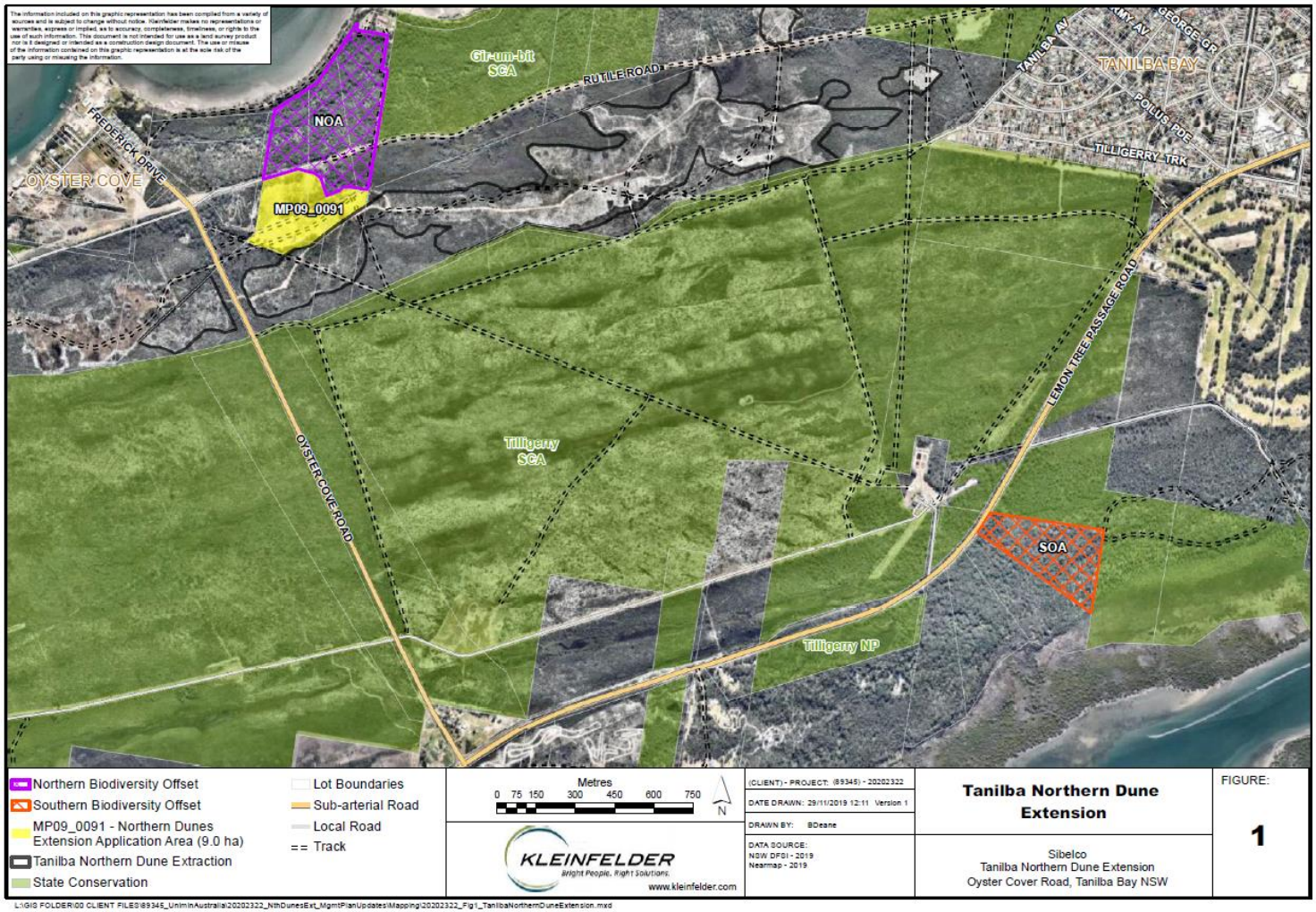


Figure 1: Northern Dune Extension Operations (Including Offset Areas)

In accordance with Schedule 5, Condition 4 of the modified Development Consent the site is required to undertake an Annual Review of the site. This Annual Review has been prepared in accordance with Schedule 5 Condition 4 (Annual Performance Monitoring) of the Development Consent and in accordance with the *Annual Review Guideline: post approvals requirements for state significant mining developments* (October 2015). The Annual Review requirements and the section where they have been addressed in this document have been provided in **Table 2**.

Table 2: Annual Review Requirement

Condition	Section in Annual Review
4. Annual Review Annual Review by the end of March each year, the Applicant shall review the environmental performance of the development to the satisfaction of the Secretary. This review must: (a) describe the development (including rehabilitation) that was carried out in the previous calendar year, and the development that is proposed to be carried out over the current calendar year;	Section 4 and 6
(b) include a comprehensive review of the monitoring results and complaints records of the development over the previous calendar year, which includes a comparison of these results against: - the relevant statutory requirements, limits or performance measures/criteria;. - the monitoring results of previous years, and - the relevant predictions in the documents listed in condition 2 of Schedule 2;	Section 6 and 7
(c) identify any non-compliance over the last year, and describe what actions were (or are being) taken to ensure compliance;	Section 1 and 11
(d) identify any trends in the monitoring data over the life of the development;	Section 6 and 7
(e) identify any discrepancies between the predicted and actual impacts of the development, and analyse the potential cause of any significant discrepancies; and	Section 6
(f) describe what measures will be implemented over the current calendar year to improve the environmental performance of the development	Section 12

2.1 Name and Contact Details

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2.2 Background Information and Mining History

The Tanilba Northern Dune is an elevated sand dune system located on the Tilligerry Peninsula adjacent to the township of Oyster Cove in the Port Stephens Shire, New South Wales.

White silica sand has been extracted from the Tanilba Northern Dune by several companies at different locations since 1991 - the approved extraction area in relation to the regional context can be seen in Figure 1.

Prior to 2003, the western parts of the Tanilba Northern Dune were mined by ACI Operations Ltd. Sibelco commenced operations in 2004. Sand extraction works at the Tanilba Northern Dune were comprised of four approval areas separated jurisdictionally by Crown Lands, Hunter Water (x2) and Department of Planning and Environment approvals.

In 2013 approval was granted by the Minister for Planning and Infrastructure to extend the approval area for quarrying activities by 9 ha in an area to the north of the existing extraction operations. The extension project was a Major Project considered under Part 3A of the *Environmental Planning and Assessment Act 1979* (EP&A Act) and is known as the Tanilba Northern Dune Extension Project (now declared a State Significant Development under an Order dated 22 November 2018). Holcim took ownership of the Project on 1 April 2020.

The project area comprises land owned by the Crown, the Hunter Water Corporation and Holcim (the site) and consists of the following:

- Lots 11, 12 ,13 DP601306 (Sibelco);
- Lot 408 DP1041934 (Crown Land); and
- Lots 1, 2 DP408240 (Hunter Water Corporation).

The above areas are depicted in Figure 3.

In terms of the mining process, clearance was undertaken progressively across the site to minimise the area exposed at any one time. Topsoil was then stripped before sand was extracted for processing at the nearby Salt Ash processing plant. Sand was extracted in a rolling south to north sequence where possible with previously mined areas no longer subject to extraction undergoing rehabilitation at the same time. Pre-clearance surveys for flora, fauna and the presence of culturally significant sites were undertaken prior to any clearing of vegetation.

Mined areas are required to be rehabilitated in accordance with an approved Landscape Management Plan and areas cleared of vegetation are required to be offset by implementation of a Biodiversity Offset Strategy including management and improvement of vegetation retained in the north of the approval area. Once rehabilitation is complete, the rehabilitated areas will be returned to their respective owners. Extraction ceased in December 2018, with the project moving to a rehabilitation only phase.

A summary of operating parameters at the Tanilba Northern Dunes Extension during the reporting period (reportable per the January 2006 Annual Environmental Management Report guidelines) is provided below.

Table 3: Summary of operations

Parameter	Site detail
Operating hours	Daylight hours from 7:00am to 6:00pm (light permitting) Monday to Friday.
Infrastructure	No permanent infrastructure has been constructed on-site at the Northern Dune Extension as per approvals.
Construction activities	No construction took place at Northern Dune Extension during the reporting period.
Equipment management	No chemicals or mobile plant are stored overnight at Northern Dune Extension
Waste management	No bins or other waste management facilities are kept on site - any waste produced is removed at the end of each working day.
Lighting	Northern Dune Extension does not operate outside of daylight hours and therefore does not have a lighting system installed.
Exploration	No exploration took place at the Northern Dune Extension during the reporting period.
Blasting	Blasting does not occur at the Northern Dune Extension Project site.
Land clearing	No land clearing occurred during the reporting period.
Extraction	Extraction ceased at the site on December 18 2019. No extraction occurred during the reporting period.

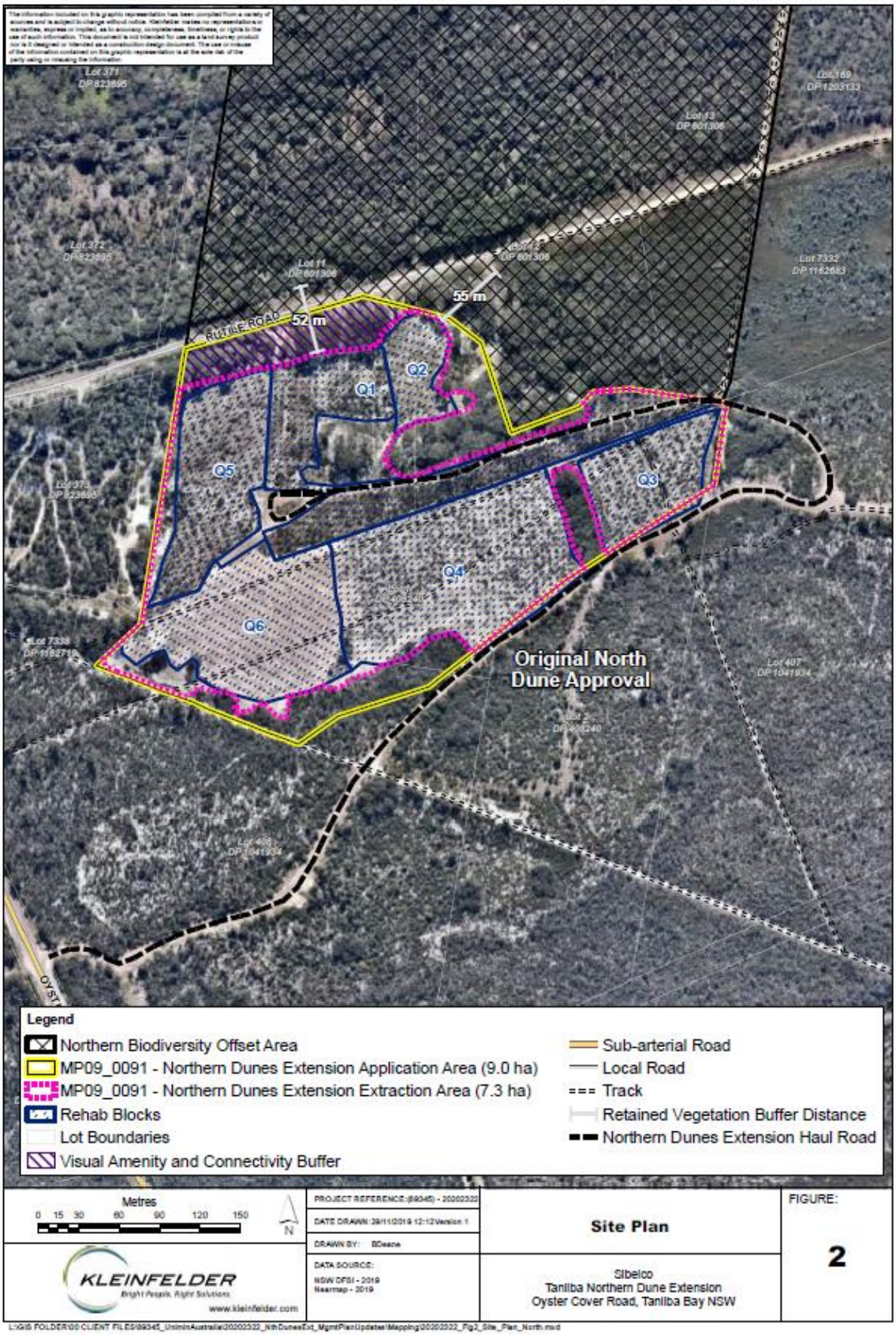


Figure 2: Northern Dune Extension Site Plan

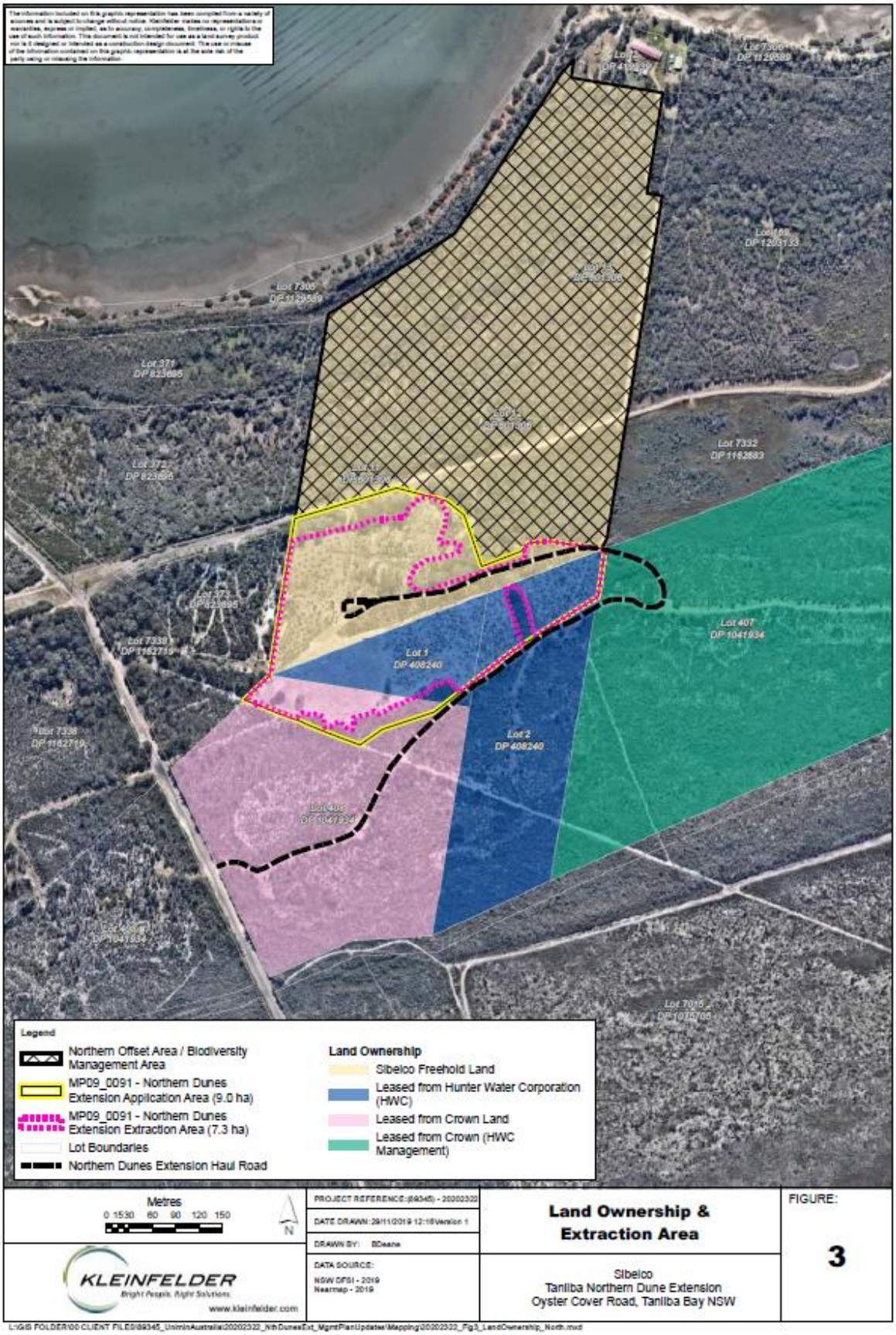


Figure 3: Northern Dune Extension Land Ownership and Extraction Area

3 APPROVALS

The site operates under the following approvals listed in **Table 4**, with the areas of land ownership displayed in **Figure 3**.

Table 4: Approvals for Northern Dune Extension

Approval	Regulatory Authority
MP 09_0091	NSW Department of Planning, Industry & Environment
EPL11633	NSW Environmental Protection Authority
Hunter Water (Special Areas) Regulations 2010 – Approval under Clause 10(1)	Hunter Water Corporation

Holcim holds EPL11633 which covers its activities at Northern Dunes Extension. **Table 5** outlines the EPL licensing limits.

Table 5: EPL Fee-Based Activity at Northern Dune Extension.

Scheduled Activity	Fee Based Activity	Scale
Extractive activities	Land-based extractive activity	>100,000 – 500,000 T extracted, processed or stored

Schedule 2 Condition 6 outlines that the proponent shall not transport more than 150, 000 tonnes of extractive materials from the site in any calendar year.

4 OPERATIONS SUMMARY

4.1 Exploration

No exploration activities were completed during the Annual Review period.

4.2 Land Preparation

No clearing took place during the Annual Review period. All areas of the site were undergoing rehabilitation and covered by vegetation

4.3 Construction Activities

There was no construction undertaken during the Annual Review period.

4.4 Quarry Operations

No extraction occurred during the reporting period. Only rehabilitation activities were performed and are discussed in Section 8. No extractive material was transported from site.

4.5 Next Reporting Period

Extraction at the Northern Dunes Extension site has ceased. Only rehabilitation activities are proposed during the next reporting period. These are discussed further in Section 8.6. Groundwater monitoring will also be performed as per the Groundwater Management Plan (GMP).

5 ACTIONS REQUIRED FROM PREVIOUS ANNUAL REVIEW

5.1 Actions from 2018/19 Annual Review

A site visit invitation was extended alongside submission of the previous AR but was not attended due to the onset of the COVID-19 pandemic and associated restrictions in place. DPIE did attend site for an inspection on 25 March 2021. At the time of writing this AR no formal feedback has been received.

5.2 Management Plan Updates

Schedule 5 Clause 4 of the project approval requires that management plans are reviewed and, if necessary, revised within 3 months of the submission of an annual review. All management plans for the Northern Dune Extension were reviewed and where necessary revised following the submission of the 2018/19 AR. Revisions were made to reflect the requirements of the current operation now that it has transitioned into a rehabilitation phase. Following revision, they were submitted to DPIE for review to meet the satisfaction of the Director-General.

A number of updates were approved, most notably to the Groundwater Management Plan (GMP) to remove monitoring locations that had expired as per the original GMP, and to provide for monitoring and reporting frequencies commensurate with the lack of extraction and the shift to the rehabilitation phase of the operation.

6 ENVIRONMENTAL PERFORMANCE

6.1 Summary of Environmental Performance

A summary of the conditions of the approval MP 09_0091 and sections within this AR where each condition is addressed is provided in **Table 6** below.

Table 6: Summary of Conditions

MP 09_0091 Reference	*Summary of Condition*	*Report Reference*	*Compliance*
ADMINISTRATIVE CONDITIONS			
S2, Cl6	*The Proponent shall not transport more than 150,000 tonnes of extractive materials from the site in any calendar year*	4.4	Y
S2, Cl7	*The Proponent shall ensure that no more than three hectares of the site would be exposed (ie cleared but not re-vegetated) at any one time*	4.2	Y
ENVIRONMENTAL PERFORMANCE CONDITIONS			
Identification of Boundaries			
S3, Cl1	*Prior to the commencement of quarrying operations, the Proponent shall:* *(a) Engage a registered surveyor to mark out the boundaries of the approved limits of extraction; and* *(b) Ensure that these boundaries are clearly marked at all times in a permanent manner that allows operating staff and inspecting officers to clearly identify those limits*	4.4	Y
Noise			
S3, Cl2	*The Proponent shall ensure that the operational noise generated by the project does not exceed the noise impact assessment criteria in Table 1 at any residence on privately-owned land*	4.4	Y
S3, C3	*The Proponent shall only conduct quarrying operations on the site … during stipulated hours*	4.4	Y
Noise Monitoring Program			
S3, Cl5	*The proponent shall prepare and implement a Noise Monitoring Program for the project to the satisfaction of the DG. This program must (amongst other items):* *Include quarterly noise monitoring during at least the first two years of operations*	6.2	Y
Air quality			
S3, Cl6	*The Proponent shall ensure that all reasonable and feasible avoidance and mitigation measures are employed so that particulate matter emissions generated by the project do not exceed the criteria listed in Tables 2 to 4 at any privately-owned land*	6.3.2	Y
S3, Cl7	*The Proponent shall regularly assess air quality monitoring data*	6.3.2	Y
S3, Cl8	*The Proponent shall prepare and implement a Dust Monitoring Program*	6.3.2	Y
Soil and Water - Management and monitoring			
S3, Cl10	*The Proponent shall not extract sand or other extractive materials or carry out any work in the extraction area below a level of 0.7 m above the predicted maximum groundwater elevation (see condition 14 of schedule 3), other than the construction of any bores approved by NOW*	4.4	Y
S3, Cl11	*The Proponent shall ensure that the final landform of the extraction area must be at least 1 metre above the predicted maximum groundwater elevation*	4.2	Y
S3, C13	*Erosion and sediment control plan*	5.2	Y
S3, Cl14	*The Ground Water Monitoring Program shall include* *(a) Detailed baseline data on groundwater levels and quality* *(b) Groundwater impact assessment criteria'* *(c) A program to monitor groundwater levels and quality* *(d) A protocol for the investigation, notification and mitigation of any notified exceedance of the impact assessment criteria;* *(e) The outcome of groundwater modelling to establish the predicted maximum groundwater elevation for the site*	7.1	 Y Y Y Y Y

MP 09_0091 Reference	*Summary of Condition*	*Report Reference*	*Compliance*
	(f) a program to monitor any impacts on GDE *(g) a contingency plan to manage any acid sulfate soils and potentially acid sulfate soils encountered during quarrying operations*		N/A Y
MP 09_0091 Reference	*Summary of Condition*	*Report Reference*	*Compliance*
Biodiversity			
S3, Cl15	*The Biodiversity Management Plan must* *(c) Address project site and offset areas* *(d) provide for retention of hollow bearing trees* *(e) on-going monitoring (at least 6 years) of at least 2 nest boxes for each hollow tree removed during clearing* *(f) a program to undertake targeted survey for* Uperoleia sp *(g) implement a program for any areas within offset areas requiring rehabilitation and/or revegetation* *(i) include monitoring procedures and performance indicators with reference to* Uperoleia *sp., Koala and Wallum Froglet*	6.5	Y
S3, Cl16	*By 31 December 2013, or otherwise agreed by the Director-General, the Proponent shall:* *(a) enter into a Biobanking agreement in respect of the proposed offset areas (see Appendix 4) with the Minister for the Environment, in accordance with Part 7A of the Threatened Species Conservation Act 1995, to implement the Biodiversity Offset Strategy; or* *(b) enter into an agreement with OEH to transfer the offset areas into the national parks estate, to the satisfaction of the Director-General*	N/A	Y
Rehabilitation and landscaping			
S3, Cl18	*The Proponent shall prepare and implement a Landscape Management Plan to the satisfaction of the DG. This shall include a Rehabilitation Management Plan and a Long Term Management Strategy.*	8	Y
Aboriginal Cultural Heritage			
S3, Cl22	*The Proponent shall prepare and implement an Aboriginal Cultural Heritage Management Plan to the satisfaction of the DG*	6.6.2	Y
Visual amenity			
S3, Cl27	*The Proponent shall minimise the visual impacts of the project to the satisfaction of the DG*	8	Y
Waste Management			
S3, Cl28-31	*The Proponent shall comply with conditions of waste management as outlined in the approval]*	6.7.1	Y
Dangerous Goods			
S3, Cl32	*The Proponent shall ensure that chemicals and/or petroleum products are not stored on site*	6.7.1	Y
Production Data			
S3, Cl34	*The Proponent shall* *(a) provide annual quarry production data to DRE using the standard form for that purpose and* *(b) include a copy of this data in the Annual Review*	4.4	Y
ENVIRONMENTAL MANAGEMENT, REPORTING AND AUDITING			
Annual Review			
S5, Cl3	*Within 12 months of the commencement of quarrying operations, and annually thereafter, the Proponent shall review the environmental performance of the project to the satisfaction of the Director-General.*	This Report and 5.2	Y
Reporting			
S5, Cl 5	*The Proponent shall notify the DG ... of any incident associated with the project*	11	Y
Auditing			
S5, Cl 7	*Within 1 month of completion of quarrying operations … the Proponent shall commission an Independent Environmental Audit to … assess the environmental performance of the project and whether it is complying with the relevant requirements in this approval and any relevant EPL.*	10	Y
Access to Information			

MP 09_0091 Reference	***Summary of Condition***	***Report Reference***	***Compliance***
S5, Cl 9	*From 1 July 2013, the Proponent shall make the following information publicly available on its website:* • *A copy of all approved strategies, plans and programs* • *A summary of all monitoring results of the project* • *A complaints register that is updated on a quarterly basis* • *Copies of any Annual Review* • *Copies of any Independent Environmental Audit and the Proponents response to the recommendation in any audit*	9.1	Y

6.2 Noise

6.2.1 Key Environmental Performance

The approved Noise Management Plan states that as quarrying operations have been performed for greater than 2 years and the project is currently in the rehabilitation and closure phase, noise monitoring will only be conducted upon the receipt of a verified noise complaint from a local resident.

6.3 Air Quality

6.3.1 Approved Criteria

Air Quality monitoring is required to be undertaken in accordance with the following development consent conditions:

"The Proponent shall ensure that all reasonable and feasible avoidance and mitigation measures are employed so that particulate matter emissions generated by the project do not exceed the criteria listed in Tables 2 to 4 at any privately-owned land."

Table 7: Long term criteria for particulate matter

Pollutant	Averaging Period	[d] Criterion
Total suspended particulate (TSP) matter	Annual	[a] 90 µg/m^3
Particulate matter < 10 µm (PM_{10})	Annual	[a] 30 µg/m^3

Table 8: Short term criterion for particulate matter

Pollutant	Averaging Period	[d] Criterion
Particulate matter < 10 µm (PM_{10})	24 hour	[a] 50 µg/m^3

Table 9: Long term criteria for deposited dust

Pollutant	Averaging Period	Maximum increase in deposited dust level	Maximum total deposited dust level
[c] Deposited dust	Annual	[b] 2 g/m^2/month	[a] 4 g/m^2/month

Notes to Tables above:

- *[a] Total impact (i.e. incremental increase in concentrations due to the projects plus background concentrations due to all other sources);*
- *[b] Incremental impact (i.e. incremental increase in concentrations due to the projects on their own);*
- *[c] Deposited dust is to be assessed as insoluble solids as defined by Standards Australia, AS/NZS 3580.10.1:2003: Methods for Sampling and Analysis of Ambient Air - Determination of Particulate Matter - Deposited Matter - Gravimetric Method.*
- *[d] Excludes extraordinary events such as bushfires, prescribed burning, dust storms, sea fog, fire incidents, illegal activities or any other activity agreed by the Director-General in consultation with DECCW.*

6.3.2 Management Measures

Air quality monitoring for the site is undertaken consistent with the Dust Management Plan, available as Appendix J of the Northern Dune Environmental Management Plan.

Depositional dust monitoring is undertaken at four locations, known as D3 / TB4, D4 / TB2, D5 / TB3 and D6 / TB1 (see **Figure 4**). Monitoring locations D3 / TB4 and D5 / TB3 are located adjacent to the closest sensitive receiver to extraction activities undertaken by Holcim within the Northern Dunes Extension area and represent compliance monitoring sites.

Monitoring locations D4 / TB2 and D6 / TB1 are located immediately adjacent to extraction activities where deposited dust is most likely to be related to Holcim's activities. These sites enable evaluation of compliance stations D3 / TB4 and D5 / TB3 with data from comparison stations D4 / TB2 and D6 / TB1 to infer whether the high dust levels are likely related to the Northern Dune Extension activities or may have been associated with external land use activities.

Depositional dust was monitored monthly over the AR reporting period and analysis conducted by ALS Laboratory Services (NATA accredited) for insoluble solids in accordance with *AS 3580.10.1 - 2003*.

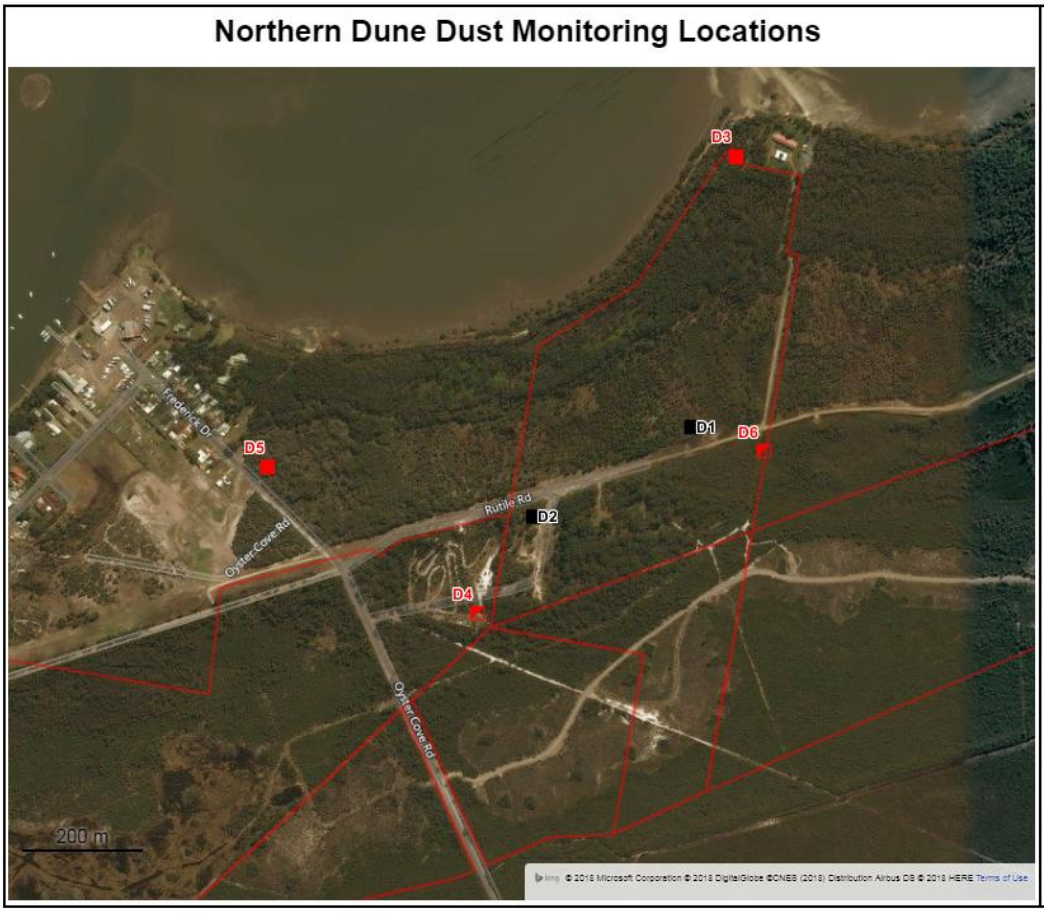


Figure 4: Dust Sampling Locations

6.3.3 Key Environmental Performance

6.3.3.1 Depositional Dust

Monitoring results for the 2020/21 reporting period are presented in Table 10 and Table 11. Results at compliance locations D3 / TB4 and D5 / TB3 have been compared against criteria in Schedule 3, Condition 6, Table 4, shown above. The criteria allows for an annual average of up to 4 g/m^2/month for insoluble solids (or Total Insoluble Matter (TIM) as reported by ALS), as a total (inclusive of the site and background dust). The criteria of 2 g/m^2/month relates to an incremental impact from the Project alone and is also assessed as a rolling annual average.

TIM is an indicator of the mineral constituent of dust as indicative of soil or rock particles and is the parameter of interest when measuring levels of deposited dust as per *Notes to Tables 2 to 4*, *Note C* referenced above. Highlighted results within the table indicate where dust trigger limits were exceeded during the reporting period.

The annual rolling average shown for D3 / TB4 and D5 / TB3 in Table 10 and Table 11 was calculated using data obtained over a rolling 12 month period in accordance with *Appendix J Dust Monitoring Program* of the approved Environmental Management Plan (EMP). The annual rolling average was then compared to the long term maximum total deposited dust level trigger level of 4 g/ m^2/month under Schedule 3, Clause 6 for analysis of ongoing compliance of Northern Dune Extension operations in relation to depositional dust levels. A standard background level of 1.5 g / m^2, drawn from the median of values from D3 / TB4, was utilised as the monthly average to generate the rolling average values for data where a 12 month back-date of data was not available.

As seen in Table 10 and Figure 5, there were two instances where measured deposited dust exceeded 4 g/m^2/month at monitoring station D5 / TB3

- September 2020 (40.5 g/m^2)
- March 2021 (6.3 g/m^2).

Review of depositional dust results at comparison sites D4 / TB2 and D6 / TB1 in the same time period found the following:

- In September 2020 comparison site D4 / TB2 had an insoluble matter level of 9.6 g/m^2 while D6 / TB1 had an insoluble matter level of 0.9g/m^2.
- In December 2021 comparison site D4 / TB2 had an insoluble matter level of 4.2 g/m^2 while D6 / TB1 had an insoluble matter level of 0.5g/m^2.

As seen in Table 10and Figure 5, there were two instances where measured deposited dust exceeded 4 g/m^2/month at monitoring station D3 / TB4

- February 2021 (5.5 g/m^2)
- March 2021 (5.7 g/m^2).

Review of depositional dust results at comparison sites D4 / TB2 and D6 / TB1 in the same time period found the following:

- In February 2021 comparison site D4 / TB2 had an insoluble matter level of 0.9 g/m^2 while D6 / TB1 had an insoluble matter level of 0.2g/m^2.
- In March 2021 comparison site D4 / TB2 had an insoluble matter level of 4.4 g/m^2 while D6 / TB1 had an insoluble matter level of 0.3g/m^2.

Regarding the exceedences experienced a the compliance sites, levels received at the comparison sites during the same time period are significantly reduced when compared to the compliance sites. This indicates that the source of the elevated dust is not related to the operations at Northern Dune Extension, and the anomalous nature of the results suggests that equipment may have been tampered with, as has been the case in previous reporting periods. As such the anomalous results have not been included in the rolling average calculations demonstrated in Table 10 and Table 11.

Further evidence to support this is that given no extraction was occurring during the time of the exceedences, the source is highly unlikely to be related to activities on the Northern Dune Extension site. The only activities performed during the reporting period were rehabilitation activities (as discussed in Section 8.2) which generally do not have the potential to generate dust beyond the criteria. A small section of Block Q5 was cleared in August 2020 to clear weeds and allow for an improved rehabilitation effort, however this was an isolated event that did not result in exceedences at the compliance sites as demonstrated by the August results presented in Table 10 and Table 11.

Given that no extractive activity occurred through the reporting period it is possible that background dust levels are responsible for exceedances of the criteria. Any dust exceedences are attributed to external activities, i.e. not related to quarrying operations due to:

1. Extraction and ground disturbing activities have not occurred during the reporting period.
2. Rainfall throughout the reporting period is increased when compared to previous years.
3. Rehabilitation monitoring shows greater ground cover in comparison to previous years (see Section 8).
4. No dust complaints have been received from nearby residents.

The annual rolling average for D5 / TB3 is below the trigger threshold under Schedule 3, Clause 6 of the conditions of approval for all months within the monitoring period, once the anomalous results are discounted for the reasons as described above.

The annual rolling average for D3 / TB4 is below the trigger threshold under Schedule 3, Clause 6 of the conditions of approval for all months within the monitoring period with the exception of September 2020 where a result of 2.1 g/m^2 was recorded. This is not attributed to a single exceedance event of the monthly threshold which have been discounted due to the anomalous nature as described above, but rather is a result of consistent readings near or above the 2 g/m^2 threshold in the preceding months of the reporting period. For the reasons provided above, it is determined that external sources of dust are contributing to these results and that the source of the dust is not from the Northern Dune Extension operations given the rehabilitation phase of the project.

Table 10: Insoluble Matter (g/m2) Monitoring results for the D3 / TB4 Monitoring Station (April 2020 – April 2021).

Sample Period		Dust Monitor		Purpose (Comparison / Compliance)	D3 - Insol. Matter (g/m^2)	Comment	D3 - Annual Rolling Average (g/m^2)	Criteria (g/m^2)
Month	Year	TB	D					
April	2020	TB4	D3	Compliance	2.1		1.8	4.0
May	2020	TB4	D3	Compliance	1.9		1.8	4.0
June	2020	TB4	D3	Compliance	2.9		1.9	4.0
July	2020	TB4	D3	Compliance	0.3		1.9	4.0
August	2020	TB4	D3	Compliance	0.3		1.9	4.0
September	2020	TB4	D3	Compliance	2.8		2.1	4.0
October	2020	TB4	D3	Compliance	0.6		2.0	4.0
November	2020	TB4	D3	Compliance	1.3		2.0	4.0
December	2020	TB4	D3	Compliance	1.4		1.9	4.0
January	2021	TB4	D3	Compliance	0.7		1.8	4.0
February	2021	TB4	D3	Compliance	5.5	D4= 0.9, D5= 0.5, D6= 0.2.	1.7	4.0
March	2021	TB4	D3	Compliance	5.7	D4= 4.4, D5= 0.5, D6= 0.3.	1.8	4.0

Table 11: Insoluble Matter (g/m2) Monitoring results for the D5 / TB3 Monitoring Station (April 2020 – March 2021).

Sample Period		Dust Monitor		Purpose (Comparison / Compliance)	D5 - Insol. Matter (g/m^2)	Comment	D5 - Annual Rolling Average (g/m^2)	Criteria (g/m^2)
Month	Year	TB	D					
April	2020	TB 3	D5	Compliance	0.4		2.0	4.0
May	2020	TB 3	D5	Compliance	0.8		2.1	4.0
June	2020	TB 3	D5	Compliance	1		1.9	4.0
July	2020	TB 3	D5	Compliance	1.3		1.9	4.0
August	2020	TB 3	D5	Compliance	0.4		1.8	4.0
September	2020	TB 3	D5	Compliance	40.5	D3=2.8, D4=9.6, D6=0.9. Comparison results suggest sample bottle tampered with. Result not included in average.	1.8	4.0
October	2020	TB 3	D5	Compliance	1.1		1.8	4.0
November	2020	TB 3	D5	Compliance	0.7		1.8	4.0
December	2020	TB 3	D5	Compliance	6.3	D3=1.4, D4=4.2, D6=0.5. Comparison results suggest sample bottle tampered with. Result not included in average.	1.5	4.0
January	2021	TB 3	D5	Compliance	0.7		1.4	4.0
February	2021	TB 3	D5	Compliance	0.5		1.3	4.0
March	2021	TB 3	D5	Compliance	0.5		1.0	4.0

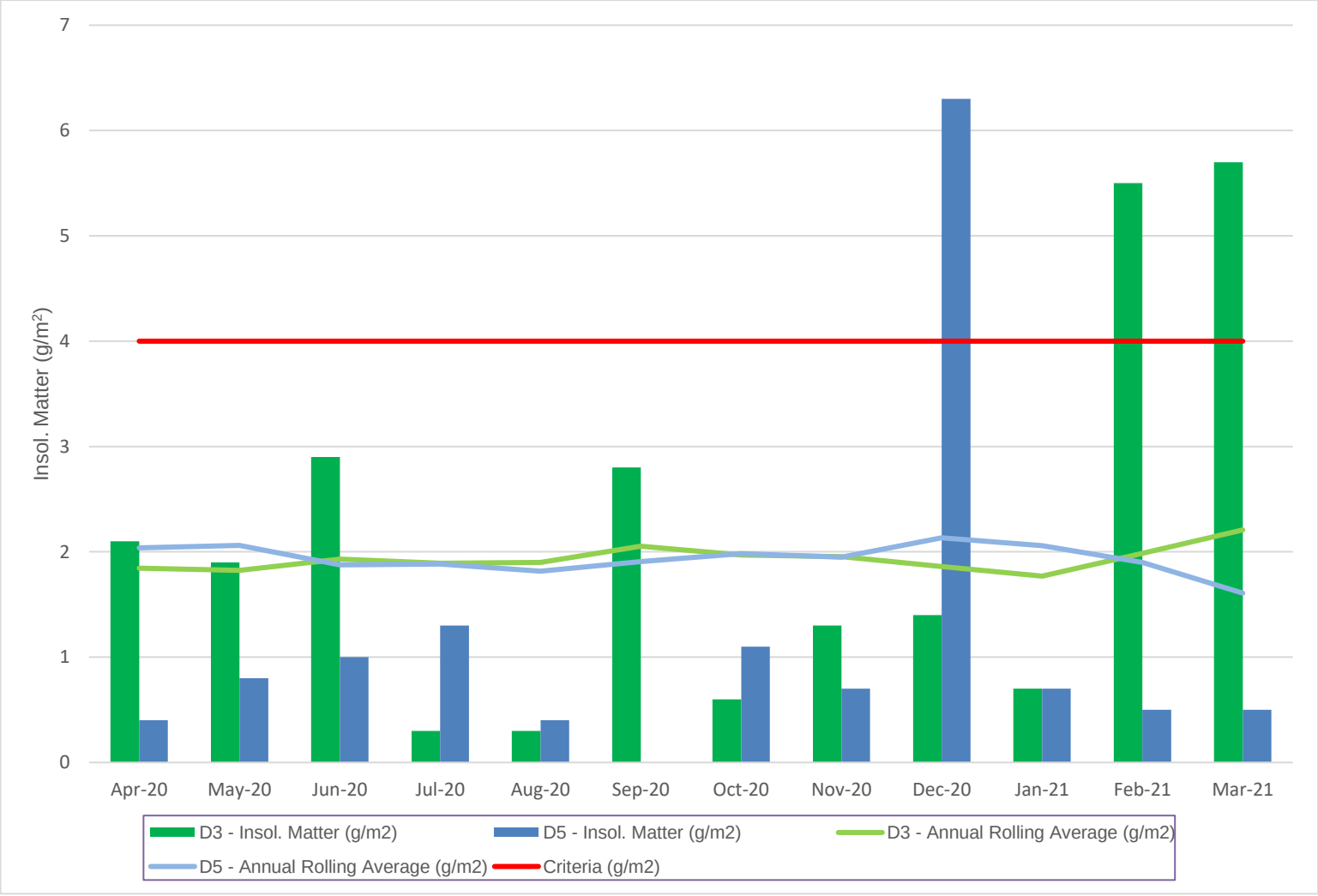


Figure 5: Insoluble Matter (g/m^2) Monitoring results for the D5 / TB3 Monitoring Station and D3 / TB4 Monitoring Station

6.3.4 Proposed Improvements

The Northern Dune Extension Dust Management Plan will be reviewed following submission of this AR and updated if necessary. Given that extractive operations are no longer occurring and the potential for air quality impacts from dust are therefore removed, the value of an ongoing dust monitoring program is limited. The results from this reporting period suggest that external sources contribute more dust to the monitoring network than the NDE site which further limits the value.

6.4 Traffic Management

6.4.1 Approved Criteria

The site is required to operate traffic and manage transport through compliance with the requirements of the conditions listed below:

TRAFFIC

Haulage Route

23. All extractive materials dispatched from the site must be delivered to Sibelco's Salt Ash Sand Processing Plant by the most direct route available.

Road Signage

24. Prior to commencing quarrying operations, the Proponent shall:
    (a) install "Trucks Crossing" and "Trucks Entering" warning signs on Nelson Bay Road on both the western and eastern approaches to the intersection of Lemon Tree Passage Road; and
    (b) pay the full cost of this installation,
    to the satisfaction of RMS.

On-Site Traffic Management

25. The Proponent shall ensure that:
    (a) all vehicles do not exceed a speed of 25 kph on the site;
    (b) all loaded vehicles entering or leaving the site have their loads covered; and
    (c) all loaded vehicles leaving the site are cleaned of sand and other materials that may fall on the road, before leaving the site.

Traffic Management Plan

26. The Proponent shall prepare and implement a Traffic Management Plan for the project, to the satisfaction of the Director-General. This plan must:
    (a) be submitted to the Director-General for approval prior to commencing quarrying operations;
    (b) include a drivers' code of conduct to minimise the impacts of project-related trucks on local residents and road users; and
    (c) describe the measures that would be put in place to ensure compliance with the drivers' code of conduct.

6.4.2 Key Environmental Performance

No extractive materials were dispatched form the site during the reporting period resulting in zero truck movements related to Northern Dune Extension. An approved Traffic Management Plan is in place, available as Appendix H of the Northern Dune EMP. No traffic related non-compliances were recorded during the reporting period.

6.5 Biodiversity

Schedule 3, Condition 15 of the Tanilba Northern Dune Extension Project Approval (MP 09_0091) required the preparation of a BMP. While the BMP requires similar management actions as the LMP, for operational and administrative simplicity, these plans apply to the site as follows:

- Management measures for the extraction area are addressed in the LMP (See Section 8).
- Management of the approved Biodiversity Offset Areas are addressed in the BMP.

Biodiversity offset areas for the project have been established in the north-east of the approved extraction area (northern biodiversity offset area) and to the south east of the extraction area off Lemon Tree Passage Road (southern biodiversity offset area).

The BMP requires the following actions to be undertaken within the offset areas:

- Implementation of a nest box installation and monitoring program within the northern offset area to replace hollow bearing tress removed from the extraction area;
- Utilisation of potential habitat features from the disturbance area (e.g. large organic debris and habitat hollows) either within the rehabilitation or northern offset area;
- Targeted fauna monitoring across all offset areas to monitor for Wallum Froglet, Koala and *Uperoleia* sp
- Establishment of a habitat restoration and rehabilitation program across all offset areas (including the visual amenity buffer along the northern boundary of the extraction area) consisting of:
    - Annual inspections to identify areas requiring weed and pest control;
    - A weed and pest management program;
    - Enhancement of the availability of habitat for the Koala through the use of *Eucalyptus robusta* (Swamp Mahogany) within the offset area;
    - Rehabilitation of the regenerating Grassland-Heath to the surrounding Swamp Mahogany – Paperbark Swamp Forest through seeding and planting of appropriate species;
- Establishment of a vegetation monitoring program (VMP) to ensure vegetation and fauna habitat qualities within the offset areas are being maintained and identify any issues requiring management.

Both the BMP and LMP were reviewed following submission of the 2018/19 AR. The plans were revised and are currently with DPIE under review.

6.5.1 Nest Box Installation and Monitoring Program

The approved BMP requires the establishment and on-going monitoring (at least 6 years) of at least two nest boxes for each tree hollow removed during clearing.

A nest box installation program was implemented on 21st December 2015 to offset the loss of 26 hollows across the whole of the approved extraction area. These were replaced at a 2:1 ratio resulting in the installation of 52 nest boxes in the Northern Offset Area within Coastal Sands Apple Blackbutt Forest and the northern section of the Swamp Mahogany – Paperbark Forest. Nest boxes were positioned in areas of vegetation that contained suitable food resources but lacked denning sites for arboreal fauna. As such, the central part of the offset area was the most appropriate site for installation. The installation of the nest boxes was supervised by suitably trained ecologists to ensure appropriate site selection.

Environmental contractor Kleinfelder was engaged by Holcim to conduct annual monitoring of the nest boxes during the reporting period on 12 October 2020, and prepared a report on the monitoring program (refer Appendix 2).

This was the fourth annual monitoring event, and as such results can be compared to the previous

surveys undertaken in 2017 and 2018, 2019. The 2020 monitoring survey recorded a combined usage rate (incorporating animal's present, recent and old evidence of use) of 48%. This is equal to last years survey findings from the 2019 survey of 48%. Raw numbers show that neither of the possum boxes had evidence of usage in 2020, while there were 23 glider boxes showing some evidence of use this year, an decrease of two from the 2019 survey.

During the 2019 survey no fauna were observed as present, with the same result during this reporting period. Following the absence of actual fauna occupation of the nest boxes in the 2019 survey which was held in December it was recommended that the 2020 survey be conducted in September or October when temperatures are cooler and fauna are actively raising young. This recommendation was followed however Fauna were still not present at the time of survey.

Initial fauna uptake of the nest boxes was successful with several species of mammals and reptiles recorded occupying boxes (present), and evidence of usage across many more. Since that initial survey (2017), no fauna has been recorded as present in the boxes, only old evidence of usage.

This year's survey was brought forward into the spring (October) to determine if the fauna were not using the nest boxes in the heat of the summer of the months. However, again no fauna were recorded occupying any of the nest boxes.

It is suggested that the relatively recent fires (late2018) in proximity to the offsets may have acted as a deterrent to the fauna utilising the offsets, even though the offsets itself was not directly fire affected and the fauna has not yet recolonised the area. Drought conditions throughout 2019 may have also led to a reduction in food supply for fauna, with effects still being seen in the populations recorded during this survey period.

6.5.2 Amphibian Monitoring

Targeted fauna monitoring for the Wallum Froglet (*Crinia tinnula*) and Mahony's Toadlet (*Uperoleia mahonyi*) was conducted by Kleinfelder ecologists as part of the requirements outlined in section 5.1.4 of the Biodiversity Management Plan Tanilba Northern Dunes Extension (Kleinfelder, 2014). Monitoring was conducted on the 28 October, 15 and 16 December 2020 by two ecologists over the three nights, following periods of rainfall. Surveys were undertaken at night, after rainfall was received

Both species targeted were recorded during the surveys. The full survey results are available in Appendix 3.

A prior diurnal assessment of the offset areas was conducted to determine habitat suitability. Surveys consisted of a meandering search in the Northern Offset Area. Survey effort was focused around ephemeral and semi-permanent water bodies using both spotlighting and call-playback techniques. Surveys revealed that no permanent water existed within the offset area. Several areas were noted which had the potential to contain water after rainfall and later became the target of nocturnal surveys. The greatest potential to detected threatened amphibian species was identified within the northern offset with habitats including areas of Melaleuca/Swamp Mahogany forest and low-lying areas dominated by herbs, rushes and/or emergent vegetation.

Nocturnal surveys for amphibian species employed visual and audible detection techniques with the aid of spotlights. Both the Wallum Froglet (*Crinia tinnula*) and Mahony's Toadlet (*Uperoleia mahonyi*) were both detected on the 28 October within and adjacent to the Northern offset area. Of the two species, *C. tinnula* was recorded within the northern offset area on all survey nights at multiple locations while *U. mahonyi* was identified calling from thick Gahnia within the North east of the Northern offset area. An adjacent waterbody to the East was visited to confirm the presence of *U. mahonyi* and *C. tinnula* and both species were found to be calling. **Table 12** represents amphibian records for the three nights of surveys in October and December of 2020. Opportunistic sightings of non-target amphibian species were also recorded. Photos of amphibians taken over the duration of the monitoring period are included in Appendix 3.

Table 12: Amphibian presence during targeted nocturnal monitoring

Species detected	Observation type	28/10/2020	15/12/2020	16/12/2020
Crinia signifera	Heard	+	+	
Crinia tinnula	Heard/Observed	+	+	
Limnodynastes peronii	Heard/Observed	+	+	+
Litoria latopalmata	Heard			+
Litoria freycineti	Heard/Observed		+	+
Litoria nasuta	Heard	+	+	
Platyplectrum ornatum	Heard/Observed	+	+	
Uperoleia mahonyi	Heard/Observed	+		

6.5.3 Koala Monitoring

Koala monitoring was undertaken using the Spot Assessment Technique (SAT) within the Northern offset area. Two Kleinfelder ecologists Mark Dean and Daniel O'Brien conducted SAT surveys on the 22 October 2020. A total of 15 SAT tests were conducted over the offset area (**Figure 1**).

The SAT surveys in 2020 found Koala activity in the Northern offset area to be slightly down from the 2019 data but still have an average of Low activity throughout the site. Please see **Table 1** for Koala activity levels for each SAT test for the Northern offset area. Within the Northern Offset area, the greater activities were found to be within the Swamp Mahogany – Paperbark Swamp Forest in the north of the offset area where there are mature trees for feeding, although evidence of use was found throughout the extent of the Northern Offset area.

The Northern Offset area has good habitat suitability for the koala with plenty of mature *Eucalyptus robusta* (Swamp Mahogany), *Melaleuca quinquenervia* (Broad-leaved Paperbark) and *Casuarina glauca* (Swamp She-oak) to the north of the area, although parts of this area are hard to move through. Areas of thick *Lantana camara* (Lantana) dominate the understory which has the potential to hinder Koala movement through the site. The remaining southern areas of the Northern Offset are still regenerating but have shown promising signs of koala use which will continue to improve as the trees mature. This will provide koalas with more habitat and a greater food source in the future.

Table 13 Koala activity levels from the Spot Assessment Technique.

Location	No Activity		Low Activity		Medium Activity		High Activity	
Northern Offset Area								
	2019	2020	2019	2020	2019	2020	2019	2020
1			+	+				
2			+	+				
3	+	+						
4		+	+					
5			+	+				
6		+	+					
7				+	+			
8					+	+		
9			+	+				
10			+	+				
11			+	+				
12			+	+				
13			+	+				
14			+	+				
15	+	+						

6.5.4 Habitat Restoration

Weed mapping was performed in the previous reporting period and identified the weeds presented in Table 14. Holcim subsequently commissioned Kleinfelder to undertake weed control works in the Northern Offset Area (Lots 11, 12 and 13) in the previous and current reporting period. Weed control works for the NDE Offsets was contracted for 2 events during this reporting period. These were conducted on 18th and 19th January 2021 and the 22nd and 23rd of February 2021.

The first event was conducted in the southern and eastern sections of the offsets area and targeted Fishpole Bamboo, Senna, Lantana and Slash Pine.

The second continued weed control works on the eastern side of the NDE offsets and targeted the dense infestations of lantana and Slash Pines in this area.

Additionally on each occasion a “sweep” was made through the areas where Slash Pine has become established and seedlings and saplings were removed by hand.

Ongoing works have been recommended and further weed control will be performed in the next reporting period.

Table 14: Weed species identified in the Northern Offset Area identified in 2019

Scientific name	Common Name	Threat Level
Lantana camara	Lantana	Severe
Pinus elliottii	Slash Pine	Severe
Watsonia meriana	Bulge Lily	Severe
Phyllostachys aurea	Fishpole Bamboo	Severe -Declared Noxious Weed
Cortaderia selloana	Pampas Grass	Negligible - high potential
Senna pendula	Cassia	Negligible

Control of Slash Pines focused on the reduction of large canopy trees and trees that were mature enough to produce seed. By reducing the number of seeding trees the rate of re-infestation is reduced. The large pine trees were ring barked using a chainsaw or felled where appropriate and safe to do so. Medium to small trees were either ring barked or cut by hand. One area in the south west corner, where it was originally too dense with saplings to walk through, the slash pines where cut down using a brush cutter to allow access to a large slash pines in the centre of the infestation. The cut stumps were not treated with herbicide, as Pine trees do not re-sprout. Large trees along Rutile Road were left to be assessed by a qualified arborist due to their proximity to the power lines and public road.

Weed control of Lantana focused on the removal of the less dense infestations first, followed by treatment of denser clumps. The less dense areas were treated via hand pulling, foliar spraying and cutting and painting the main canes with herbicide. Time then allowed for the targeting of several isolated dense stands. Upon further inspection of the site, it was determined that the Lantana bush in the North-west corner of the site was very dense (>90% cover), so work began in the east and moved west following best practice bush regeneration techniques where treatment moves from less dense to more dense infestations. Tracks where cut into the dense bushes to allow for access. Large stem bases that were found during the track cutting were cut and painted with 100% glyphosate. To prevent further growth up trees, Lantana canes were skirted by cutting at the highest possible point. The remaining patches were sprayed with a strong glyphosate mix (1L glyphosate: 9 L water). The strong mixture allowed the Lantana to be “Splatter gunned”, meaning only 5-10% of the leaf coverage needed to be sprayed for the chemical to be effective. The use of this technique helps reduce the possibility of off-target damage and reduces the overall volume of chemical sprayed on the site.

An area south of Rutile Road was treated for Fishpole Bamboo. Large canes were cut at the base and painted with 100% glyphosate. Short clumps were treated by spraying a 2% glyphosate mixture. Due to the highly invasive nature of bamboo, the clumps were sprayed twice, once during each week.

One population of Cassia was treated in order to reduce the risk of further invasion. Treatment included hand pulling and cutting and painting larger trunks with 100% glyphosate.

Treatment of Bulge Lily has not been completed at this time. Bulge Lily is a spring-time perennial, in which it undergoes an annual growth and die-back event. Treatment must coincide with its active growing season, spring. At the time of the works, most plants had already died off making any treatment impossible.

Kleinfelder was commissioned and undertook a survey of the Southern Offsets Area (Lots 21, 22, 23 and 24 Lemon Tree Passage Rd, Tanilba Bay) on the 8th January 2020 as part of the Biodiversity Stewardship Agreement ID Number 225 and submitted to the Biodiversity Conservation Trust.

No planting of native species was undertaken on the North Dunes Extension Offsets Areas during this reporting period.

6.6 Heritage

6.6.1 Approved Criteria

"The Proponent shall prepare and implement an Aboriginal Cultural Heritage Management Plan to the satisfaction of the Director-General. This plan must:

(a) be prepared in consultation with all relevant local Aboriginal communities;

(b) be submitted to the Director-General for approval prior to commencing quarrying operations; and

(c) include:

· measures for the protection and management of site 38-4-0318 within Lot 13 DP601306;

· a program to complete prospective pre-clearance surveys of the extraction area in consultation with Aboriginal stakeholders;

· measures for ongoing consultation with local Aboriginal communities and the involvement of these communities in pre-clearance surveys and the ongoing management of any Aboriginal cultural heritage values identified within the site;

· an Aboriginal cultural education program for the induction of personnel and contractors involved in quarrying operations; and

· a description of the measures that would be implemented if any new Aboriginal objects or skeletal remains are discovered during the project."

6.6.2 Cultural Heritage Management Plan

An Aboriginal Cultural Heritage Management Plan (CHMP) has been prepared in consultation with the three Registered Aboriginal Parties (RAPs) within the local area:

- Worimi Local Aboriginal Land Council;
- Mur-Roo-Ma Incorporated, and;
- Nur-Run-Gee Pty Ltd

The CHMP contains plans of actions for pre-clearance surveys and unexpected finds such as new Aboriginal objects or skeletal remains during extraction as well as an ongoing plan to manage Aboriginal Cultural Heritage. With respect to actions under the CHMP during the reporting period:

- No clearing or extraction occurred as the project is in the rehabilitation phase;
- Site 38-4-0318 is located in the northern part of Lot 13 outside the extraction area. There was no disturbance of this area during the reporting period.

6.6.3 Key Environmental Performance

No clearing or extraction occurred during the reporting period. There were no issues relating to Aboriginal and Cultural Heritage in the reporting period.

6.6.4 Proposed Improvements

The CHMP will be reviewed and if necessary updated in the next reporting period.

6.7 Waste Minimisation

6.7.1 Management Measures

The following management measures are in place at Northern Dune Extension:

- No burning of waste;

- Any noxious plant species will be removed from the site, bagged and disposed of at a licensed landfill;
- Any waste will be removed daily and recycled or disposed of directly at a licensed landfill; and
- The site will be maintained and kept free of rubbish and cleaned up at the end of each working day.

6.7.2 Key Environmental Performance

No bins or other waste management facilities are kept on site - any waste produced is removed at the end of each working day.

6.7.3 Proposed Improvements

There are no proposed improvements to waste management during the Annual Review period.

7 WATER MANAGEMENT

This section addresses compliance with the approved GMP required by Schedule 3, Clause 14 of Project Approval MP 09_0091, and EPL 11633. It should be noted that the GMP was revised and the updated version approved on 10 March 2020. Therefore, monitoring requirements changed during the previous reporting period. This is discussed further below in Section 7.1.

During the reporting period, visual inspections were carried out throughout the operational and rehabilitated areas with no surface water or ponding being noted. No environmental incidents or implementations of the Emergency Response Plan (ERP) in relation to groundwater occurred.

As described in the approved GMP there are no Groundwater Dependent Ecosystems (GDE) identified within the Northern Dune Extension area, therefore no impacts are able to be assessed. A study by SKM in 2012 for the NOW on NSW Coastal GDE's did not identify a GDE at the Northern Dune Extension area site, and a site is not listed in the National Atlas of GDE's.

7.1 Groundwater Management Measures

Groundwater Management issues are managed by the regulatory approved Groundwater Management Plan 2020 (GMP). The GMP has been developed to ensure compliance with the conditions of consent and licensing requirements stipulated by the relevant regulatory authorities, during development and operation at Northern Dune. The GMP provides a formal framework for ongoing monitoring of groundwater at the site to manage the potential impact of sand extraction on groundwater level and quality. The GMP stipulates that:

- No excavation is to be carried out to a depth greater than 0.7m above the maximum predicted elevation of the water table;
- The land surface is to be restored, following mining, to a level at least 1m above the maximum predicted elevation of the water table; and
- If concentrations of any analyte are found to exceed the provisional trigger levels given in the GMP, that monitoring point will be re-sampled within fourteen days, with investigatory monitoring implemented should re-sampling also be in exceedance of the trigger values.
- The relevant Regulatory Authorities will be contacted if any recorded water level exceeds the benchmark maximum predicted groundwater levels.

The GMP states that the GMP will be reviewed at the completion of sand extraction in a zone and/or prior to commencement of operations in each new zone (the Northern Dune Extension is effectively a single zone). If this review indicates a need to change programs or procedures, then a submission outlining the proposed changes and the need for them will be made to DPIE and HWC. Extraction ceased in 2018 and no extraction occurred during the reporting period.

A revised GMP was submitted and approved in March 2020 due to the cessation of extraction and progression of the project into a rehabilitation activity. The revised GMP includes monitoring at a reduced number of bores. It was also revised to lower the frequency of groundwater quality monitoring and reporting for bores that:

- Were not representative for the measurement of potential groundwater impacts from rehabilitation activities on the project area; and
- Were not part of the EPL monitoring network.

This resulted in the groundwater quality monitoring locations and frequencies listed in Table 15 remaining. The locations of these bores are shown in Figure 6.

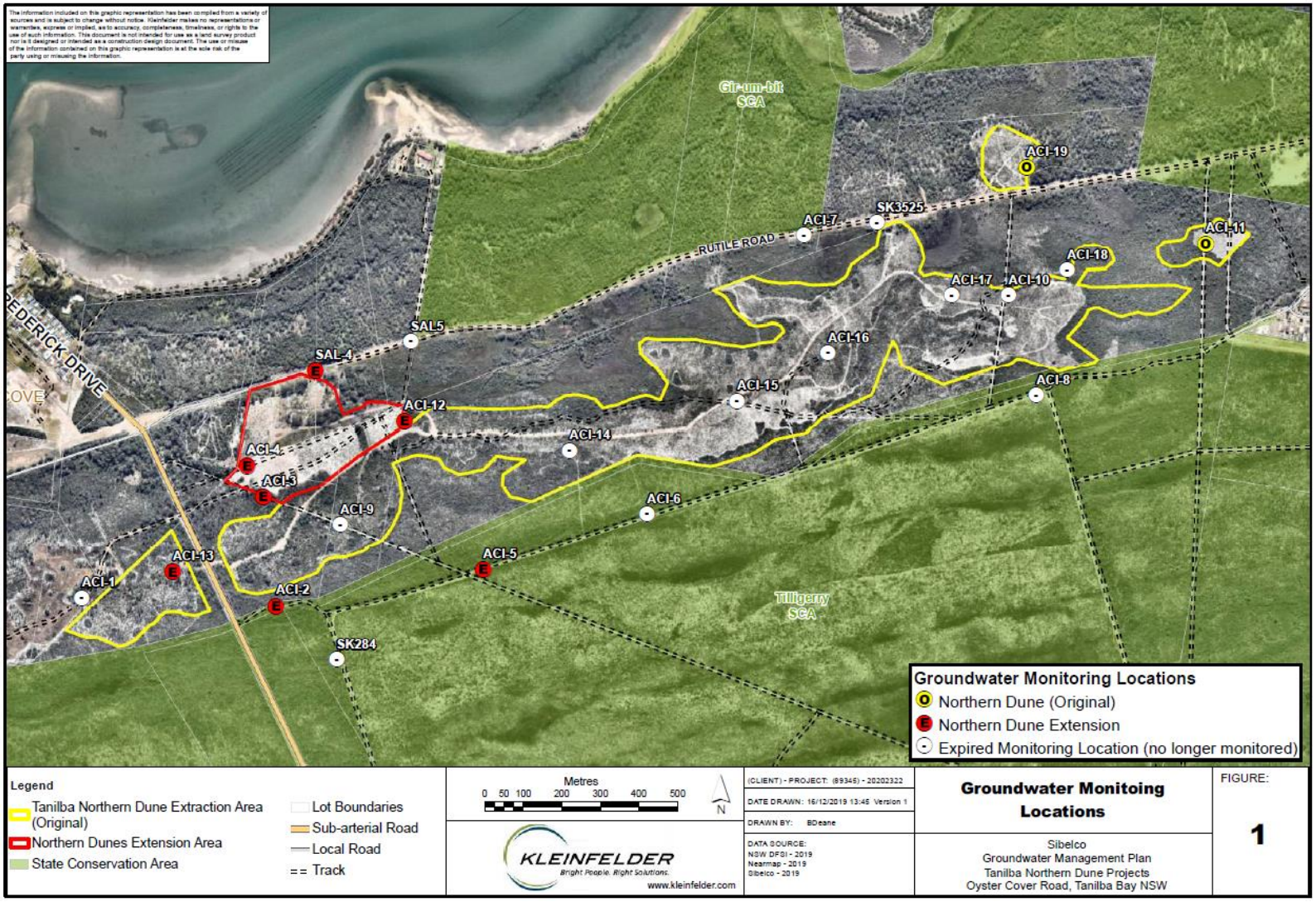


Figure 6: Location of the Tanilba Northern Dune Projects and Associated Current Monitoring Locations

Table 15 Current Groundwater Quality Monitoring Locations

Project	Agency / Approval Jurisdiction	Monitoring Location Name	Easting	Northing	End of Mining Activity	Groundwater quality Monitoring Frequency	Groundwater Level Monitoring Frequency
Northern Dune Extension	DPIE / HWC / EPA	ACI-2	402538	6376802	Ceased Jan 2006 (monitoring required until EPL surrendered / varied)	6 Monthly	Monthly
	DPIE / HWC / EPA	ACI-5	403076	6376897	Outside of extraction zone (monitoring required until EPL surrendered / varied)	6 Monthly	Monthly
	DPIE / HWC / EPA	ACI-13	402270	6376891	Ceased Jun 2005 (monitoring required until EPL surrendered / varied)	6 Monthly	Monthly
	DPIE / HWC / EPA	SAL-4	402641	6377413	Outside of extraction zone (monitoring required until EPL surrendered / varied)	6 Monthly	Monthly
	DPIE / HWC	ACI-3	402505	6377085	July 2018	Annually	Monthly
	DPIE / HWC	ACI-4	402463	6377166	July 2018	Annually	Monthly
	DPIE / HWC	ACI-12	402872	6377282	July 2018	Annually	Monthly

The results of the requirements of the current GMP, as per Table 15 are reported in this AR, as is now required by the 2020 updated to the GMP (noting that separate biannual reporting is no longer required).

Groundwater quality is tested for the parameters required by EPL 11633, as presented in Table 16.

Table 16: EPL 11633 Groundwater Monitoring Requirements

POINT 2,5,13,14

Pollutant	Units of measure	Frequency	Sampling Method
Arsenic	milligrams per litre	Every 6 months	Grab sample
Conductivity	microsiemens per centimetre	Every 6 months	Grab sample
Iron	milligrams per litre	Every 6 months	Grab sample
Manganese	milligrams per litre	Every 6 months	Grab sample
pH	pH	Every 6 months	Grab sample
Standing Water Level	metres	Monthly	In situ
Total petroleum hydrocarbons	milligrams per litre	Every 6 months	Grab sample

Water and land

EPA Identification no.	Type of Monitoring Point	Type of Discharge Point	Location Description
2	Groundwater quality monitoring		Groundwater monitoring bore ACI-2 located to the South of Extraction Zone 1 near DLWC in "Northern Dune Water Bore Locations" figure accompanying additional information supplied to EPA on 6 May 2002.
5	Groundwater quality monitoring		Groundwater monitoring bore ACI-5 located at the South of Extraction Zone 2 & outside lease boundary in "Northern Dune Water Bore Locations" in additional information supplied to EPA on 6 May 2002.
13	Groundwater quality monitoring		Groundwater monitoring bore ACI-13 located within Extraction Zone 1 in "Northern Dune Water Bore Locations" figure in additional information supplied to EPA on 6 May 2002.
14	Groundwater quality monitoring		Groundwater monitoring bore SAL4 as identified on Figure 6.2 of report titled 'Tanilba Northern Dune Sand Extraction Extension - Environmental Assessment' dated August 2012.

7.1.1 Groundwater Levels

Wider groundwater monitoring was initiated at Northern Dune in 2002, prior to the commencement of sand extraction in 2003. Baseline groundwater level and quality monitoring is undertaken within a planned zone prior to commencing sand extraction. Baseline groundwater level monitoring is used to create a Predicted Maximum Groundwater Elevation (PMGE) which is then used for determining depth of extraction and final landform.

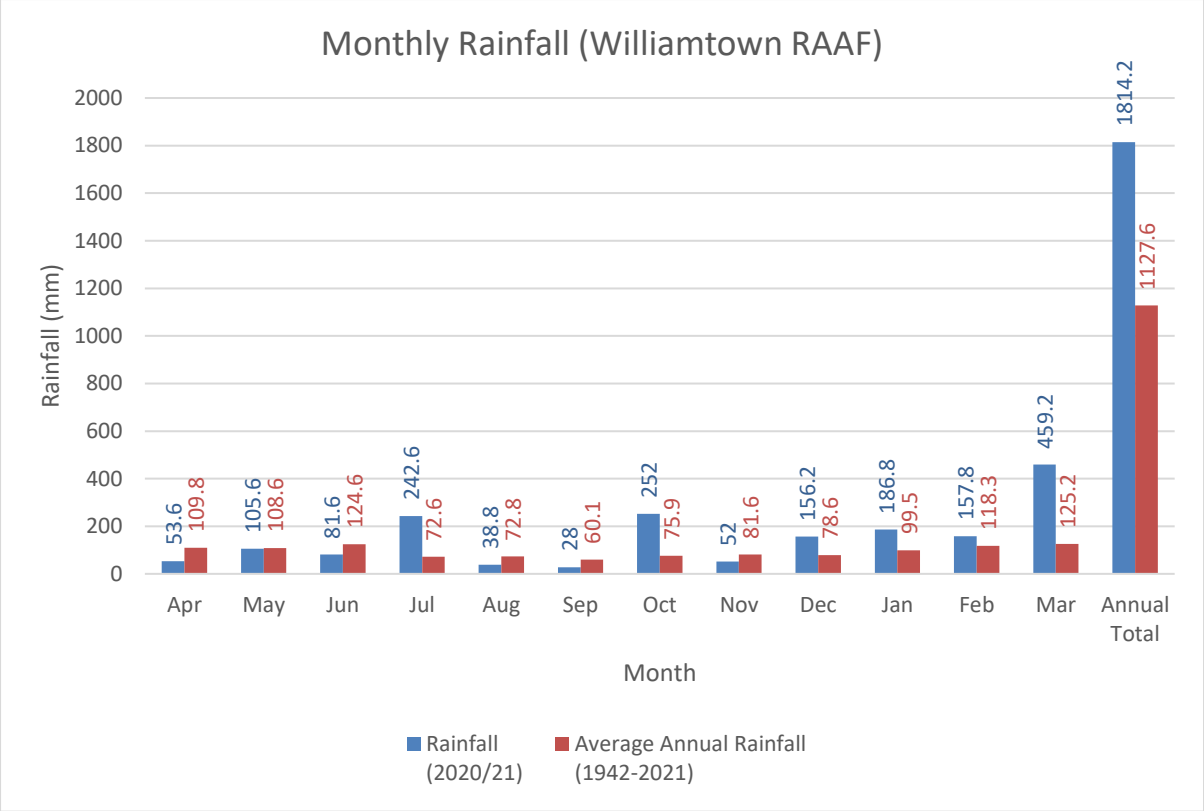


Figure 7: 2020/21 Monthly Rainfall at Williamtown RAAF

Historically, groundwater level data is collected monthly across the entire wider monitoring network with reporting against the piezometers used to analyse Predicted Maximum Groundwater Extent (PMGE) surfaces for the extraction zones.

For the Northern Dune Extension area, the required monitoring locations were reduced in March 2020 to those that are considered most relevant to groundwater level observation as detailed in Table 15. This was done via regulatory approval of a revised GMP as discussed above.

Other locations within the wider monitoring network are considered to be more applicable to the wider Northern Dune area, and of less significance to the specific Northern Dune Extension area (this report). The results for all locations are provided in tabulated form for this reporting period in

Table 17, with those relevant to the Northern Dune Extension area shaded grey.

The hydrographs in Appendix 6 demonstrate the groundwater trends throughout the life of the project, and Table 8 presents the monthly results for the current reporting period which demonstrate that all locations were monitored monthly (or weekly) during the current reporting period as per the

requirements.

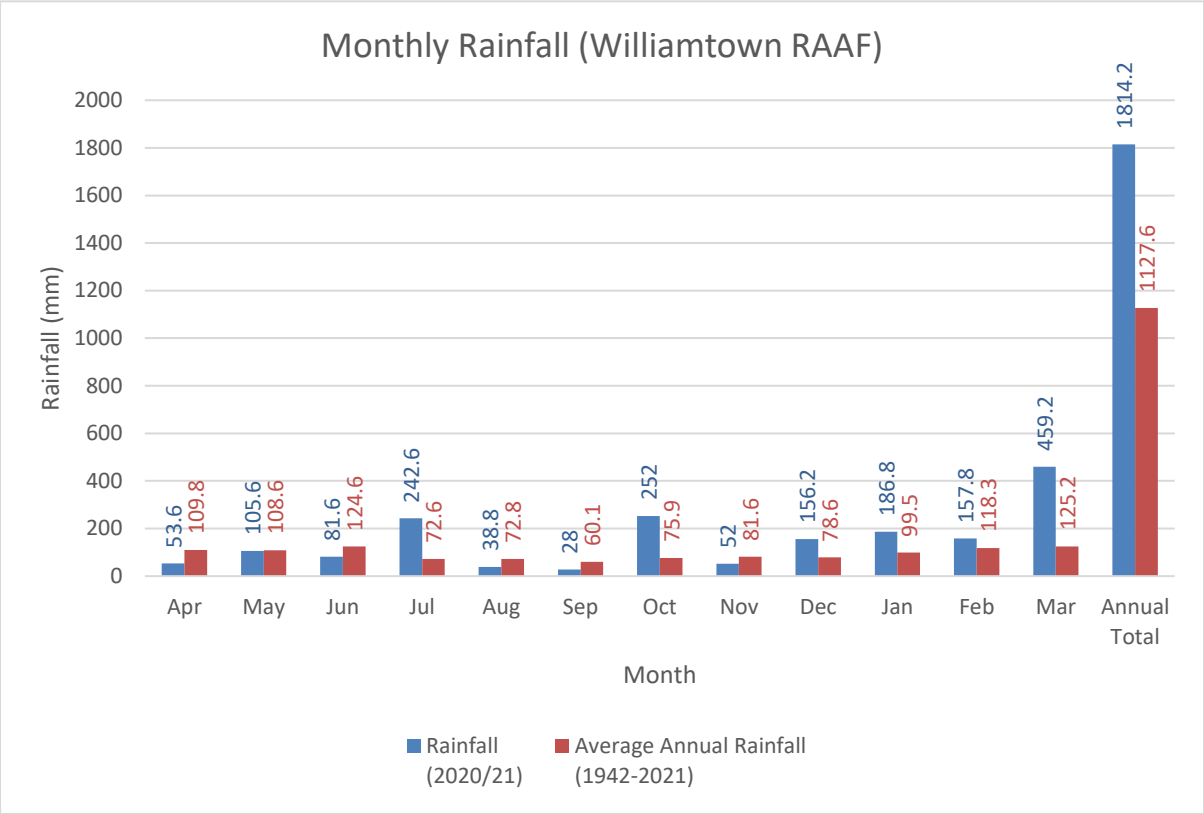


Figure 7Annual rain monitoring data recorded at Williamtown throughout the reporting period has been included in Figure 7 for reference. During the reporting period, the highest recorded rainfall was in March 2021 with 459.2 mm being recorded. This was a very significant rain event that resulted in more than three times the monthly average rainfall. During this event, the majority of this rain fell heavily and consistently for 5 consecutive days. There were further significant rainfall events in July 2020 (242.2 mm) and October 2020 (252 mm). Over the reporting period, the total rainfall received was 38% higher than the average since records began in 1942. September 2020 saw the lowest rainfall, with 28 mm falling throughout the month. The rainfall received s is likely to influence the groundwater levels which respond to rainfall.

When rainfall levels exceeded more than 100 mm in a seven-day period, bores are monitored weekly for a total of four weeks. This occurred once during the reporting period in February 2020 and subsequent weekly monitoring was performed, the results of which are presented in Table 17.

Groundwater level monitoring results (Table 17) demonstrate that there have been no exceedances of the Predicted Maximum Groundwater Extent (PMGE) during the reporting period except for during the exceptional rain event that occurred in March 2021. This event saw 459.2 mm of rain fall in comparison to the long-term average of 125 mm for the month of March. Further, the majority of this rain fell within a five-day period. Rainfall such as this has not been experienced before and is attributed to the La Nina weather phenomenon that has been experienced throughout the summer of 2021 resulting in significantly increased rainfall as demonstrated in Figure 7 which shows that over the reporting period, rainfall is 38% higher than the long term average, with approximately 25% of the annual rainfall recorded at Williamtown station falling across a single rain event in March which resulted in exceedences of the PMGE at ACI-4 and ACI-12. Table 17 demonstrates ACI-12 was back below the PMGE within 1 week of the exceedance, with ACI-4 still exceeding the PMGE by 10 cm at the end of the reporting period.

Table 17: Groundwater Levels at Northern Dune Extension Monitoring Locations

Date	ACI-2	ACI-3	ACI-4	ACI-5	ACI-12	ACI-13	SAL4
28/04/2020	6.10	7.09	7.50	6.66	7.73	7.83	7.10
28/05/2020	6.62	6.91	7.12	6.79	7.67	6.61	7.21
26/06/2020	6.72	7.24	7.37	6.91	8.04	6.90	7.34
29/07/2020	7.44	7.94	8.05	7.71	8.07	7.67	7.81
05/08/2020	7.29	7.94	8.06	7.58	7.99	7.66	7.76
12/08/2020	7.37	7.90	8.01	7.60	7.92	7.61	7.74
28/08/2020	7.33	7.84	7.95	7.49	7.85	7.53	7.67
28/09/2020	7.21	7.79	7.93	7.38	7.79	7.48	7.62
28/10/2020	7.01	7.59	8.38	7.03	7.58	7.22	7.46
04/11/2020	7.33	7.85	8.01	7.56	7.64	7.45	7.75
11/11/2020	7.38	7.89	8.00	7.59	7.76	7.53	7.77
18/11/2020	7.42	7.93	8.00	7.61	7.88	7.61	7.77
26/11/2020	7.21	7.85	8.01	7.32	7.78	7.51	7.65
24/12/2020	7.15	7.79	7.98	7.25	7.74	7.45	7.57
21/01/2021	7.22	7.63	7.83	7.31	7.63	7.29	7.66
15/02/2021	7.28	7.90	8.13	7.40	7.84	7.54	7.71
16/03/2021	7.54	7.98	8.13	7.76	7.90	7.67	7.83
24/03/2021	8.20	9.32	9.66	8.13	9.45	9.16	7.83
31/03/2021	8.32	9.31	9.41	8.10	9.20	9.05	8.50
PMGE	**8.44**	**9.47**	**9.31**	**8.16**	**9.28**	**9.20**	**8.65**

In accordance with the GMP, the results of groundwater level monitoring are analysed to determine whether they are anomalous and whether further sampling is required. If further sampling confirms anomalous results, then notification to the regulators is required.

The groundwater elevations above the PMGE at ACI-4 and ACI-12 correspond to the extraordinary rainfall event and as such are not considered to be anomalous. Other than the exceedences related to the extraordinary event, during the reporting period there were no groundwater level elevations recorded to be above the PMGE or any other anomalous results at any of the monitoring points, as demonstrated by Table 17.

7.1.1.1 Groundwater Level Results Discussion and Trend Summary

During previous reporting periods, it was noted that the trend observed in groundwater levels is that they fluctuate naturally in response to rainfall. During this reporting period Table 17 demonstrates the same trend is observed; groundwater levels rise as there is increased monthly rainfall and fall during periods of reduced rainfall. This trend is highlighted by the elevated levels following the significant rain

events in September 2020 and March 2021. The two rain events resulted in weekly monitoring being undertaken as required by the GMP. The annual trends over previous reporting periods show that following rain significant rain events, groundwater levels return to the expected fluctuating trend over time and this is demonstrated with the September event. The March event trend will be confirmed as levels are monitored throughout the next reporting period.

The ongoing fluctuating trend over the life of the project is shown in the hydrographs provided in Appendix 5. As the groundwater in the area is rain fed, and this reporting period has seen an overall increased trend in the rainfall received annually, groundwater levels have shown a slight trend of increasing across the monitoring network when compared to previous years.

No significant change to the trends demonstrated in groundwater levels over the life of the project have been observed within this reporting period.

7.1.2 Groundwater Quality

In addition to the requirements of EPL11633, Trigger Values were established for a number of initial monitoring bores. Baseline groundwater quality samples were collected prior to extraction to create trigger values for comparison against sample concentrations during extraction operations and post-extraction operations to assist in detecting any changes in groundwater quality at the site.

The trigger values are then tested against at predetermined increments. Groundwater quality testing is undertaken as per Table 15 and reported to the relevant regulators.

Groundwater quality is sampled and tested by an external third party with results sent to Holcim.

The groundwater quality monitoring results presented in Table 18 show that all results were within normal limits with the exception of:

- ACI-2 which displayed an exceedance of the trigger value for Iron and Manganese in the September 2020 monitoring event. However, it should be noted that the results were back below reportable values for Dissolved Iron and Dissolved Manganese in the March 2021 monitoring event. Total Manganese showed a very minor exceedences during the March 2021 monitoring event also.

Previous reports submitted to DPIE and HWC stated that Iron results are on a rising trend and have exceeded the assigned triggers (3.058mg/L dissolved Fe and 3.62mg/L Total Fe) in the September/October monitoring events at ACI-2 since September 2017 and that results have been below trigger values during the March/April monitoring events. The March 2020 result continues this trend.

Figure 9 demonstrates how Manganese results are also on a rising trend and have exceeded the assigned triggers in the September / October monitoring events at ACI-2 since September 2017. Results have been below trigger values during the March/April monitoring events until the current reporting period. The level does however return very close to being within limit in the March 2021 monitoring event. The significantly above average rainfall experienced over summer has likely mobilized manganese and given a result more in line with those experienced during winter levels of rainfall during previous reporting periods.

Table 18: Comparison of Groundwater quality results against trigger values for the 2019/20 reporting period.

	Date	Bore	pH	EC µS/cm	Iron mg/L		Arsenic mg/L		Manganese mg/L		TPH mg/L			
					Dissolved	*Total*	*Dissolved*	*Total*	*Dissolved*	*Total*	*C6- C9*	*C10- C14*	*C15- C28*	*C29- C40*
Trigger Value		**ACI-2**	N/A	N/A	3.058	3.623	0.001	0.01	0.015	0.014	0.02 (LOR)	0.05 (LOR)	1 (LOR)	1 (LOR)
Results	23/09/2020		4.53	141	3.77	3.62	<0.001	<0.001	0.016	0.016	<LOR	<LOR	<LOR	<LOR
Results	*04/03/2021*		5.00	128	2.55	2.74	x	x	0.015	0.016	<LOR	<LOR	<LOR	<LOR
Trigger Value		**ACI-3**	x	x	x	x	x	x	x	x	x	x	x	x
Results	23/09/2020		4.61	166	1.26	1.13	<0.001	<0.001	0.004	0.004	<LOR	<LOR	<LOR	<LOR
Results	*04/03/2021*		4.94	185	0.88	1.14	<0.001	<0.001	0.003	0.005	<LOR	<LOR	<LOR	<LOR
Trigger Value		**ACI-4**	x	x	x	x	x	x	x	x	x	x	x	x
Results	23/09/2020		4.19	138	0.27	0.26	<0.001	<0.001	0.001	0.001	<LOR	<LOR	<LOR	<LOR
Results	*04/03/2021*		4.62	144	0.25	0.30	<0.001	<0.001	0.002	0.003	<LOR	<LOR	<LOR	<LOR
Trigger Value		**ACI-5**	N/A	N/A	2.048	3.286	0.001	0.015	0.014	0.036	0.02	0.05	1	1
Results	23/09/2020		4.36	141	0.46	0.43	<0.001	<0.001	0.002	0.002	<LOR	<LOR	<LOR	<LOR
Results	*04/03/2021*		4.85	143	0.56	0.60	<0.001	<0.001	0.002	0.002	<LOR	<LOR	<LOR	<LOR
Trigger Value		**ACI-12**	N/A	N/A	0.493	0.935	0.001	0.001	0.006	0.006	0.02	0.05	1	1
Results	23/09/2020*		5.72*	621*	0.14*	6.00*	<0.001*	<0.001*	0.027*	0.196*	<LOR*	<LOR*	<LOR*	<LOR*
Re-test	*04/03/2021*		3.98	362	0.15	0.20	<0.001	<0.001	0.004	0.005	<LOR	<LOR	<LOR	<LOR
Trigger Value		**ACI-13**	N/A	N/A	1.547	6.428	0.001	0.012	0.061	0.056	0.02	0.05	1	1
Results	23/09/2020		4.68	105	1.38	2.43	<0.001	<0.001	0.024	Dry	<LOR	<LOR	<LOR	<LOR
Results	*04/03/2021*		5.58	112	1.00	1.20	<0.001	<0.001	0.009	Dry	<LOR	<LOR	<LOR	<LOR
Trigger Value		**SAL-4**	4.44 - 6.6	213	3.21	3.64	0.001	0.002	0.093	0.116	0.02	0.05	1	1
Results	23/09/2020		3.61	178	0.11	1.10	<0.001	<0.001	0.012	0.005	<LOR	<LOR	<LOR	<LOR
Results	*04/03/2021*		4.81	148	0.38	0.50	<0.001	<0.001	0.009	0.005	<LOR	<LOR	<LOR	<LOR

*ACI-12 was full of sediment and cleared on 23/09/2020 monitoring event. An opportunistic sample was taken for analysis however cannot be relied upon due to the disturbance to the bore immediately prior to sampling. The results are therefore not discussed further.

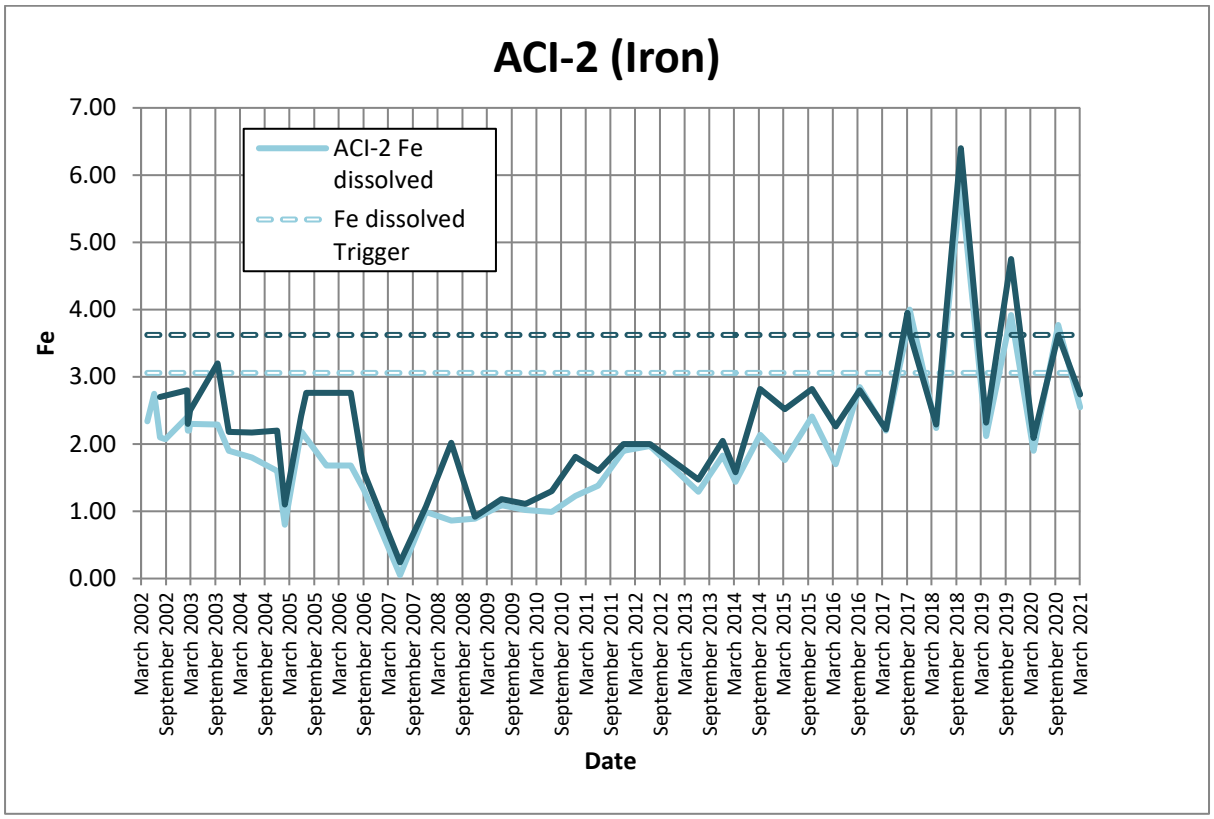


Figure 8: ACI-2 Iron Results Trend History

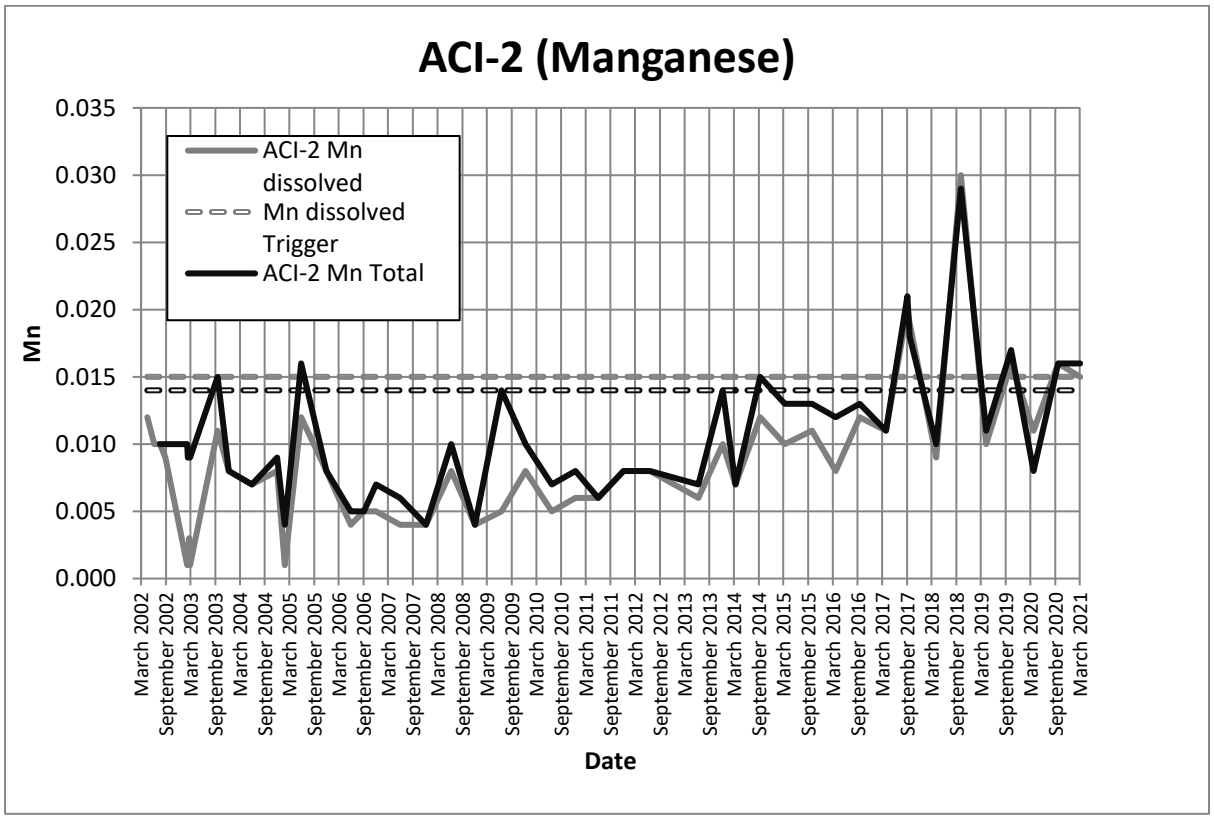


Figure 9: ACI-2 Manganese Results Trend History

Groundwater quality at Northern Dune is driven by the nature of rainfall and properties of the unsaturated zone. Rainfall entering the soil zone undergoes significant changes in chemical composition and pH by processes such as root respiration and decomposition of organic matter via chemical reactions such as sorption and redox. The chemical constituency of infiltrating water in turn modifies groundwater chemistry by processes such as leaching, dilution but not concentration (which is protected against by licence conditions limiting depth to groundwater) as well as dissolution/precipitation. The effect of multiple processes on groundwater quality parameters and therefore setting Trigger Values is that water quality data is often multiple-modal (non-normal distribution) and so simple statistical analysis using mean and standard deviation may not adequately represent processes leading to water quality change. Water quality is dependent upon the nature of rainfall (ie. timing, intensity, duration...etc.) which determines whether infiltration provides a diluting effect and/or a leaching effect on ions and/or metals. Water quality can improve or deteriorate with rainfall and therefore timing of a small, limited sample set strongly influences the calculated trigger value.

It is noted that extraction activities within proximity to ACI-2 ceased in 2005 and therefore the elevated iron levels observed are unlikely to be the result of extraction activities.

The ACI-2 monitoring location has exhibited similar seasonal exceedances for Iron in previous reporting periods as detailed in reports previously provided. ACI-2 has historically been used to monitor potential impacts from the Northern Dune project area, not the Northern Dune extension area. These exceedances are not related to the extension area and, consequently, have not been reported to the DPIE under Project Approval MP09_0091.

7.1.2.1 Groundwater Quality Results Discussion and Trend Summary

Observations of groundwater quality trends over time show concentrations have fluctuated throughout the life of the project. This trend has been demonstrated by the results provided in previous annual reports provided as per the approval requirements, along with previously required bi-annual groundwater monitoring reports. This observation was also made based upon analysis of data collected during operations across the wider Tanilba Northern Dune site and presented in the trend predictions of the Environmental Assessment (EA) for the Northern Dune Extension Area.

The fluctuating trend previously identified has been continued in the current reporting period as demonstrated by the data presented in the hydrographs (Quality vs. trigger values) which demonstrate this trend over the life of the project in Appendix 8, and in the tabulated results for the current reporting period provided in Table 18.

The EA for the Northern Dunes Extension project discussed possible causes and influences of the trends observed in metal concentrations (based upon observations of the wider Northern Dune area) and predicted that:

- Peak total iron concentration seems to be attributed to the re-establishment of topsoil and regeneration which occurs after mining has ceased.
- The fluctuation of the water table (in response to rainfall) may cause enhanced mobilisation of iron from the coffee rock horizon, giving rise to potentially increased concentrations of iron.
- Localised variability of metal concentrations has been seen throughout monitoring of the wider northern dune area and appears to be impacted from well construction through localised coffee rock deposits.

Groundwater quality trends have continued as expected during the reporting period. In line with earlier predictions of the EA, measured metal concentrations are consistent with data collected across the wider Tomago Sandbeds and have generally not exceeded the natural variation within metal concentrations recorded in the wider Tomago region. This is due to operations occurring above the deep grey sands and the groundwater table (by maintaining an exclusion zone from the PMGE), which are known to liberate metals in significant quantities if disturbed. The results presented in this report do not suggest any significant disturbance during the reporting period.

8 REHABILITATION AND LANDSCAPE MANAGEMENT

Rehabilitation objectives and targets for the Tanilba Northern Dune Extension Project are described in the LMP prepared to satisfy Schedule 3, Condition 17 of the Tanilba Northern Dune Extension Project Approval (MP 09_0091). The LMP describes management measures for the extraction (disturbed) area and, in accordance with the Project Approval, includes a Rehabilitation Management Plan (RMP) and Long-Term Management Strategy.

8.1 Rehabilitation Management

Rehabilitation at the Tanilba Northern Dunes Extension area is undertaken in conjunction with works in areas mined as part of the approvals for the wider Tanilba Northern Dune. For rehabilitation purposes, works across both approval areas have been subdivided into several blocks: The extraction area within Tanilba Northern Dunes Extension is known as Block Q.

Inspection of revegetated areas forms part of monthly site inspections to identify issues requiring management. The outcomes and observations of inspection are incorporated into the future works program together with any items or recommendations resulting from the annual performance monitoring program (refer Table 29).

Works undertaken within the Tanilba Northern Dunes Extension during the reporting period include:

- Supplementary planting of assorted native species undertaken over several planting events
- Weed management inspections to identify areas requiring control by spraying.

The revegetation (planting) program at the Extension site was completed during the current reporting period. Sibelco previously implemented a regime of weed control across the whole of the Tanilba Northern Dunes mining area which is ongoing and Holcim maintains a continued commitment to ongoing and progressive rehabilitation. Site wide weed management of the Extension will continue to be undertaken following the completion of planting.

8.2 Rehabilitation Monitoring

During the reporting period, monitoring of the progress of rehabilitation at the Tanilba Northern Dune Extension Project area was undertaken by Kleinfelder in July 2020 and January 2021.

The objective of the LMP is to progressively re-establish original vegetation community types, after extraction and landform rehabilitation has been completed, to as close as possible to that of the original vegetation. This recognises that the final landform will be lower in elevation than the original topography, and Section 4.5 of the LMP therefore describes performance measures to assess the success of the rehabilitation. This section addresses compliance to the following parts of the approved LMP:

- 4.5.1 Baseline Data – sets target figures for vegetation structure and content.
- 4.5.2 Performance Indicators – provides performance indicators for each stage of the rehabilitation program.

Section 4.5.3 of the LMP provides completion criteria to be applied to each rehabilitation block at the end of the monitoring program (8 years) to determine eligibility of operational areas for release from further rehabilitation or monitoring. Rehabilitation of the Northern Dunes Extension area commenced in 2016: Section 4.5.3 is therefore not discussed in the current report.

The Tanilba Northern Dunes Extension area has been subdivided into several blocks (known as Q1 to Q6 shown in Figure 10) for ease of data collection. Rehabilitation blocks are prepared and biannually surveyed after 6 months of growth for a period of 3 years. Details of each block surveyed for the 2019 annual report are provided below**.**

Table 19: Block preparation and survey details for the North Dunes Extension Rehabilitation Blocks

Block	Prepared	First Biannual Survey Conducted	Last Biannual Survey (Due)
Q1	December 2016 - July 2017	January 2018	July 2020
Q2	July 2018	January 2019	July 2021
Q3	July 2018	January 2019	July 2021
Q4	July 2018	January 2019	July 2021
Q5	July 2018	January 2019	July 2021
Q6	July 2019	January 2020	Jan 2022

The monitoring plan has been designed in accordance with principles of the EMP and will facilitate the stated aim of the EMP (Section 7.1) to re-establish stable and sustainable native vegetation cover in-line with the original vegetation community types pre-extraction, including similar structural components and species composition at similar elevations.

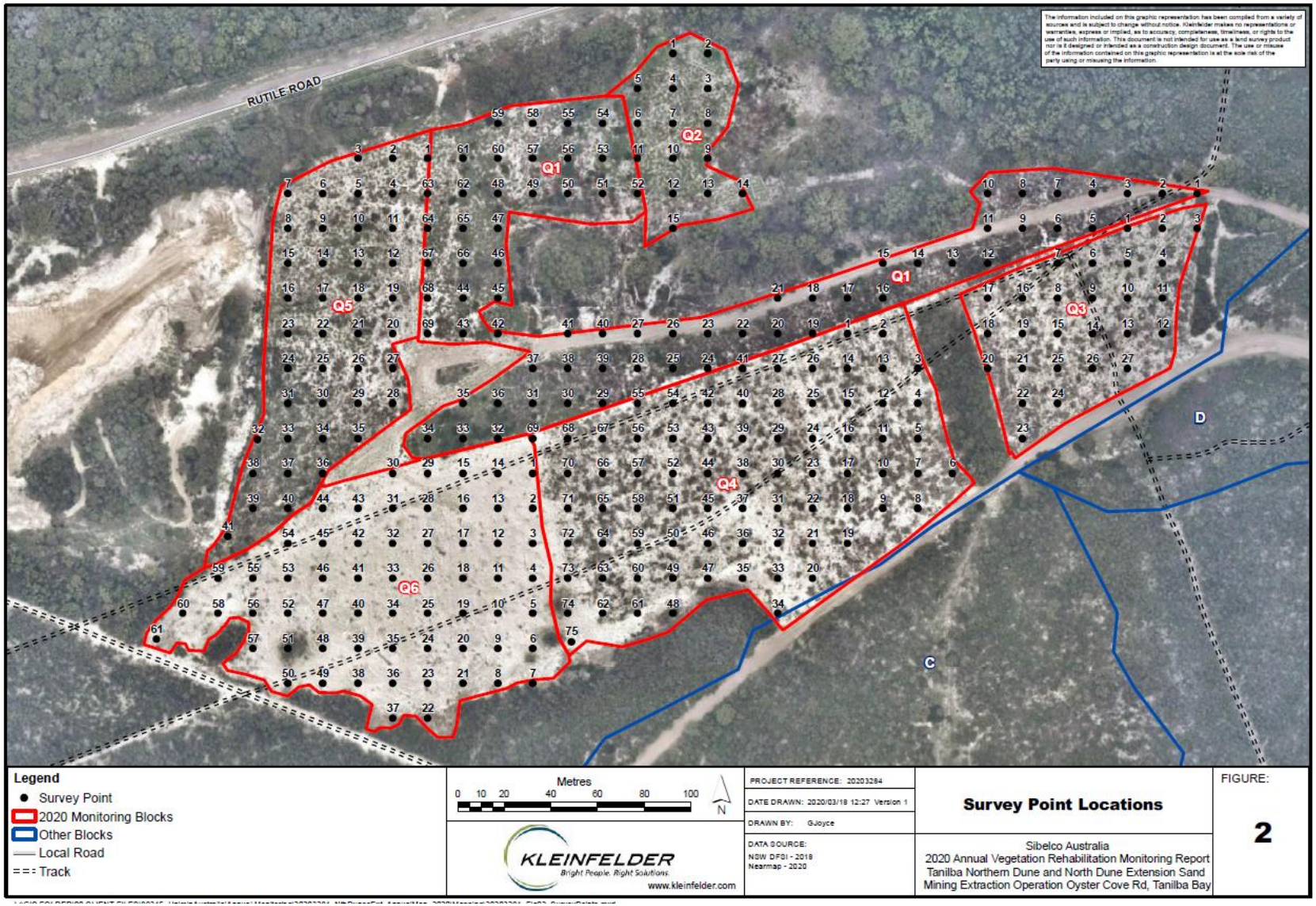


Figure 10: Locations of Blocks Q1 to Q6

A total of 227 plots were surveyed for the purpose of the current annual report consisting of:

- 69 plots on Block Q1,
- 15 plots on Block Q2,
- 27 plots of Block Q3,
- 75 plots on Block Q4,
- 41 plots of Block Q5, and,
- 62 plots of Block Q6.

Each of the blocks has been established at different time intervals as per **Table 19**. Results for each of the blocks is therefore presented in summary separately below.

The full rehabilitation monitoring report is provided in Appendix 7 and includes survey results against rehabilitation and species composition targets established in the LMP.

8.2.1 Block Q1

July 2020 represented the sixth and last of the biannual surveys for this block and represents 36 months of growth after the start of rehabilitation of this block. Data for Block Q1 is presented in **Table 20** and relates to information collected from the July 2020 monitoring event comparing progress to the previous surveys and against targets established in the LMP.

Table 20: Progression of average monitoring parameter data and target projections for Block Q1

Parameter	Target	Rehab status Jan 2018	Rehab status Jul 2018	Rehab status Jan 2019	Rehab status Jul 2019	Rehab status Jan 2020	Rehab status Jul 2020	Percentage Target Achieved (Jul 20)
Average Cover (%)	**80**	36.09	36.38	55.20	65.36	57.71	44.13	55.16
Average height (cm)	**230**	29.9	33.15	43.01	63.33	66.62	72.35	31.46
Ave. No. of plants (plants/4 m^2)	**40**	23.2	16.38	27.74	23.78	17.14	11.04	27.61
Ave. No. Fire resistant species (plants/4 m^2)	**1**	1.9	1.80	2.41	1.78	1.46	1.56	156.52
Ave. Species Richness (species/4 m^2)	**12**	9.3	7.30	9.38	8.46	6.04	3.76	31.40
Ave. Ground stratum proportion (%)	**27**	25.91	14.96	25.43	25.78	43.54	20.47	75.83
Ave. Shrub stratum proportion (%)	**61**	39.67	36.94	40.02	45.17	29.40	29.32	48.07
Ave. Midstorey stratum proportion (%)	**7**	11.89	19.17	12.24	12.01	14.60	13.47	192.43

Parameter	Target	Rehab status Jan 2018	Rehab status Jul 2018	Rehab status Jan 2019	Rehab status Jul 2019	Rehab status Jan 2020	Rehab status Jul 2020	Percentage Target Achieved (Jul 20)
Ave. Overstorey stratum proportion (%)	**5**	8.03	12.99	6.36	11.25	12.47	10.65	212.98

8.2.2 Block Q2

This is the third annual survey for Block Q2. Data for Block Q2 is presented in Table 21. This block is relatively older than the remaining blocks (Q3 – Q6) and this is reflected in the average height and cover parameters. This block was also the subject of extensive weed control works during the reporting period.

Table 21: Results of the annual rehabilitation monitoring for Block Q2

Parameter	Target	Rehab status Jan 2019	Rehab status Jul 2019	Rehab status Jan 2020	Rehab status Jul 2020	Rehab status Jan 2021	Percent Target Achieved (Jan 21)
Average Cover (%)	**80**	53.30	61.33	59.00	37.00	54.33	67.92
Average height (cm)	**230**	41.62	37.19	54.65	41.77	65.68	28.56
Ave. No. of plants (plants/4 m^2)	**40**	32.67	27.73	18.86	13.86	23.60	59.00
Ave. No. Fire resistant species (plants/4 m^2)	**1**	1.27	0.53	1.46	1.46	1.46	146.67
Ave. Species Richness (species/4 m^2)	**12**	8.73	6.6	6.0	5.8	5.9	49.44
Ave. Ground stratum proportion (%)	**27**	50.77	41.20	46.59	49.82	48.62	180.07
Ave. Shrub stratum proportion (%)	**61**	34.36	40.09	19.25	21.80	32.79	53.75
Ave. Midstorey stratum proportion (%)	**7**	13.31	16.93	25.19	16.13	8.92	127.44
Ave. Overstorey stratum proportion (%)	**5**	1.56	1.78	8.97	5.58	9.67	193.44

8.2.3 Block Q3

Block Q3 has been rehabilitated for approximately 30 months and appears to have recovered from the die back that was observed during the January 2020 survey.– refer Table 22.

Table 22: Results of the initial rehabilitation monitoring for Block Q3

Parameter	Target	Rehab status Jan 2019	Rehab status Jul 2019	Rehab status Jan 2020	Rehab status Jul 2020	Rehab status Jan 2021	Percentage Target Achieved (Jan 21)
Average Cover (%)	**80**	33.70	42.10	27.03	46.29	66.29	82.87
Average Height (cm)	**230**	21.42	28.75	27.49	40.40	47.40	20.61
Ave. No. of plants (plants/4 m^2)	**40**	56.70	52.27	29.00	35.88	32.85	82.13
Ave. No. Fire resistant species (plants/4 m^2)	**1**	2.04	2.10	1.74	1.62	2.22	222.22
Ave. Species Richness (species/4 m^2)	**12**	15.44	17.34	13.00	15.96	14.92	124.38
Ave. Ground stratum proportion (%)	**27**	5.98	5.30	8.31	8.38	8.28	30.66
Ave. Shrub stratum proportion (%)	**61**	82.75	81.39	79.04	78.78	79.85	130.90
Ave. Midstorey stratum proportion (%)	**7**	5.17	4.65	6.31	6.24	3.84	54.85
Ave. Overstorey stratum proportion (%)	**5**	6.09	5.21	6.33	6.60	8.04	160.72

8.2.4 Block Q4

This is the fifth survey undertaken on Block Q4. The rehabilitation parameters for this block have improved over the of the course of the monitoring – refer Table 23.

Table 23: Results of the initial rehabilitation monitoring for Block Q4

Parameter	Target	Rehab status Jan 2019	Rehab status Jul 2019	Rehab status Jan 2020	Rehab status Jul 2020	Rehab status Jan 2021	Percent Target Achieved (Jan 21)
Average Cover (%)	**80**	2.48	20.48	41.84	48.38	66.96	83.70
Average height (cm)	**230**	13.84	10.02	13.86	36.16	44.70	19.44
Ave. No. of plants (plants/4 m^2)	**40**	12.83	18.26	29.97	34.96	32.48	81.40
Ave. No. Fire tolerant species (plants/4 m^2)	**1**	1.13	1.57	1.41	1.74	1.97	197.33
Ave. Species Richness (species/4 m^2)	**12**	5.11	7.64	10.94	13.68	14.23	118.56
Ave. Ground stratum proportion (%)	**27**	2.28	2.88	7.47	6.51	8.39	31.07
Ave. Shrub stratum	**61**	75.97	74.67	78.02	77.58	76.55	125.49

Parameter	Target	Rehab status Jan 2019	Rehab status Jul 2019	Rehab status Jan 2020	Rehab status Jul 2020	Rehab status Jan 2021	Percent Target Achieved (Jan 21)
proportion (%)							
Ave. Midstorey stratum proportion (%)	**7**	6.34	10.21	8.07	7.10	6.32	90.35
Ave. Overstorey stratum proportion (%)	**5**	11.40	12.23	6.44	8.80	8.74	174.78

8.2.5 Block Q5

Block Q5 has been surveyed for the fifth time and appears to have suffered from the drier than normal conditions in 2019– refer to Table 24 for survey data. Since the previous survey, this block has had extensive weed control work conducted including a controlled burn August 2020.

Average cover and height have increased from the previous surveys. Average plant density has decreased to 40 plants per 4m2 as a result of the weed control efforts although Eragrostis curvula (African Lovegrass) is still the dominant ground cover.

Table 24: Results of the initial rehabilitation monitoring for Block Q5

Parameter	Target	Rehab status Jan 2019	Rehab status Jul 2019	Rehab status Jan 2020	Percentage Target Achieved (Jan 20)
Average Cover (%)	**80**	42.20	58.98	31.60	39.51
Average height (cm)	**230**	28.64	51.56	32.93	14.32
Ave. No. of plants (plants/4 m^2)	**40**	39.10	21.48	40.56	101.40
Ave. No. Fire resistant species (plants/4 m^2)	**1**	4.85	4.36	3.56	356.10
Ave. Species Richness (species/4 m^2)	**12**	12.88	8.73	8.60	71.75
Ave. Ground stratum proportion (%)	**27**	46.13	35.72	53.93	199.74
Ave. Shrub stratum proportion (%)	**61**	38.56	44.96	22.66	37.15
Ave. Midstorey stratum proportion (%)	**7**	12.17	15.37	22.71	324.48
Ave. Overstorey stratum proportion (%)	**5**	3.14	3.95	0.70	13.92

8.2.6 Block Q6

This was the third survey undertaken on Block Q6 which was rehabilitated approximately 18 months previously, and average cover, height, plant density and fire tolerant plants all increased substantially over the previous surveys. While most of these parameters are still below target, trajectories are indicating that targets will be met at this stage. – refer to Table 25.

Table 25: Results of the initial rehabilitation monitoring for Block Q6

Parameter	Target	Rehab status Jan 2020	Rehab status Jul 2020	Rehab status Jan 2021	Percent Target Achieved (Jan 21)
Average Cover (%)	**80**	6.11	18.90	40.88	51.11
Average height (cm)	**230**	14.65	19.81	30.27	13.16
Ave. No. of plants (plants/4 m^2)	**40**	19.14	21.29	28.18	70.45
Ave. No. Fire resistant species (plants/4 m^2)	**1**	2.14	1.70	2.32	232.79
Ave. Species Richness (species/4 m^2)	**12**	6.93	7.32	13.32	111.07
Ave. Ground stratum proportion (%)	**27**	7.49	4.31	3.82	14.14
Ave. Shrub stratum proportion (%)	**61**	60.22	68.07	74.31	121.85
Ave. Midstorey stratum proportion (%)	**7**	12.59	15.28	12.73	181.92
Ave. Overstorey stratum proportion (%)	**5**	19.69	12.35	9.14	182.84

8.3 Weeds

As has been reported previously (Kleinfelder, 2020) weeds are a major problem for the Northern Dune Extension. Weeds encroach into blocks Q3, Q4 and Q6 from the adjoining haul roads and weed infested areas adjacent to the site. The northern section of block Q1, the whole of Q2 and Q5 are heavily weed infested. Table 26 lists the major weeds identified from the survey – but is not a comprehensive list of weed species - and calculates their density.

It should be noted that Holcim has undertaken several weed control measures in the period covered by this report including scalping of portions of Block Q1 and Q5, burning of dense E. curvula on Block 5 as well as hand control and herbicide application in Blocks Q1, Q2 and along the adjacent haul road. Weed control operations were undertaken in July through to December 2020.

Table 26: Numbers of the major weed species across the North Dunes Extension by block. Please note these are calculated densities based on survey data undertaken in January 2020.

Scientific Name	Common Name	Block Density					
		Q1	Q2	Q3	Q4	Q5	Q6
Acanthospermum australe	-	0	53	0	0	222	56
Conyza spp.	Fleabane	216	0	0	0	0	0
Eragrostis curvula	African Lovegrass	3343	1973	0	476	6770	225
Leptospermum laevigatum	Coastal Tea Tree	1186	320	0	357	5327	56
Megathyrsus maximus	Guinea Grass	0	0	0	297	1443	0
Melinis repens	Red Natal Grass	4097	373	115	119	9266	56
Oenothera mollissima	-	0	0	0	0	444	0

Block Q1 – this block has good revegetation along its eastern portion, but at its western end, near the turning circle, E. curvula has formed a dense infestation. This species is now starting to encroach into the adjoining Block Q4. The northern section of Q1, between the haul road and the northern boundary was densely weed infested, the major weed being E. curvula, but this is by no means the only weed species present with the weedy grasses Megathyrsus maximus (Guinea Grass), Melinis repens (Red Natal Grass), Axonopus fissifolius (Narrow-leafed Carpet Grass) and Eleusine indica (Crowsfoot Grass) also recorded. Holcim have undertaken a major revegetation of this section of the block, with topsoil scraping and replanting conducted.

Block Q2 – this is small block to the east of Q1 and presents the same issues as Q1 with a high density of weeds, including the listed weed species Gloriosa superba (Glory Lilly) and a lack of native species diversity. Just to the east of this block in the Offsets area, several other weed species have been identified and treated, but the major concern here is the Phyllostachys aurea (Fishpole Bamboo) that despite multiple treatments was still observed to be re-growing. Further ongoing and frequent treatment of this species is required. The recent weed control works undertaken for the North Dunes Extension Offsets has targeted these infestations.

Block Q3 - The grass weed Melinis repens (Red Natal Grass) was recorded within the rehabilitation for the first time this survey, although the infestations are sparse, limited to single plants.

Block Q4 - has four weed species recorded within the rehabilitation. These are the grass weeds, E. curvula, M. repens and Megathyrsus maximus (Guinea Grass) encroaching from Block Q1 along its northern boundary. L. laevigatum has become established with the rehabilitation and individuals should be removed before seed set.

Block Q5 – sits to adjacent to The Knoll, between the haul road and the northern boundary of the site. It too is heavily weed infested but does have a greater species richness than the adjacent portions of Block Q1 and Block Q2. It suffers from recruitment of weed species from the buffer zone along Rutile Rd to the north as well as the previously mentioned dense E. curvula. This block has been the subject of on-going control works and replanting by Holcim field staff.

Block Q6 – this is the latest block to be rehabilitated and as such has small, young plants and low coverage. Weeds are starting to encroach from Block Q5. In addition, during sand extraction it appears a short haul road was constructed using road base. This has not been removed prior to

rehabilitation and is now a source of weeds with some minor Acanthospermum australe re-establishing after previous weed control and a substantial infestation of a weed identified as Oenothera mollissima. This infestation has been the subject of weed control efforts by Holcim staff.

8.4 Plantings

Planting and seeding were undertaken on the North Dunes Extension from July 2020 to December 2020 and concentrated on the blocks highlighted in previous reports as deficient in particular species. As part of the re-planting works, Holcim also removed the topsoil and weed infestation of a large area of Q1 and Q5 back to the soil surface with the aim of removing a large component of the weeds and, as importantly, reduce the weed seed bank. The planting and seeding works are detailed in the table below.

Table 27: Details of species and numbers planted during the reporting period

Species	Number	Area	Month	Units	Method
Banksia aemula/serrata	284	Q1 & Q5	July - November	Forestry Tubes & seed	Hand Planted, direct seed
Corymbia gummifera	135	Q1 & Q5	August - September	Forestry Tubes	Hand Planted
Eucalyptus piperita	315	Q1 & Q5	August	Forestry Tubes	Hand Planted
Eucalyptus robusta	101	Q2 & Q5	August	Forestry Tubes	Hand Planted
Leptospermum polygalifolium	495	Q5	August & December	Forestry Tubes	Hand Planted
Leptospermum trinervium	-	Q1, Q2, Q5 & Q6	December	-	Brushmatting
Melaleuca nodosa	1085	Q2 & Q5	August	Forestry Tubes	Hand Planted

8.5 Performance Indicators

At each stage of monitoring, rehabilitation is compared to the performance indicators outlined in Table 11 of the LMP. Those relevant to the rehabilitation stages of the Tanilba Northern Dunes Extension area (years 1 to 3) are summarised below in Table 28. Performance indicators are relevant to age of each rehabilitation quadrat. As such, performance indicators not relevant to each quadrat in **Table 28** are listed as 'NA – Not Applicable'. If rehabilitation areas do not meet these performance indicators, specific management measures are required to be outlined in the AR.

Table 28: Performance Indicators for Tanilba Northern Dune Extension rehabilitation

Aims for Each Strategic Ecosystem Development Stage	Year	Performance Indicators	Compliance						
			Q1 (Sth Haul Road)	Q1 (Nth Haul Road)	Q2	Q3	Q4	Q5	Q6
Monitoring will be on a bi-annual basis until achieving the early pioneer stage with the following features: • Topsoil stabilised by primary colonisers (e.g. acacias & pea species); • Key species present and densities increasing towards target numbers • No significant erosion problems; and • Weed control program in place	1	Early pioneer stage appearing small seedlings (<5cm) regenerating from topsoil, <5% cover.	NA	NA	NA	NA	NA	NA	NA
		At least 25 mature Grass Trees per hectare.	NA	NA	NA	NA	NA	NA	NA
		Brush matting evident.	NA	NA	NA	NA	NA	NA	NA
		Adequate store of fresh local seed.	NA	NA	NA	NA	NA	NA	NA
	2	Natural regeneration of pioneer species covering 20% of ground surface, average 20cm tall.	Y	N	N	Y	Y	P	Y
		Seedling developing under brush-matting.	Y	N	N	Y	Y	Y	Y
		Planted trees and shrubs in predetermined numbers according to revegetation strategy, 20-30cm tall.	Y	Y	Y	Y	Y	N	Y
		No significant problems.	Y	Y	Y	N	N	Y	N
		Noxious or significant environmental weeds control program in place	P*[1]	N	N	Y	Y	N	P
		Rehabilitation area is clean of rubbish.	Y	Y	Y	Y	Y	Y	Y
	3	All structural species present in predetermined density, 30-90 cm tall.	Y	N	Not Applicable to these Monitoring Quadrats within the Northern Dune Extension Area at this period in time.				
		Shrub layer and ground cover strata intact.	Y	N					
		Natural regeneration covering 40-60% of surface, average 50-80cm tall.	P	N					
		No significant erosion problems.	N	N					
		Weed control program in place and weeds successfully controlled.	N	P					
		Rehabilitation area is clean of rubbish.	Y	Y					

8.6 Rehabilitation Actions

A summary of the results of the 2019/20 monitoring program, including an outline of rehabilitation actions to be undertaken during the 2020 – 2021 reporting period are provided in **Table 29** below. Rehabilitation actions have been derived from recommendations from both the January 2020 Monitoring Report and a letter prepared by Kleinfelder following the July 2019 monitoring event.

Holcim will continue to manage rehabilitation commitments to address action identified in the monitoring program. As progress reports are compiled throughout the reporting period any actions that arise will be managed accordingly to continue our commitment to the Rehabilitation Management Plan (as included within the LMP).

Refer to the full monitoring report provided in Appendix 7 for further detail on the rehabilitation actions to be undertaken during the next reporting period.

Table 29: Summary of monitoring program and rehabilitation actions to be applied at the Northern Dune Extension area.

Block	Developmental Parameters	Remedial Actions for 2020/21 AR Reporting Period (July 2020 and January 2021 Recommendations)
Q1	This section of the rehabilitation exhibits good canopy density and height, with many of the trees estimated to be up to 5m tall, although most are estimated to be between 1.5m and 2.5m in height. Shrub species have begun to die-back and there is a considerable amount of bare ground that is beginning to be colonised by the grassy weed species. Growth parameters have been negatively affected by the combination of drought and weed infestation in large sections of this block. Species diversity has decreased to its lowest point since monitoring commenced. Additional seeding of shrub species is required to increase the species diversity in those areas where E. curvula is densest and after treatment of the weeds.	• Additional seeding of native species, especially shrubs and ground covers is required to reach species diversity targets. • Weed control of introduced grasses and other exotics.
Q2	Development parameters are only superficially good, with a very high weed content accounting for the average cover, average number of plants per quadrat, and the high proportion of ground stratum overall. The return to better conditions has led to a resurgence the weed species – mainly E. curvula, but also the listed weed noxious weed species Gloriosa superba (Plate 17). Additional seeding of native species, especially shrubs and ground covers is required to reach species diversity targets.	• Additional seeding of native species, especially shrubs and ground covers is required to reach species diversity targets. • Weed control of introduced grasses and other exotics
Q3	The previous annual report (Kleinfelder, 2020) stated the drought has adversely affected this block with most growth parameters reduced from the previous (2019) survey. However, this block has rebounded well displaying a high of resilience.	• Weed control of introduced grasses and other exotics
Q4	This block has continued to progress and has improved its rehabilitation parameters since the previous surveys. This block on trajectory to achieve rehabilitation targets.	• Weed control of encroaching grasses
Q5	This block is very similar to Blocks Q1 (north section) and Q2 in that it is older rehabilitation with a high level of grassy weeds (mainly E. curvula but also M. maximus) and other woody weeds.	• Additional seeding of native species, especially shrubs and ground covers is required to reach species diversity targets. • Additional weed control measures as per Q1 and Q2

Block	Developmental Parameters	Remedial Actions for 2020/21 AR Reporting Period (July 2020 and January 2021 Recommendations)
	The distribution of native vegetation is uneven across the block with some areas dominated by the grassy weeds. A. longifolia is the dominant native shrub species with many of the individual plants now getting quite large but even this species is not present in all areas of the block. Where it is present, it tends to dominate as this species has an average height of 180cm (ranging up to 300cm) on this block at the time of survey. It can achieve heights of 800cm, suggesting that it will pose severe competition to smaller species.	
Q6	Including the biannual survey undertaken in June 2020, this was the third survey of this block. Rehabilitation parameters are progressing satisfactorily. Revegetation is well underway with increasing cover, species diversity and plant numbers, although the proportion of ground stratum species is very low. Further monitoring will be required to determine if numbers improve.	• Weed control of introduced grasses and other exotics

9 COMMUNITY

9.1 Community Engagement Activities

Schedule 5, Clause 9 of the project approval requires specific information to be made available on the proponents website.

Holcim provides information on operations at the Tanilba Northern Dune Extension Project to the public via its website. This includes a copy of approved strategies, management plans, monitoring data, approvals and annual reviews. This AR will be made available on Holcim's website once accepted.

9.2 Complaints

Holcim maintained a community complaint register that was updated quarterly throughout the reporting period to include any new community complaints. Any complaints that are received are elevated to a Level 2 incident and investigated internally using the Incident Cause Analysis Method (ICAM) method.

There were no community complaints received during the reporting period.

10 INDEPENDENT AUDIT

Schedule 5 Clause 7 requires an Independent Environmental Audit (IEA) to be commissioned within one month of the completion of quarrying operations. An IEA was performed the IEA on 7 August 2019. No further IEA was required during the reporting period.

11 INCIDENTS AND NON-COMPLIANCE

Schedule 5 Clause 5 requires reporting of any incident associated with the project as soon as practicable after Sibelco becomes aware of the incident. This includes circumstances that cause or threaten to cause material harm to the environment and / or breaches or exceeds the limits of performance measures/criteria in approval MP 09_0091.

No incidents or non-compliances were recorded during this AR period.

12 ACTIVITIES TO BE COMPLETED IN THE NEXT REPORTING PERIOD

Along with the improvements discussed throughout this document, Holcim will undertake the following activities in the next reporting period (April 1 2021 – March 31 2022) to ensure compliance with the consent and to ensure that effective environmental management controls are in place and operating in accordance with the requirements of the Consent.

Table 30: Proposed works – 2021/22

Item	Requirement		2020-2021 program	Due Date
OPERATIONS/ADMINISTRATION				
1		Site condition	Inspection of site for identification of maintenance requirements including condition of roadside drainage and rehabilitated areas	Monthly
2	S5, Cl 3	Annual Review	Prepare and submit AR to DPIE on activities undertaken in the 2021-2022 reporting period	30 June 2022
3	S5 Cl 2	Performance review	Monitoring requirements will be reviewed to ensure all future monitoring and reporting following closure is relevant to the activities being performed. The review will be performed in consultation with DPI-Water and HWC	Following submission of AR
GROUNDWATER				
4		Groundwater Level Monitoring	Sibelco to monitor bores as per approved GMP.	Monthly (weekly for 4 weeks if >100 mm rain per 7 days)
5		Groundwater quality Monitoring	Third Party contractor to monitor bores as per approved GMP.	As per GMP
6		GMP Review	The GMP will be reviewed to ensure the monitoring and reporting is relevant to the activities being performed. The review will be performed in consultation with DPI-Water and HWC.	Following submission of AR
7		Reporting	The results of the groundwater level and quality monitoring will be reported as per the GMP. Reporting frequency will be determined during the review of the GMP following consultation with DPI-Water and HWC.	Frequency determined following GMP review and consultation with DPI-Water and HWC
Item	**Requirement**		**2020-2021 program**	**Due Date**
S5, Cl 17 - FORMER EXTRACTION AREA (LMP)				
8			Supplementary planting as required following the inspections and biannual monitoring	As required
9	LMP 4.3.9	Weed management	Site wide weed spraying following the completion of the final stage of revegetation planting	As required
10		Maintenance	Follow up inspections to identify and manage regrowth across all rehabilitated areas	As required
11	LMP	Performance	Implement recommendations in Annual	As required

	4.3.6	monitoring	Vegetation Rehabilitation Monitoring Report (Kleinfelder 2021)	
12			Monitoring of rehabilitated areas to assess performance against the requirements of the BMP	Biannual
13			Prepare report to summarise results of rehabilitation program, identify trends and any management measures required to achieve objectives of rehabilitation program	April 2022
14	S5 Cl 2	LMP Review	The LMP will be reviewed to ensure the monitoring and reporting is relevant to the activities being performed. The review will be performed in consultation with DPI-Water and HWC	Following submission of AR
S3, Cl15 - OFFSET AREAS (BMP)				
15	BMP 5.1.2	Nest box installation and monitoring program	Annual monitoring for a minimum six year period within the northern offset area to record uptake and attend to maintenance	October 2021
16	BMP 5.1.4	Fauna survey program	Targeted monitoring across all offset areas for Wallum Froglet to detect changes in recruitment success and assess impacts	In accordance with seasonal survey requirements
17	BMP 5.1.4, 5.2		Targeted monitoring across all offset areas for *Uperoleia sp nov* to identify habitat preferences of spp	In accordance with seasonal survey requirements
18	BMP 5.2		Monitoring to determine if Koala is utilising areas determined as Preferred Koala Habitat (Swamp Mahogany – Paperbark Swamp Forest) and Supplementary Habitat (Coastal Sand Apple – Blackbutt Forest) within the offset areas	
	5.1.5 of BMP	Vegetation management and monitoring program	Habitat restoration and rehabilitation program for proposed offset area in Lots 11, 12 and 13:	
19			• Inspection to identify areas requiring weed and pest control	Annual
20			• Weed and pest management	Annual
21			• Rehabilitation of the regenerating Grassland-Heath	Annual
Item	**Requirement**		**2020-2021 program**	**Due Date**
22	BMP 5.1.7		• Supplementary planting of *E robusta* within offset area to expand availability of habitat for Koala	During rehab program
23	BMP 5.2		• Monitoring of the offset area to ensure vegetation and habitat qualities are being maintained	
24	S5 Cl 2	BMP Review	The BMP will be reviewed to ensure the monitoring and reporting is relevant to the activities being performed. The review will be performed in consultation with DPI-Water and HWC	Following submission of AR
COMMUNITY				
25	S5, Cl9	Information Access	Upload the Annual Review for 2019-2020 to the company website when approved.	
26		Complaints Register	Maintain and update	Quarterly

13 APPENDICES

APPENDIX 1
Project Approval MP-09-0091

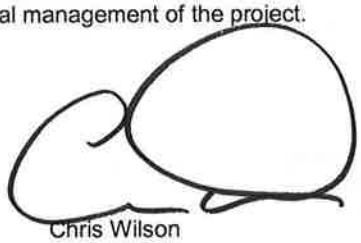
Project Approval

Section 75J of the *Environmental Planning and Assessment Act 1979*

As delegate for the Minister of Planning, I approve the project application referred to in schedule 1, subject to the conditions in schedules 2 to 5.

These conditions are required to:

- prevent, minimise, and/or offset adverse environmental impacts;
- set standards and performance measures for acceptable environmental performance;
- require regular monitoring and reporting; and
- provide for the on-going environmental management of the project.



Chris Wilson
Executive Director
Development Assessment Systems & Approvals

Sydney 8 MARCH 2013

SCHEDULE 1

Project Application:	09_0091
Proponent:	Sibelco Australia Limited
Approval Authority:	Minister for Planning and Infrastructure
Land:	Lots 11, 12, 13 DP601306; Lot 408 DP1041934; and Lots 1, 2 DP406240.
Project:	Tanilba Northern Dune Extension Project

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DEFINITIONS

Annual Review	The review required by condition 3 of schedule 5
Biodiversity Offset Strategy	The conservation and management of the Proponent's offset sites on the Tilligerry Peninsula, being Lots 11, 12, 13 DP601306 and Lot 24 DP579700
Conditions of this approval	Conditions contained in schedules 2 to 5 inclusive
Council	Port Stephens Council
Day	The period from 7.00am to 6.00pm, Monday to Saturday
Department	Department of Planning and Infrastructure
Director-General	Director-General of the Department of Planning and Infrastructure, or nominee
DRE	Division of Resources and Energy (within the Department of Trade and Investment, Regional Infrastructure and Services)
DST	Daylight Savings Time
EA	Environmental Assessment of the project titled *Tanilba Northern Dune Extraction Extension - Environmental Assessment Report* prepared by ERM Australia Pty Limited, dated June 2012 and the Proponent's response to the issues raised in submissions, dated November 2012
EP&A Act	*Environmental Planning and Assessment Act 1979*
EP&A Regulation	*Environmental Planning and Assessment Regulation 2000*
EPL	Environment Protection Licence under the *Protection of the Environment Operations Act 1997 (POEO Act)*
EST	Eastern Standard Time
Feasible	Feasible relates to engineering considerations and what is practical to build
HWC	Hunter Water Corporation
Incident	A set of circumstances that causes or threatens to cause material harm to the environment, and/or breaches or exceeds the limits or performance measures/criteria in this approval
Land	Land means the whole of a lot, or contiguous lots owned by the same landowner, in a current plan registered at the Land Titles Office at the date of this approval
m AHD	metres Australian Height Datum
Material harm to the environment	Material harm to the environment as defined in the *Protection of the Environment Operations Act 1997*
Minister	Minister for Planning and Infrastructure, or nominee
NOW	NSW Office of Water (within the Department of Primary Industries)
OEH	Office of Environment and Heritage (within the Department of Premier and Cabinet)
Privately-owned land	Land that is not owned by a public agency or a quarrying company (or its subsidiary)
Project	The development as described in the EA
Proponent	Sibelco Australia Limited, or its successors in title
Quarrying operations	The extraction, processing and transportation of extractive materials on the site and the associated removal of vegetation, topsoil and overburden
Reasonable	Reasonable relates to the application of judgement in arriving at a decision, taking into account: mitigation benefits, cost of mitigation versus benefits provided, community views and the nature and extent of potential improvements
Rehabilitation	The treatment or management of land disturbed by the project for the purpose of establishing a safe, stable and non-polluting environment
RMS	NSW Roads and Maritime Services
Statement of Commitments	The Proponent's commitments in Appendix 3
Site	Land to which the Project Approval applies, as listed in schedule 1 and shown in Appendix 1

SCHEDULE 2
ADMINISTRATIVE CONDITIONS

Obligation to Minimise Harm to the Environment

1. The Proponent shall implement all reasonable and feasible measures to prevent and/or minimise any material harm to the environment that may result from the construction, operation or rehabilitation of the project.

Terms of Approval

2. The Proponent shall carry out the project generally in accordance with the:
   (a) EA;
   (b) Statement of Commitments; and
   (c) conditions of this approval.

   Note: The general layout of the project is shown in the figure in Appendix 1.

3. If there is any inconsistency between the above documents, the most recent document shall prevail to the extent of the inconsistency. However, the conditions of this approval shall prevail to the extent of any inconsistency.

4. The Proponent shall comply with any reasonable requirement/s of the Director-General arising from the Department's assessment of:
   (a) any reports, plans, programs or correspondence that are submitted in accordance with this approval; and
   (b) the implementation of any actions or measures contained in these reports, plans, programs or correspondence.

Limits on Approval

5. The Proponent may carry out quarrying operations on the site until 31 December 2020.

   Note: Under this Approval, the Proponent is required to rehabilitate and revegetate the site and provide and implement a Biodiversity Offset Strategy to the satisfaction of the Director-General. Consequently this approval will continue to apply in all other respects other than the right to conduct quarrying operations until the site has been rehabilitated and revegetated and the Biodiversity Offset Strategy implemented to a satisfactory standard.

6. The Proponent shall not transport more than 150,000 tonnes of extractive materials from the site in any calendar year.

7. The Proponent shall ensure that no more than three hectares of the site would be exposed (ie cleared but not re-vegetated) at any one time.

Staged Submission of any Strategy, Plan or Program

8. With the approval of the Director-General, the Proponent may submit any strategy, plan or program required by this approval on a progressive basis.

Protection of Public Infrastructure

9. The Proponent shall:
   (a) repair, or pay the full costs associated with repairing, any public infrastructure that is damaged by the project; and
   (b) relocate, or pay the full costs associated with relocating, any public infrastructure that needs to be relocated as a result of the project.

Operation of Plant and Equipment

10. The Proponent shall ensure that all plant and equipment used at the site, or to transport extractive materials from the site, is:
    (a) maintained in a proper and efficient condition; and
    (b) operated in a proper and efficient manner.

Section 94 Contributions

11. For the life of quarrying operations under the project, the Proponent shall pay Council a Section 94 contribution rate in accordance with the *Port Stephens Section 94 Development Contributions Plan 2007*.

Notification of Commencement

12. The Proponent shall notify the Department of its intention to commence quarrying operations at least two weeks prior to the commencement of quarrying operations.

SCHEDULE 3
ENVIRONMENTAL PERFORMANCE CONDITIONS

IDENTIFICATION OF BOUNDARIES

1. Prior to the commencement of quarrying operations, the Proponent shall:
   (a) engage a registered surveyor to mark out the boundaries of the approved limits of extraction; and
   (b) ensure that these boundaries are clearly marked at all times in a permanent manner that allows operating staff and inspecting officers to clearly identify those limits.

NOISE

Impact Assessment Criteria

2. The Proponent shall ensure that the operational noise generated by the project does not exceed the noise impact assessment criteria in Table 1 at any residence on privately-owned land.

Table 1: Noise impact assessment criteria

Receiver	$L_{Aeq\ (15\ min)}$ ***dB(A)***
R1, R2, R3 and all residences in Oyster Cove	37
All other receivers	35

Notes:

- *Receiver locations are shown in the Figure in Appendix 2; and*
- *Noise generated by the project is to be measured in accordance with the relevant procedures and exemptions (including certain meteorological conditions) of the NSW Industrial Noise Policy.*

Hours of Operation

3. The Proponent shall only conduct quarrying operations on the site:
   (a) between 7.00 am and 6.00 pm EST, Monday to Friday;
   (b) between 7.00 am and 7.00 pm DST, Monday to Friday; and
   (c) at no time on Saturday, Sunday or public holidays.

Operating Conditions

4. The Proponent shall:
   (a) implement best practice noise management to minimise the construction, operational and traffic noise of the project;
   (b) maintain the effectiveness of any noise suppression equipment on site at all times and ensure defective equipment is not used operationally until fully repaired; and
   (c) conduct extraction activities in a south to north direction so that the topography shields the sensitive receivers,

   to the satisfaction of the Director-General.

Noise Monitoring Program

5. The Proponent shall prepare and implement a Noise Monitoring Program for the project to the satisfaction of the Director-General. This program must:
   (a) be submitted to the Director-General for approval prior to commencing quarrying operations;
   (b) include quarterly attended noise monitoring during at least the first two years of quarrying operations, to be conducted on days when at least 30 truck dispatches occur from the site; and
   (c) include details of how the noise performance of the project would be monitored, and include a noise monitoring protocol for evaluating compliance with the noise criteria in this approval.

AIR QUALITY

Impact Assessment Criteria

6. The Proponent shall ensure that all reasonable and feasible avoidance and mitigation measures are employed so that particulate matter emissions generated by the project do not exceed the criteria listed in Tables 2 to 4 at any privately-owned land.

Table 2: Long term criteria for particulate matter

Pollutant	Averaging Period	[d] Criterion
Total suspended particulate (TSP) matter	Annual	[a] 90 µg/m^3
Particulate matter < 10 µm (PM_{10})	Annual	[a] 30 µg/m^3

Table 3: Short term criterion for particulate matter

Pollutant	Averaging Period	[d] Criterion
Particulate matter < 10 µm (PM_{10})	24 hour	[a] 50 µg/m^3

Table 4: Long term criteria for deposited dust

Pollutant	Averaging Period	Maximum increase in deposited dust level	Maximum total deposited dust level
[c] Deposited dust	Annual	[b] 2 g/m^2/month	[a] 4 g/m^2/month

Notes to Tables 2 to 4:

- [a] *Total impact (i.e. incremental increase in concentrations due to the projects plus background concentrations due to all other sources);*
- [b] *Incremental impact (i.e. incremental increase in concentrations due to the projects on their own);*
- [c] *Deposited dust is to be assessed as insoluble solids as defined by Standards Australia, AS/NZS 3580.10.1:2003: Methods for Sampling and Analysis of Ambient Air - Determination of Particulate Matter - Deposited Matter - Gravimetric Method.*
- [d] *Excludes extraordinary events such as bushfires, prescribed burning, dust storms, sea fog, fire incidents, illegal activities or any other activity agreed by the Director-General in consultation with DECCW.*

Dust Management

7. The Proponent shall:
   (a) implement best management practice to minimise the dust emissions of the project;
   (b) regularly assess air quality monitoring data and relocate, modify, and/or stop operations on site as may be required to ensure compliance with the relevant conditions of this approval;
   (c) minimise any visible off-site air pollution; and
   (d) minimise surface disturbance of the site, other than as permitted under this approval.

Dust Monitoring Program

8. The Proponent shall prepare and implement a Dust Monitoring Program for the project to the satisfaction of the Director-General. This program must:
   (a) be submitted to the Director-General for approval prior to commencing quarrying operations;
   (b) include a program for the use of a water tanker on unsealed roads;
   (c) include details of how the air quality performance of the project would be monitored, and a protocol for evaluating compliance with the relevant air quality criteria in this approval.

SOIL AND WATER

Pollution of Waters

9. Except as may be expressly provided for by an EPL, the Proponent shall comply with section 120 of the *Protection of the Environment Operations Act 1997* in carrying out the project.

Management and Monitoring

10. The Proponent shall not extract sand or other extractive materials or carry out any work in the extraction area below a level of 0.7 m above the predicted maximum groundwater elevation (see condition 14 of schedule 3), other than the construction of any bores approved by NOW.

11. The Proponent shall ensure that the final landform of the extraction area must be at least 1 metre above the predicted maximum groundwater elevation.

12. The Proponent shall prepare and implement a Soil and Water Management Plan for the project to the satisfaction of the Director-General. This plan must:
    (a) be prepared:
        - by suitably qualified person(s), approved by the Director-General; and
        - in consultation with HWC and NOW;
    (b) include a(n):
        - Erosion and Sediment Control Plan; and
        - Groundwater Monitoring Program; and
    (c) be submitted to the Director-General for approval prior to commencing quarrying operations.

13. The Erosion and Sediment Control Plan shall:
    (a) be consistent with the requirements of *Managing Urban Stormwater, Soils and Construction Volume 2E Mines and Quarries,* (DECC 2008), or the latest edition;
    (b) identify activities that could cause soil erosion and generate sediment;
    (c) describe measures to minimise soil erosion and the potential for the transport of sediment off site;
    (d) describe the location, function, and capacity of erosion and sediment control structures; and
    (e) describe what measures would be implemented to maintain these structures over time.

14. The Ground Water Monitoring Program shall include:
    (a) detailed baseline data on groundwater levels and quality, based on statistical analysis;
    (b) groundwater impact assessment criteria;
    (c) a program to monitor groundwater levels and quality;
    (d) a protocol for the investigation, notification and mitigation of any identified exceedances of the groundwater impact assessment criteria;
    (e) the outcome of groundwater modelling to establish the predicted maximum groundwater elevation for the site;
    (f) a program to monitor any impacts of the project on groundwater dependent ecosystems, and
    (g) a contingency plan to manage any acid sulfate soils and potentially acid sulfate soils encountered during quarrying operations.

BIODIVERSITY

Biodiversity Management Plan

15. The Proponent shall prepare and implement a Biodiversity Management Plan for the project to the satisfaction of the Director-General. This plan must:
    (a) be prepared:
        - by suitably qualified person(s), approved by the Director-General; and
        - in consultation with Council and OEH;
    (b) be submitted to the Director-General for approval prior to commencing quarrying operations;
    (c) address both the project site and the offset areas;
    (d) provide for the retention of hollow-bearing trees, wherever practicable;
    (e) ensure the establishment and on-going monitoring (at least 6 years) of a least 2 nest boxes for each tree hollow removed during clearing;
    (f) include a program to undertake targeted surveys for the novel *Uperoleia sp*.;

(g) identify any areas within the offset areas requiring rehabilitation and/or re-vegetation and implement a program for this;
(h) include a detailed description of the measures that would be implemented, including the procedures to be implemented for:
- enhancing the quality of existing vegetation, fauna habitat and wildlife corridors;
- landscaping the site to minimise any visual impacts of the project;
- maximising the salvage of resources within the approved disturbance area – including vegetative, soil and cultural heritage resources – for beneficial reuse in the offset areas and/or rehabilitation areas;
- minimising the impacts of the project on fauna, including undertaking pre-clearance surveys and minimising the use of insecticides, herbicides, pesticides and biocides;
- controlling weeds and feral pests;
- maintenance of a buffer zone at the northern edge of the extraction area;
- controlling access;
- minimising edge effects; and
- bushfire management; and

(i) include:
- management measures;
- monitoring procedures;
- performance indicators; and
- reporting frameworks,

with particular reference to the novel *Uperoleia sp.*, Koala, and Wallum Froglet.

Long-term Security for Offset

16. By 31 December 2013, or otherwise agreed by the Director-General, the Proponent shall:
(a) enter into a Biobanking agreement in respect of the proposed offset areas (see Appendix 4) with the Minister for the Environment, in accordance with Part 7A of the *Threatened Species Conservation Act 1995*, to implement the Biodiversity Offset Strategy; or
(b) enter into an agreement with OEH to transfer the offset areas into the national parks estate,
to the satisfaction of the Director-General.

REHABILITATION AND LANDSCAPING

Landscape Management Plan

17. The Proponent shall prepare and implement a Landscape Management Plan for the project to the satisfaction of the Director-General. This plan must:
(a) be prepared:
- by suitably qualified person(s), approved by the Director-General; and
- in consultation with Council and HWC;

(b) be submitted to the Director-General for approval prior to commencing quarrying operations; and
(c) include:
- a Rehabilitation Management Plan; and
- a Long Term Management Strategy.

18. The Rehabilitation Management Plan must include:
(a) rehabilitation objectives for the site;
(b) a description of the measures that would be implemented to:
- rehabilitate and stabilise the site;
- minimise the removal of mature trees; and
- manage the remnant vegetation and habitat on the site;

(c) detailed performance and completion criteria for the rehabilitation and stabilisation of the site;
(d) a detailed description of how the performance of rehabilitation would be monitored over time to measure achievement of the performance and completion criteria and the rehabilitation objectives;
(e) a detailed description of what measures would be implemented to rehabilitate and manage the landscape of the site, including the procedures to be implemented for:
- progressively rehabilitating and stabilising areas disturbed by quarrying;
- implementing revegetation and regeneration within the disturbance areas;
- protecting areas outside the disturbance areas;

- vegetation clearing protocols, including a protocol for clearing any trees containing hollows and the relocation of hollows from felled trees;
- managing impacts on fauna, particularly threatened fauna and the novel *Uperoleia* sp.;
- controlling weeds and pests;
- controlling access;
- bushfire management; and
- reducing the visual impacts of the project;

(f) a description of the potential risks to successful rehabilitation, and a description of the contingency measures that would be implemented to mitigate these risks; and

(g) details of who is responsible for monitoring, reviewing, and implementing the plan.

19. The Long Term Management Strategy must:
    (a) define the objectives and criteria for quarry closure and post-extraction management;
    (b) investigate and/or describe options for the future use of the site;
    (c) describe the measures that would be implemented to minimise or manage the ongoing environmental effects of the project; and
    (d) describe how the performance of these measures would be monitored over time.

Rehabilitation Bond

20. Prior to commencing quarrying operations, the Proponent shall lodge a rehabilitation bond for the project with the Director-General. The Proponent may lodge the rehabilitation bond in two portions. The first portion for 4.5 hectares must be lodged with the Department prior to commencing quarrying operations, with no land disturbance to exceed 4.5 hectares until the second portion of the bond is accepted by the Department.

    The sum of the bond shall be calculated at $\$2.50/m^2$ for the area to be disturbed by quarrying operations, to the satisfaction of the Director-General.

    If rehabilitation and revegetation works have been completed in accordance with the Rehabilitation Management Plan and to the satisfaction of the Director-General, the Director-General will release the rehabilitation bond.

    If rehabilitation and revegetation works are not completed to the satisfaction of the Director-General, the Director-General will call in all or part of the rehabilitation bond, and arrange for the satisfactory completion of the relevant works.

21. Within 3 months of each Independent Environmental Audit (see condition 8 of schedule 5), the Proponent shall review, and if necessary revise, the sum of the rehabilitation bond to the satisfaction of the Director-General. This review must consider:
    (a) the effects of inflation; and
    (b) performance under the Rehabilitation Management Plan to date.

ABORIGINAL CULTURAL HERITAGE

Aboriginal Cultural Heritage Management Plan

22. The Proponent shall prepare and implement an Aboriginal Cultural Heritage Management Plan to the satisfaction of the Director-General. This plan must:
    (a) be prepared in consultation with all relevant local Aboriginal communities;
    (b) be submitted to the Director-General for approval prior to commencing quarrying operations; and
    (c) include:
        - measures for the protection and management of site 38-4-0318 within Lot 13 DP601306;
        - a program to complete prospective pre-clearance surveys of the extraction area in consultation with Aboriginal stakeholders;
        - measures for ongoing consultation with local Aboriginal communities and the involvement of these communities in pre-clearance surveys and the ongoing management of any Aboriginal cultural heritage values identified within the site;
        - an Aboriginal cultural education program for the induction of personnel and contractors involved in quarrying operations; and

- a description of the measures that would be implemented if any new Aboriginal objects or skeletal remains are discovered during the project.

TRAFFIC

Haulage Route

23. All extractive materials dispatched from the site must be delivered to Sibelco's Salt Ash Sand Processing Plant by the most direct route available.

Road Signage

24. Prior to commencing quarrying operations, the Proponent shall:
    (a) install "Trucks Crossing" and "Trucks Entering" warning signs on Nelson Bay Road on both the western and eastern approaches to the intersection of Lemon Tree Passage Road; and
    (b) pay the full cost of this installation,
    to the satisfaction of RMS.

On-Site Traffic Management

25. The Proponent shall ensure that:
    (a) all vehicles do not exceed a speed of 25 kph on the site;
    (b) all loaded vehicles entering or leaving the site have their loads covered; and
    (c) all loaded vehicles leaving the site are cleaned of sand and other materials that may fall on the road, before leaving the site.

Traffic Management Plan

26. The Proponent shall prepare and implement a Traffic Management Plan for the project, to the satisfaction of the Director-General. This plan must:
    (a) be submitted to the Director-General for approval prior to commencing quarrying operations;
    (b) include a drivers' code of conduct to minimise the impacts of project-related trucks on local residents and road users; and
    (c) describe the measures that would be put in place to ensure compliance with the drivers' code of conduct.

VISUAL

Visual Amenity

27. The Proponent shall minimise the visual impacts of the project to the satisfaction of the Director-General.

WASTE MANAGEMENT

28. The Proponent shall minimise the amount of waste generated by the project to the satisfaction of the Director-General.

29. The Proponent shall ensure that wastewater and/or sewage disposal is not undertaken on the site.

30. The Proponent shall not undertake any refuelling or maintenance of vehicles or equipment on the site, except to the extent necessary to remove vehicles or equipment from the site in the case of breakdowns.

31. The Proponent must not cause, permit or allow any waste generated outside the site to be received at the site for storage, treatment, processing, reprocessing or disposal or any waste generated at the site to be disposed of at the site, except with the approval of the Director-General and as expressly permitted by a licence under the *Protection of the Environment Operations Act 1997.*

Note: This condition only applies to the storage, treatment, processing, reprocessing or disposal of waste at the site if it requires an EPL under the Protection of the Environment Operations Act 1997.

EMERGENCY AND HAZARDS MANAGEMENT

Dangerous Goods

32. The Proponent shall ensure that chemicals and/or petroleum products are not stored on site.

Safety

33. The Proponent shall ensure public safety at the site to the satisfaction of the Director-General.

PRODUCTION DATA

34. The Proponent shall:
    (a) provide annual quarry production data to DRE using the standard form for that purpose; and
    (b) include a copy of this data in the Annual Review (see condition 3 of Schedule 5).

SCHEDULE 4
ADDITIONAL PROCEDURES

NOTIFICATION OF LANDOWNERS

1. If the results of the monitoring required in schedule 3 identify that the impacts generated by the project on site are greater than the relevant impact assessment criteria, and there is no negotiated agreement in place to allow the impact, then within 2 weeks of obtaining the monitoring results the Proponent shall:
   (a) notify the Director-General, the affected landowners and tenants (including tenants of any quarry-owned properties) accordingly, and provide monitoring results to each of these parties until the results show that the project is complying with the relevant criteria in schedule 3; and
   (b) in the case of exceedances of the relevant air quality criteria, send the affected landowners and/or tenants a copy of the NSW Health fact sheet entitled *"Mine Dust and You"* (as may be updated from time to time).

INDEPENDENT REVIEW

2. If a landowner of privately-owned land considers the project to be exceeding the relevant criteria in schedule 3, then he/she may ask the Director-General in writing for an independent review of the impacts of the project on his/her land.

   If the Director-General is satisfied that an independent review is warranted, then within 2 months of the Director-General's decision the Proponent shall:
   (a) commission a suitably qualified, experienced and independent person, whose appointment has been approved by the Director-General, to:
      - consult with the landowner to determine his/her concerns;
      - conduct monitoring to determine whether the project is complying with the relevant criteria in schedule 3; and
      - if the project is not complying with these criteria then identify the measures that could be implemented to ensure compliance with the relevant criteria; and
   (b) give the Director-General and landowner a copy of the independent review.

SCHEDULE 5
ENVIRONMENTAL MANAGEMENT, REPORTING AND AUDITING

ENVIRONMENTAL MANAGEMENT

Environmental Management Strategy

1. The Proponent shall prepare and implement an Environmental Management Strategy for the project to the satisfaction of the Director-General. The strategy must:
   (a) be submitted to the Director-General for approval prior to the commencement of quarrying activities;
   (b) provide the strategic framework for environmental management of the project;
   (c) identify the statutory approvals that apply to the project;
   (d) describe the role, responsibility, authority and accountability of all key personnel involved in the environmental management of the project;
   (e) describe the procedures that would be implemented to:
      - keep the local community and relevant agencies informed about the operation and environmental performance of the project;
      - receive, handle, respond to, and record complaints;
      - resolve any disputes that may arise during the course of the project;
      - respond to any non-compliance; and
      - respond to emergencies; and
   (f) include:
      - copies of the various strategies, plans and programs that are required under the conditions of this approval once they have been approved; and
      - a clear plan depicting all the monitoring to be carried out in relation to the project.

Management Plan Requirements

2. The Proponent shall ensure that the Management Plans required under this approval are prepared in accordance with any relevant guidelines, and include:
   (a) detailed baseline data;
   (b) a description of:
      - the relevant statutory requirements (including any relevant approval, licence or lease conditions);
      - any relevant limits or performance measures/criteria; and
      - the specific performance indicators that are proposed to be used to judge the performance of, or guide the implementation of, the project or any management measures;
   (c) a description of the measures that would be implemented to comply with the relevant statutory requirements, limits, or performance measures/criteria;
   (d) a program to monitor and report on the:
      - impacts and environmental performance of the project; and
      - effectiveness of any management measures (see (c) above);
   (e) a contingency plan to manage any unpredicted impacts and their consequences;
   (f) a program to investigate and implement ways to improve the environmental performance of the project over time;
   (g) a protocol for managing and reporting any:
      - incidents;
      - complaints;
      - non-compliances with statutory requirements; and
      - exceedances of the impact assessment criteria and/or performance criteria; and
   (h) a protocol for periodic review of the plan.

   Note: At the discretion of the Director-General, some of these requirements may be waived where they are either not relevant or necessary.

Annual Review

3. Within 12 months of the commencement of quarrying operations, and annually thereafter, the Proponent shall review the environmental performance of the project to the satisfaction of the Director-General. This review must:
   (a) describe the works (including rehabilitation) that were carried out in the previous year, and the works that are proposed to be carried out over current year;
   (b) include a comprehensive review of the monitoring results and complaints records of the project over the past year, which includes a comparison of these results against:
      - the relevant statutory requirements, limits or performance measures/criteria;
      - the monitoring results of previous years; and
      - the relevant predictions in the EA;
   (c) identify any non-compliance over the last year, and describe what actions were (or are being) taken to ensure compliance;
   (d) identify any trends in the monitoring data over the life of the project;
   (e) identify any discrepancies between the predicted and actual impacts of the project, and analyse the potential cause of any significant discrepancies; and
   (f) describe what measures will be implemented over the next year to improve the environmental performance of the project.

Revision of Strategies, Plans & Programs

4. Within 3 months of:
   (a) the submission of an annual review under condition 3 above;
   (b) the submission of an incident report under condition 5 below;
   (c) the submission of an audit report under condition 8 below; and
   (d) any modifications to this approval,

   the Proponent shall review, and if necessary revise, the strategies, plans, and programs required under this approval to the satisfaction of the Director-General.

   Note: This is to ensure the strategies, plans and programs are updated on a regular basis, and incorporate any recommended measures to improve the environmental performance of the project.

REPORTING

Incident Reporting

5. The Proponent shall notify the Director-General and any other relevant agencies of any incident associated with the project as soon as practicable after the Proponent becomes aware of the incident. Within 7 days of the date of the incident, the Proponent shall provide the Director-General and any relevant agencies with a detailed report on the incident.

Regular Reporting

6. The Proponent shall provide regular reporting on the environmental performance of the project on its website, in accordance with the reporting arrangements in any plans or programs approved under the conditions of this approval, and to the satisfaction of the Director-General.

AUDITING

Independent Environmental Audit

7. Within 1 month of the completion of quarrying operations, unless the Director-General directs otherwise, the Proponent shall commission and pay the full cost of an Independent Environmental Audit of the project. This audit must:
   (a) be conducted by suitably qualified, experienced and independent team of experts whose appointment has been endorsed by the Director-General;
   (b) include consultation with the relevant agencies;
   (c) assess the environmental performance of the project and assess whether it is complying with the relevant requirements in this approval and any relevant EPL (including any assessment, plan or program required under these approvals);

(d) review the adequacy of strategies, plans or programs required under the abovementioned approval or licences; and
(e) be completed within 2 months of the approval of the audit team.

Note: This audit team must be led by a suitably qualified auditor and include experts in any fields specified by the Director-General.

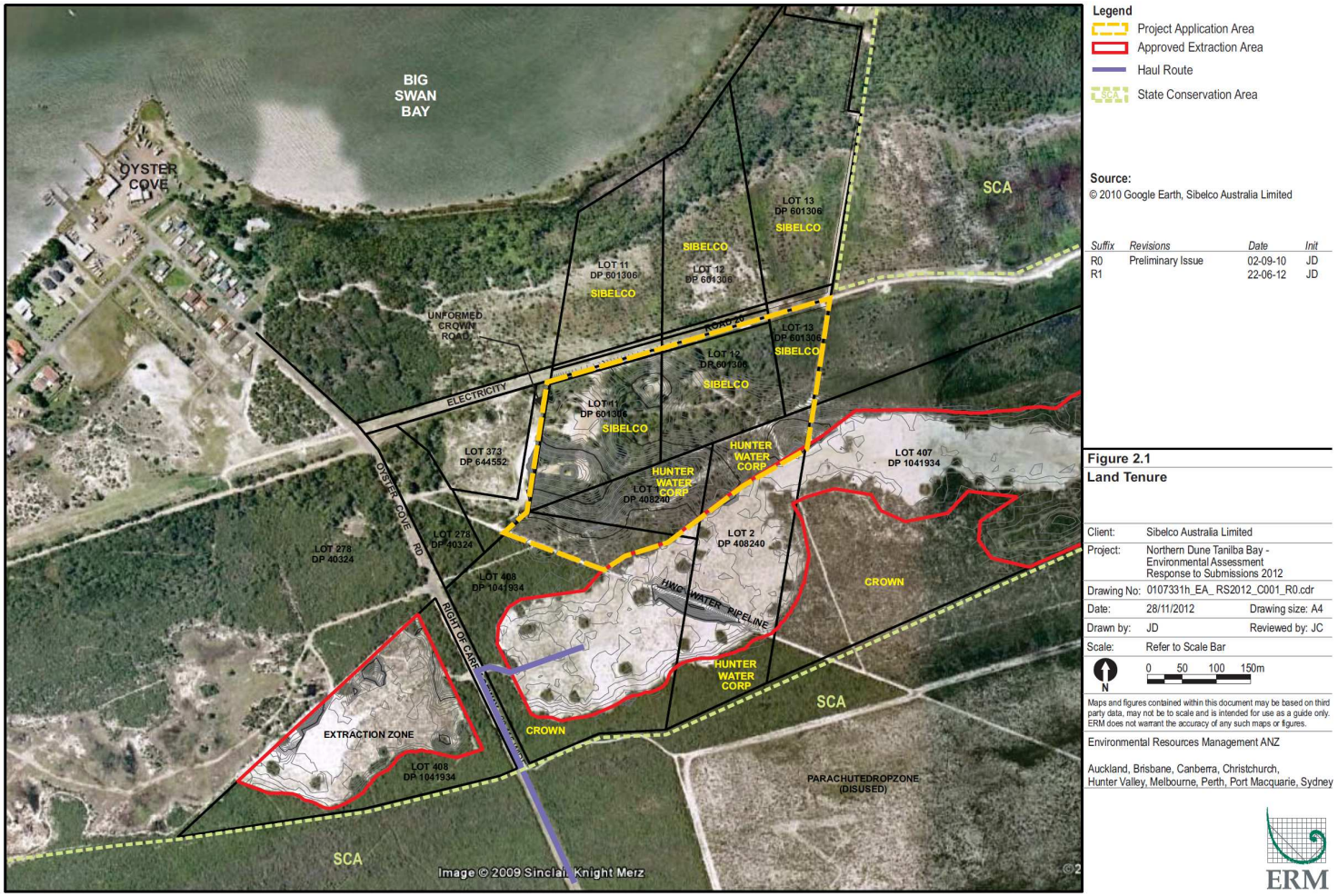
8. Within 6 weeks of the completing of this audit, or as otherwise agreed by the Director-General, the Proponent shall submit a copy of the audit report to the Director-General, together with its response to any recommendations contained in the audit report.

ACCESS TO INFORMATION

9. From 1 July 2013, the Proponent shall:
(a) make the following information publicly available on its website:
- a copy of all approved strategies, plans and programs;
- a summary of all monitoring results of the project, which have been reported in accordance with the various plans and programs approved under the conditions of this approval, updated on a quarterly basis;
- a complaints register, updated on a quarterly basis;
- copies of any Annual Reviews;
- copies of any Independent Environmental Audit, and the Proponent's response to the recommendations in any audit;
- copies of the development consent and approved management plans for existing adjacent quarrying operations; and
- any other matter required by the Director-General; and

(b) keep this information up-to-date,
to the satisfaction of the Director-General.

APPENDIX 1
PROJECT SITE



Legend
- Project Application Area
- Approved Extraction Area
- Haul Route
- State Conservation Area

Source:
© 2010 Google Earth, Sibelco Australia Limited

Suffix	Revisions	Date	Init
R0	Preliminary Issue	02-09-10	JD
R1		22-06-12	JD

Figure 2.1
Land Tenure

Client:	Sibelco Australia Limited	
Project:	Northern Dune Tanilba Bay - Environmental Assessment Response to Submissions 2012	
Drawing No:	0107331h_EA_ RS2012_C001_R0.cdr	
Date:	28/11/2012	Drawing size: A4
Drawn by:	JD	Reviewed by: JC
Scale:	Refer to Scale Bar	

N
0 50 100 150m

Maps and figures contained within this document may be based on third party data, may not be to scale and is intended for use as a guide only. ERM does not warrant the accuracy of any such maps or figures.

Environmental Resources Management ANZ

Auckland, Brisbane, Canberra, Christchurch, Hunter Valley, Melbourne, Perth, Port Macquarie, Sydney

ERM

***Figure 1**: Project site*

APPENDIX 2
NOISE RECEIVER LOCATIONS

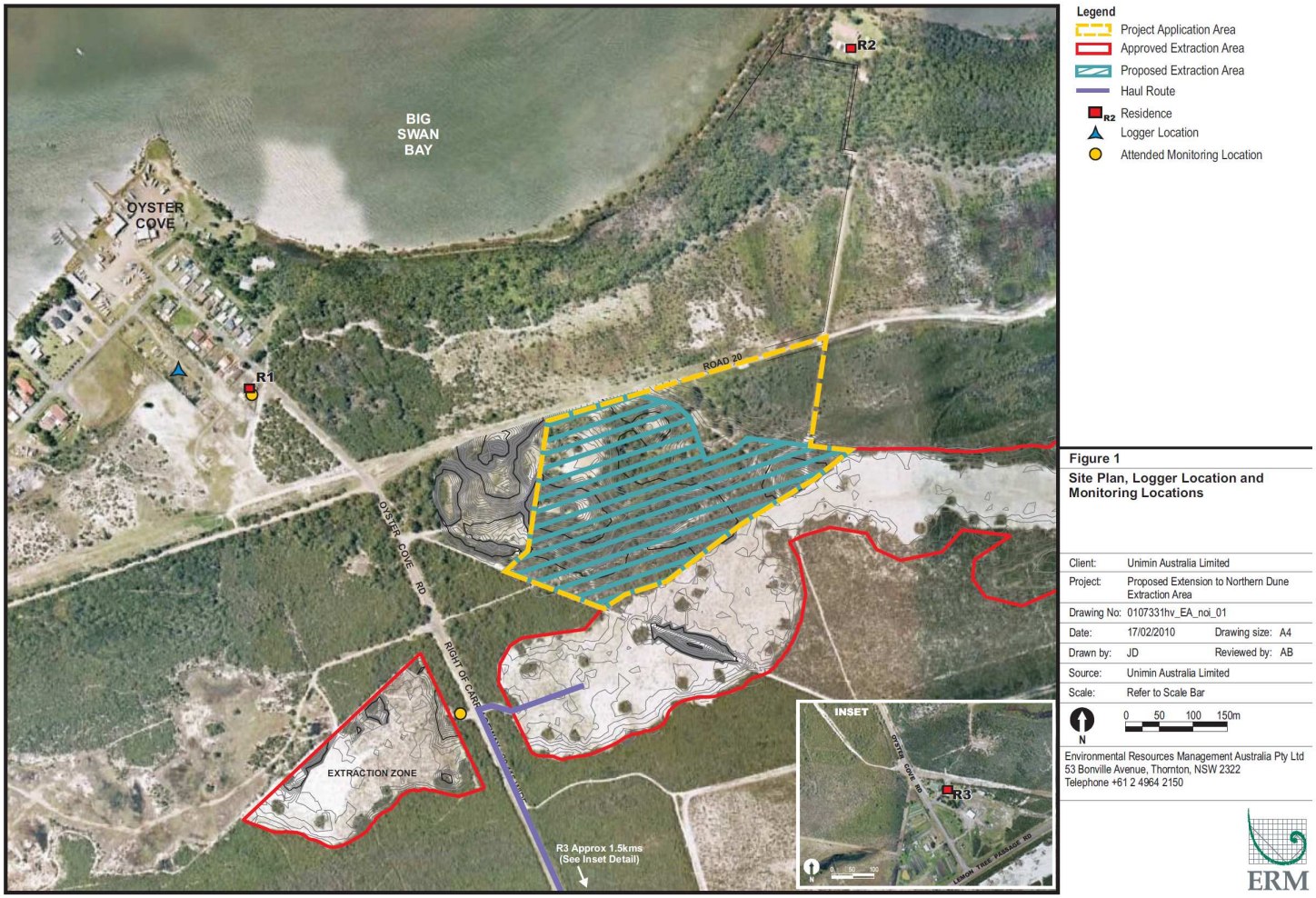


Figure 2: *Noise receivers*

APPENDIX 3
STATEMENT OF COMMITMENTS

Issue	Mitigation Measure/Commitment
Environmental Management Plan	The currently approved EMP (2003) will be applied over all 9 EMPs and updated as necessary to meet the needs of the extension area. These include; • EMP1 - Environmental Induction and Training • EMP2 - Hydrocarbon Spill Procedure • EMP3 - Operations Management Procedure • EMP4 - Extraction Depth and Area Monitoring • EMP5 - Groundwater • EMP6 - Cultural Heritage • EMP7 - Vegetation Rehabilitation • EMP8 - Landform Rehabilitation • EMP9 - Erosion and Sediment Control
Groundwater Monitoring	The Groundwater Management Plan (GMP) in place for the existing operation will be updated to incorporate ongoing monitoring at additional bores SAL4 and SAL5 in accordance with the existing approved monitoring regime.
	Current environmental management commitments will be adopted for the extraction extension, including: • groundwater quality and level monitoring, and reporting as part of the approved groundwater management plan; • regular review of environmental performance through the AEMR process; • maintenance of a minimum 1.0 m vertical buffer between the predicted maximum groundwater elevation and the final landform (extraction will occur to 0.7 m above predicted maximum groundwater elevation, with final rehabilitated landform being 1.0 m above these elevations following placement of 0.3 m topsoil); • staged rehabilitation of extraction areas; • avoiding storing machinery or hazardous materials onsite; and • avoiding servicing or refuelling equipment onsite.
Noise Emissions	The currently approved EMP (2003) would continue to be applied, and updated as necessary to meet the needs of the proposed extension area.
	All reasonable steps would be undertaken to reduce noise emissions during extraction and transport. • sequentially extracting from the south to the north, so that the topography will naturally help shield the sensitive receptors to the north against operational noise emissions; • ensuring all machines are in good working condition, with particular attention to exhaust silencers, engine covers and other noise reduction devices;

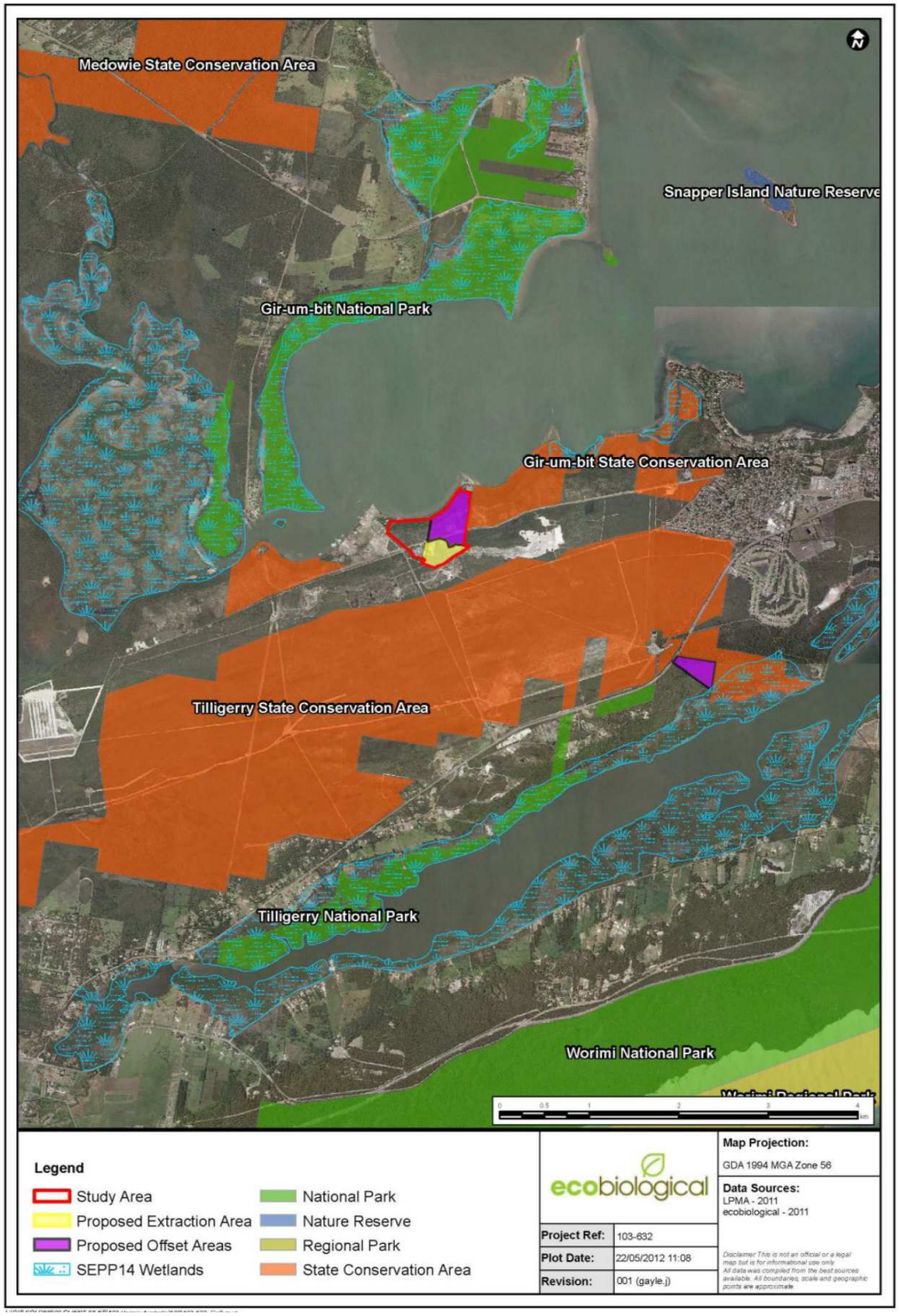
Issue	Mitigation Measure/Commitment
	• all work and transport will be restricted to daylight hours, typically from 7:00am to 6:00pm Monday to Friday, but when light permits continuing to 7:00pm; and • site imposed speed limits up to 25 km/hr to be enforced to minimise noise generation.
Air Emissions	Air emissions related management measures are already in place and proposed to continue as part of the extension of operations to reduce the generation of particulate emissions.
	A water tanker will be used on all unsealed roads on an as-needs basis, dependant on weather conditions.
	Sand extraction cells will be progressively rehabilitated throughout the life of the extraction. It is anticipated that no more than three hectares will be exposed at any one time.
Surface and Groundwater Quality	Surface water management principles will be implemented to prevent contamination of surface (and therefore groundwater) quality. Management and monitoring actions stipulated in the existing Groundwater Management Plan (2011) for current operations will be
	Additional documents will be produced for the extraction extension area to mitigate any impacts to the quality of the groundwater, the adjoining forested wetlands and, to aid in the rehabilitation of the extraction area post sandmining including: • Surface Water Management Plan to prevent runoff, pollution and sedimentation from the extraction area entering into adjoining forested wetlands; • Vegetation and Weed Management Plan for rehabilitation of the proposed sand extraction area; and • Offset Strategy and associated Habitat Management Plan which will detail management actions to be undertaken on the remaining portions of Lots 11, 12 and 13 and on Lot 24. This plan will cover vegetation, weed, fire and stormwater management, minimisation of edge effects, control of public access and management of habitat enhancement measures.
Ecology	Hollow bearing trees 16, 17, 18 and 20 (refer to Figure 2.2, Northern Dune Submission Report) to be retained.
	• avoidance of the use of biocides and implementing erosion and sediment controls; • incorporating implementation of pre-clearing surveys, a fauna displacement mitigation protocol, Koala mitigation measures, nestbox installation and monitoring, and a monitoring plan for the Wallum Froglet as detailed in Annex M of the EA; • staged rehabilitation of the extraction area (to be supported by a Vegetation Rehabilitation Management Plan), to be conducted in the same fashion as successful rehabilitation of Sibelco's existing approved extraction areas directly to the south; and • implementation of an Offset Strategy as detailed in Section 11.6.4 if the EA.
Vegetation Clearing	At least one week prior to any vegetation clearing, a survey of habitat trees will be conducted in the planned clearing area in accordance

Issue	Mitigation Measure/Commitment
	with the survey methodology outlined in Section 11.6.1 of the EA.
	Pre-clearing surveys will be conducted to check for the presence of any Koalas within the proposed extraction area.
	Hollow-bearing trees will be left standing for two nights after the surrounding vegetation has been cleared to encourage any native fauna species utilising the habitat hollows to self-relocate. The actual felling of any habitat trees will be attended by a suitably experienced fauna ecologist in order to ensure the safety of any fauna found to be in the hollows. On all occasions, trees having potential habitat hollows should be 'soft felled' by an experienced machine operator in accordance with the procedure outlined in section 11.6.1 of the EA.
Fauna Displacement Protocol	A fully qualified, experienced and licensed ecologist will supervise clearing and encourage movement of any displaced animals into adjoining vegetation.
	Captured fauna and/or displaced fauna will be relocated to adjacent habitat by an ecologist. During tree removal or any other construction activity, Fauna Displacement protocols outlined in Section 11.6.2 of the EA will be followed in the case of an injured animal.
Wallum Froglet Management Plan	A management plan for the Wallum Froglet (*Crinia tinnula*) will be developed in accordance with the management guidelines outlined under Section 6 of the National Recovery Plan for the Wallum Sedgefrog and Other Wallum- dependent Frog Species. In particular this will include specifications on: • minimising affects from soil disturbance; • ensuring sufficient retention of vegetation particularly around breeding sites; and • monitoring the habitat condition and frog numbers to ensure the threats to the species are properly managed. This should be undertaken with sufficient regularity and should preferably be carried out a year or more before development starts and continue for the duration of extraction operations, including rehabilitation works.
Nestbox Installation and Monitoring Program	A nestbox installation and monitoring program will be implemented on a ratio of 2:1 to replace 38 hollows present in the 17 hollow-bearing trees mapped within the proposed extraction area. Nestboxes should be erected prior to clearing commencing in order to provide alternative den and/or nest sites for any displaced fauna.

Issue	Mitigation Measure/Commitment
	Nestboxes are to be erected within the Proposed Offset Areas on Lots 11, 12 and 13. Nest box designs should be selected to replace the natural hollow sizes removed (ie, 20 small, 16 medium and 2 large) and will target insectivorous bats, gliders and possums. Annual monitoring for a minimum 6-year period post installation is recommended to record uptake of the nestboxes and to attend to any maintenance issues. A brief letter confirming annual inspection of the nestboxes and documentation of results should be provided to OEH.
Vegetation Management and Monitoring Plan	Weed Management and Vegetation Management and Monitoring Plans will be prepared for the rehabilitation area and proposed Offset Areas on Lots 11, 12, 13 and 24, which will include a thorough and intensive program to protect the adjoining forested wetland communities against weed invasion, and surface and underground run-off that may occur both during and after sand extraction activities. The management and monitoring plans will consider: • the nature and control of sediment run-off during the extraction phase particularly as a result of an exceptional storm event; • the volume, path and content of stormwater discharging from the site during and after extraction; • the handling of hydrocarbon spills on the site ; • existing flow regime of surface and groundwater flow from the proposed extraction area into the forested wetlands; and • weed invasion
Biodiversity Offset Strategy	A biodiversity offset strategy will be adopted as outlined in detail in Annex P of the EA. Biodiversity offsets are proposed on lands currently owned by Sibelco, comprising portions of Lots 11 to 13, DP601306 (approximately 18.35 ha) and all of Lot 24, DP579700 (approximately 9.44 ha) (the offset lands). A secure offset mechanism (through a Voluntary Conservation Agreement or other similar tool for management in perpetuity) will be placed over these offset lands, which will result in permanent protection and management of the land and result in numerous ecological benefits.
Aboriginal Heritage	As ground visibility is limited within the extraction extension area, further archaeological work is required prior to commencement of extraction operations. The further assessment will be undertaken in accordance with any conditions of consent and will consist of a prospective clearing program that will be undertaken to improve ground visibility and allow the registered Aboriginal stakeholders to inspect the ground surface within the approved extraction area, to provide greater certainty of the presence or otherwise of Aboriginal archaeological sites. Sibelco will contact the three Aboriginal stakeholder groups at least three weeks prior to the proposed clearing and invite them to attend. Details of the methodology as agreed by the registered Aboriginal stakeholders is presented in Chapter 7 of Annex N of the EA, including procedures for undertaking the required site clearance, required actions should Aboriginal sites or artefacts be found during the prospective clearing program, and the requirements for updating the Cultural Heritage Management Plan, which will be undertaken prior to commencement of any extraction.

Issue	Mitigation Measure/Commitment
Bushfire	• provision of a separation distance (minimum of 10 m) between stockpiles of combustible material and remnant vegetation;
	• managing operations and the site to minimise likelihood of ignition sources through good 'housekeeping' (for example, all waste in bins);
	• emergency planning procedures in the event of a fire occurring on the site;
	• fitting of all earth moving machinery with spark arresting mufflers and haul trucks have serviceable exhaust systems to prevent accidental ignition of vegetation; and
	• equipping the operations to assist in the management of any fires on-site, including presence of fire extinguishers, water cart (as contracted), and the site front-end loader and bulldozer for any requisite fire fighting purposes.
Waste Management	• no burning of waste;
	• any noxious plant species will be removed from the site, bagged and disposed of at a licensed landfill;
	• any waste will be removed daily and recycled or disposed of directly at a licensed landfill; and
	• the site will be maintained and kept free of rubbish and cleaned up at the end of each working day.

APPENDIX 4
BIODIVERSITY OFFSET STRATEGY


Medowie State Conservation Area
Snapper Island Nature Reserve
Gir-um-bit National Park
Gir-um-bit State Conservation Area
Tilligerry State Conservation Area
Tilligerry National Park
Worimi National Park
Legend
Study Area
Proposed Extraction Area
Proposed Offset Areas
SEPP14 Wetlands
National Park
Nature Reserve
Regional Park
State Conservation Area
ecobiological
Map Projection:
GDA 1994 MGA Zone 56
Data Sources:
LPMA - 2011
ecobiological - 2011
Project Ref: 103-632
Plot Date: 22/05/2012 11:08
Revision: 001 (gayle.j)

APPENDIX 2

NEST BOX, AMPHIBIAN AND KOALA MONITORING REPORT

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Tanilba North Dunes Extension Biodiversity Offsets Area 2020 Monitoring Report



Holcim (Australia) Pty Ltd

Tanilba North Dunes Extension Northern Biodiversity Offsets Area

Rutile Rd, Oyster Cove, NSW

25 May 2021

Tanilba North Dunes Extension Biodiversity Offsets Area 2020 Monitoring Report

Tanilba North Dunes Extension Northern Biodiversity Offsets Area
Rutile Rd, Oyster Cove, NSW

Kleinfelder Document Number: NCA20R11120417
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EXECUTIVE SUMMARY

Holcim (Australia) Sibelco Australia has consent to extract white silica sand from the Tanilba North Dune Extension located in the Oyster Cove area, in the Port Stephens Council Local Government Area. Schedule 3, Condition 15 of the Tanilba Northern Dune Extension Project Approval (MP 09_0091) required the preparation of a Biodiversity Management Plan (BMP) (Kleinfelder, 2019). The BMP outlines management measures for the approved Biodiversity Offsets Areas (BOA). BOAs for the project have been established in the north-east of the approved extraction area (Northern Biodiversity Offset Area, NBOA). The NBOA consists of an area of 18.3 ha of native vegetation in varying condition that is covered by Lots 11, 12 and 13 of DP 601306 and is located to the north and north-east of the Tanilba North Dunes Extension sand extraction project. The NBOA is owned as freehold by Holcim (Australia).

The BMP requires the following actions to be undertaken within the NBOA. The relevant sections of the BMP are noted:

- *Annual inspection and monitoring to be conducted by a suitably qualified person/s (Section 5.1.3B) – results detailed in this report,*
- *Implementation of a nest box installation and monitoring program within the northern offset area to replace hollow bearing tress removed from the extraction area (Section 5.1.3F),*
- *Targeted fauna monitoring across all offset areas to monitor for Wallum Froglet (Crinia tinnula), Mahony's Toadlet (Uperoleia mahonyi), and Koala (Phascolarctos cinereus) (Section 5.2),*
- *Establishment of a habitat restoration and rehabilitation program across the offset areas (including the visual amenity buffer along the northern boundary of the extraction area) consisting of (Section 5.1.3D),*
    - *Annual inspections to identify areas requiring weed and pest control (5.1.3B),*
    - *A weed and pest management program (Section 5.1.3C),*
    - *Enhancement of the availability of habitat for the Koala through the installation of Eucalyptus robusta (Swamp Mahogany) within the offset area (Section 5.1.3D),*
    - *Rehabilitation of the regenerating Grassland-Heath to the surrounding Swamp Mahogany – Paperbark Swamp Forest through seeding and planting of appropriate species (Section 5.1.3D).*

To satisfy the above requirements, Kleinfelder was engaged by Holcim to conduct targeted fauna monitoring for the amphibians and koalas as outlined above, annual monitoring of the

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52 nest boxes that have been installed in the NBOA, an assessment of the vegetation of the NBOA and weed mapping to inform and conduct weed control works.

Amphibians

*Targeted fauna monitoring for the Wallum Froglet (Crinia tinnula) and Mahony's Toadlet (Uperoleia mahonyi) was conducted by Kleinfelder ecologists on the 28th October and the 15th and 16th December 2020 by two ecologists over the three nights, following periods of rainfall. A prior diurnal assessment of the offset areas was conducted to determine habitat suitability. Surveys consisted of a meandering search in the NBOA. Surveys revealed that no permanent water existed within the NBOA. Several areas were noted which had the potential to contain water after rainfall and later became the target of nocturnal surveys. Nocturnal surveys for amphibian species employed visual and audible detection techniques with the aid of spotlights. Both U. mahonyi and C. tinnula were detected on the 28th October within and adjacent to the NBOA. C. tinnula was recorded within the NBOA on all survey nights in October and December at multiple locations while U. mahonyi was identified calling from thick Gahnia within the north-east of the NBOA during the October survey only (**Figure 2**). An adjacent waterbody to the east was visited to confirm the presence of U. mahonyi and C. tinnula and both species were found to be calling. Opportunistic sightings of non-target amphibian species were also recorded. Additional opportunistic sightings of non-amphibian species within the NBOA included the Grey-headed flying fox (Pteropus poliocephalus), Brushtail Possum (Trichosurus vulpecula) and an unidentified species of freshwater crayfish. Results from the surveys show that the targeted species are utilising the NBOA for breeding and foraging habitat when the conditions are suitable. With no permanent water bodies on the NBOA, this is restricted to periods of higher rainfall. Nearby more permanent water bodies are presumed to be the core habitat for these species. Ongoing surveys after suitable rain events will determine if the species continue to utilise the NBOA.*

Koala SAT Surveys

Koala monitoring was undertaken using the Spot Assessment Technique (SAT) within the NBOA as described by Phillips and Callaghan (2011). The SAT test involves a radial survey of koala "activity" within the immediate area of a tree that is known or deemed to be utilised by koalas. The search beneath each tree is conducted for two person minutes or until a single pellet is found, whichever occurs first. A tree is defined as a live woody stem of any species (except for cycads, palms, tree ferns and grass trees) which has a diameter at breast height (dbh) greater than 10cm. Two Kleinfelder ecologists conducted SAT surveys on the 22 October

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2020. A total of 15 SAT tests were conducted over the offset area. The SAT surveys in 2020 found Koala activity in the NBOA to be slightly down from the 2019 data but still recorded an average of Low activity throughout the site. Within the NBOA, the greater activities were found to be within the Swamp Mahogany – Paperbark Swamp Forest in the north of the offset area where there are mature trees for feeding, although evidence of use was found throughout the extent of the NBOA. The NBOA has good habitat suitability for the koala to the north of the area, although parts of this area were hard to traverse due to of thick belt of Lantana camara (Lantana) dominating the understory which has the potential to hinder Koala movement through the site. The remaining southern areas of the NBOA are still regenerating but have shown promising signs of koala use which will continue to improve as the trees mature. The assessed low activity levels within the NBOA suggest that koalas are not permanently resident within the site but use it to transition between other areas of higher populations.

Nest Box Monitoring

In December 2015, Kleinfelder installed 52 nest boxes within the NBOA as per the offset requirements for the Tanilba Northern Dune Extension Project. As per the Nest Box Installation and Monitoring Protocol within the Biodiversity Management Plan – Tanilba Northern Dune Extension (Kleinfelder 2019), the 52 nest boxes were required to be monitored annually for a period of six years. This was the fourth survey conducted by Kleinfelder on behalf of Holcim (Australia) and the previous owners of the site, Sibelco Australia. Nest boxes were monitored using a wireless GoPro™ camera mounted on an extension pole capable of reaching heights of over 6 m. A live video feed is transferred wirelessly from the camera to an iPhone device capable of capturing still HD images or video. Images were captured in the field and processed in the office. A handheld Global Positioning System (GPS), pre-loaded with co-ordinates, was used to locate the boxes. Once a box was located, the pole camera was used to open the lid and to observe the contents. In 2020, the percentage of all nest boxes exhibiting any sign of use was 48% (25). Eight percent (4) of the total number of nest boxes were determined to be unavailable for use resulting from occupation by pest species such as wasps or bees. In 2020, no boxes (0%) were observed to have animals present (A) as per the 2019 survey. There were no boxes showing recent evidence although one box was judged to be E2, "moderately fresh" category, and the total number of boxes showing old evidence was 24 boxes, or 48%. A total of six boxes were categorised as either NA – not available due to insects as noted above, but one box - Glider box no 2 – was missing, believed stolen. This brought the total number of nest boxes available for fauna use to 46, one less than the 2019 survey. None of the Possum boxes showed evidence of use, Glider boxes had a utilisation rate of 74% (25 out of 34 boxes) and none of the Bat boxes showed evidence of use.

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Fauna uptake of the nest boxes was successful in the first year of installation with several species of mammals and reptiles recorded occupying boxes, and evidence of usage across many more boxes. Since that initial survey, no fauna has been recorded in the boxes. This year's survey was brought forward into the spring (October) to determine if the fauna were not using the nest boxes in the heat of the summer of the months. It should be noted that for two of the box types – possum and bat – little evidence of usage will be apparent, unless an animal is actually recorded in the box as neither of the target fauna generally leave nesting materials behind, as with gliders. Suggestions for further action are –

- *Increase the survey effort to twice per year one in the autumn/winter and one in the following spring for a single year. This would indicate whether the Offsets nest boxes are being used seasonally or whether the Offsets are no longer being used for nesting, and following on from the above,*
- *Placing remote cameras in the offsets to determine if fauna are utilising the offsets for foraging and are simply not using the nest boxes, but utilising natural hollows in adjacent vegetation.*

Vegetation Condition Survey

An annual inspection of the NBOA is to be conducted as per Section 5.1.3B of the Biodiversity Management Plan Tanilba Northern Dunes Extension (Kleinfelder, 2019). This survey was conducted on 27th January 2021. As per the BMP, photo monitoring points were established, weed infestations were noted, locations of rubbish dumping were noted, establish and survey the regeneration and health of the Eucalyptus robusta along one transect, east to west across the NOA noting the size in classes of trees 1m either side of the transect, noting the extent and requirement of any revegetation works in the NOA.

South of Rutile Rd, a small section of the NBOA abuts the extraction zone. Most of this area was affected by the 2018 fires but has recovered with increased rainfall in late 2020 and early 2021. This area has some scattered Fishpole Bamboo (*Phyllostachys aurea*), Senna (*Senna pendula*) and Bugle Lily (*Watsonia borbonica*). *The 50m buffer zone of vegetation along Rutile Rd is quite weedy with exotic grasses, Lantana (Lantana camara) and some minor Blackberry (Rubus fruticosus spp. agg.) also observed. North of Rutile Rd., the Swamp Mahogany – Paperbark Swamp Forest was assessed as regenerating. This area contains a number of weed species that are the subject of on-going control efforts including Slash Pine (Pinus elliottii), Bugle Lily and Lantana (Lantana camara). Native species are present, and evidence of some regeneration is present with seedling and saplings apparent. Regeneration within this community was assessed by measuring the health and size of Eucalyptus robusta trees within*

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1 m of a transect running East to West across the NBOA. A total of 81 trees were assessed along the transect that was approximately 400m long. The assessment found that there were no saplings <1m, only nine were estimated to be between 1-2m in height, with the remaining 72 trees estimated to between 2 and 10m. No trees were classified as mature. Two areas at the western end of the NBOA are classified as regenerating grassland where the density of trees and shrubs is greatly reduced. Since the initial survey in 2013, natural regeneration has occurred, with many shrubs and some midstorey species self-seeding. The northern most section of the NBOA has been classified as mature Swamp Mahogany – Paperbark Swamp Forest. This area contains mature E. robusta and Melaleuca quinquenervia trees with an understorey of Tall Saw-sedge (Gahnia clarkei) and other swamp flora. Lantana has colonised this section of the NOA with infestation levels varying from scattered individuals to very heavy (<75% cover), with a belt of dense Lantana acting to separate this section from the southern regenerating section of the NOA. Weed mapping was conducted in conjunction with vegetation condition survey and was used to inform the weed control works.

Where weed species have not become established the condition of the native vegetation is quite good. Native vegetation is generally in good health with no visible dieback observed amongst the canopy species on site. The regenerating grassland is slowly self-seeding with some native species such as Coastal Wattle (Acacia longifolia) and Coast Teatree, but would benefit from a modest planting program of tubestock installation of E. robusta, Red Bloodwood (Corymbia gummifera) and Smooth-barked Apple (Angophora costata). Sibelco Australia (the previous owners) had commenced a modest weed control program, and Holcim (Australia) have continued this program. Further on-going and more intense weed control efforts will be required to improve the condition of the NOA.

Weed Control Works

Kleinfelder was engaged by Holcim (Australia) to conduct weed control works in the NOA during the 2020 reporting period. These works consisted of a team of two Land Management Technicians working on site for two rounds of two days each. Works were performed on the 18th and 19th January and the following month on the 22nd and 23rd of February. The technicians were instructed to work from areas of low infestation towards higher infestation and concentrated on the southern and eastern sections of the NOA. The January weed control effort targeted the Fishpole Bamboo, Senna, Lantana and Slash Pine. The February weed control effort again applied herbicide to the bamboo before returning to treating the lantana and slash pine in the north-east section of the NAO. Works were completed in this section and

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the team continued with sweep through the entire regenerating section of the forest hand pulling slash pine seedlings.

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1. INTRODUCTION

1.1 BACKGROUND

Holcim (Australia) Sibelco Australia has consent to extract white silica sand from the Tanilba North Dune Extension located in the Oyster Cove area, in the Port Stephens Council Local Government Area.

Schedule 3, Condition 15 of the Tanilba Northern Dune Extension Project Approval (MP 09_0091) required the preparation of a Biodiversity Management Plan (BMP) (Kleinfelder, 2019). The BMP outlines management measures for the approved Biodiversity Offsets Areas (BOA). BOAs for the project have been established in the north-east of the approved extraction area (Northern Biodiversity Offset Area, NBOA) and to the south east of the extraction area off Lemon Tree Passage Road (Southern Biodiversity Offset Area). The Lemon Tree Passage Road Offset Area is subject to a separate Biobanking Agreement and thus this report deals with the monitoring requirements for the NBOA.

The NBOA consists of an area of 18.3 ha of native vegetation in varying condition that is covered by Lots 11, 12 and 13 of DP 601306 and is located to the north and north-east of the Tanilba North Dunes Extension sand extraction project. The NBOA is owned as freehold by Holcim (Australia) (**Figure 1**).

1.2 SCOPE

The BMP requires the following actions to be undertaken within the NBOA. The relevant sections of the BMP are noted:

- Annual inspection and monitoring to be conducted by a suitably qualified person/s (Section 5.1.3B) – results detailed in this report,
- Implementation of a nest box installation and monitoring program within the northern offset area to replace hollow bearing tress removed from the extraction area (Section 5.1.3F),
- Targeted fauna monitoring across all offset areas to monitor for Wallum Froglet (*Crinia tinnula*), Mahony's Toadlet (*Uperoleia mahonyi*), and Koala (*Phascolarctos cinereus*) (Section 5.2),

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- Establishment of a habitat restoration and rehabilitation program across the offset areas (including the visual amenity buffer along the northern boundary of the extraction area) consisting of (Section 5.1.3D),
    - Annual inspections to identify areas requiring weed and pest control (5.1.3B),
    - A weed and pest management program (Section 5.1.3C),
    - Enhancement of the availability of habitat for the Koala through the installation of *Eucalyptus robusta* (Swamp Mahogany) within the offset area (Section 5.1.3D),
    - Rehabilitation of the regenerating Grassland-Heath to the surrounding Swamp Mahogany – Paperbark Swamp Forest through seeding and planting of appropriate species (Section 5.1.3D).

To satisfy the above requirements, Kleinfelder was engaged by Holcim to conduct targeted fauna monitoring for the amphibians and koalas as outlined above, annual monitoring of the 52 nest boxes that have been installed in the NBOA, an assessment of the vegetation of the NBOA and weed mapping to inform and conduct weed control works.

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DRAWN BY: GJoyce

DATA SOURCE:
NSW DFSI - 2020
NSW OEH - 2019
Nearmap - 2020

Locality

Holcim Australia
North Dunes Extension Offsets
Fauna & Vegetation Monitoring 2020

FIGURE:

1

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2. TARGETED FAUNA SURVEYS

2.1 AMPHIBIANS

Targeted fauna monitoring for the Wallum Froglet (*Crinia tinnula*) and Mahony's Toadlet (*Uperoleia mahonyi*) was conducted by Kleinfelder ecologists as part of the requirements outlined in section 5.2 of the Biodiversity Management Plan Tanilba Northern Dunes Extension (Kleinfelder, 2019). Monitoring was conducted on the 28th October and the 15th and 16th December 2020 by two ecologists over the three nights, following periods of rainfall. Surveys were undertaken at night, after rainfall was received (**Table 1**). **Figure 2** shows the extent and location of the nocturnal surveys conducted on the NBOA and adjoining areas.

Table 1. Weather conditions during surveys

Date	Temperature (°C)	Humidity (%)	Barometric pressure (hPa)	Wind (spd/direction)	Rain past 24 hours (mm)	Rain past 3 days (mm)
28/10/2020	18.5	76	1019.4	24/SSE	76.2	219
15/12/2020	26.5	86	1015.0	26/ENE	5.4	5.4
16/12/2020	29.6	74	1011.7	31/NE	15.8	22.2

Source: Bureau of Meteorology – Williamtown RAAF (061078).

2.1.1 Methods and Results

A prior diurnal assessment of the offset areas was conducted to determine habitat suitability. Surveys consisted of a meandering search in the NBOA. Survey effort was focused around ephemeral and semi-permanent water bodies using both spotlighting and call-playback techniques. Surveys revealed that no permanent water existed within the NBOA. Several areas were noted which had the potential to contain water after rainfall and later became the target of nocturnal surveys. The greatest potential for detection of threatened amphibian species was identified within the NBOA with habitats including areas of Melaleuca/Swamp Mahogany forest and low-lying areas dominated by herbs, rushes and/or emergent vegetation.

Nocturnal surveys for amphibian species employed visual and audible detection techniques with the aid of spotlights. Both *U. mahonyi* (**Plate 1**) and *C. tinnula* (**Plate 2**) were detected on the 28th October within and adjacent to the NBOA. *C. tinnula* was recorded within the NBOA on all survey nights in October and December at multiple locations while *U. mahonyi* was identified calling from thick *Gahnia* within the north-east of the NBOA during the October survey only (**Figure 2**). An adjacent waterbody to the east was visited to confirm the presence of *U.*

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mahonyi and *C. tinnula* and both species were found to be calling. **Table 2** represents amphibian records for the three nights of surveys in October and December of 2020. Opportunistic sightings of non-target amphibian species were also recorded. For instance, the Ornate Burrowing Frog (*Platyplectrum ornatum*) (**Plate 3**). Additional opportunistic sightings of non-amphibian species within the NBOA included the Grey-headed flying fox (*Pteropus poliocephalus*), Brushtail Possum (*Trichosurus vulpecula*) and an unidentified species of freshwater crayfish.

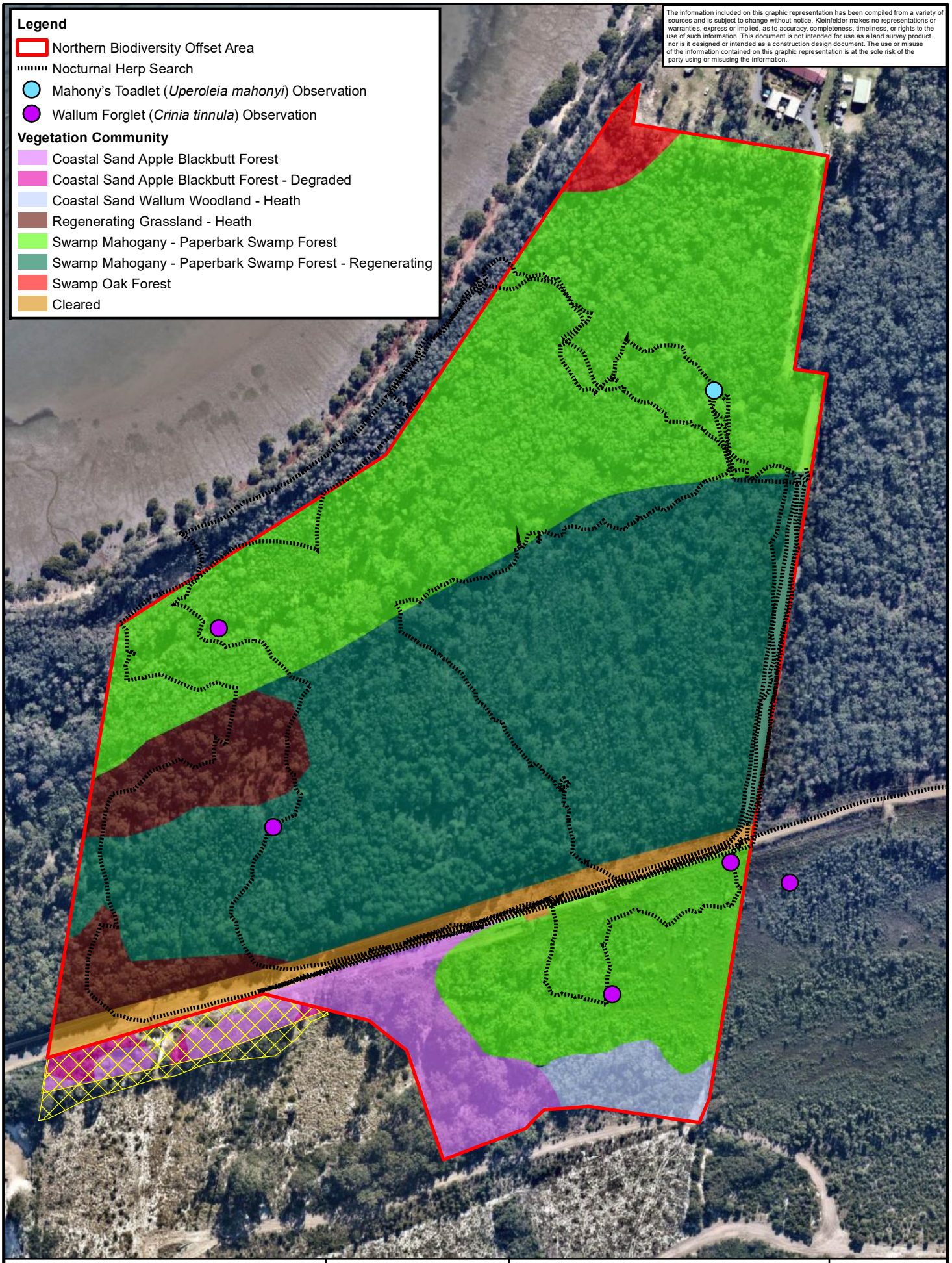
Table 2: Amphibian presence during targeted nocturnal monitoring

Species detected	Observation type	28/10/2020	15/12/2020	16/12/2020
Crinia signifera	Heard	+	+	
Crinia tinnula	**Heard/Observed**	**+**	**+**	**+**
Limnodynastes peronii	Heard/Observed	+	+	+
Litoria latopalmata	Heard			+
Litoria freycineti	Heard/Observed		+	+
Litoria nasuta	Heard	+	+	
Platyplectrum ornatum	Heard/Observed	+	+	
Uperoleia mahonyi	**Heard/Observed**	**+**		

2.1.2 Discussion

Results from the surveys show that the targeted species are utilising the NBOA for breeding and foraging habitat when the conditions are suitable. With no permanent water bodies on the NBOA, this is restricted to periods of higher rainfall. Nearby more permanent water bodies are presumed to be the core habitat for these species. Ongoing surveys after suitable rain events will determine if the species continue to utilise the NBOA.

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Nearmap - 2020

Frog Survey Effort and Observations

Holcim Australia
North Dunes Extension Offsets
Fauna & Vegetation Monitoring 2020

FIGURE:

2

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Plate 1: **Mahony's Toadlet (*Uperoleia mahonyi*)**



Plate 2: **Wallum Froglet (*Crinia tinnula*)**

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Plate 3: **Ornate Burrowing Frog (*Platyplectrum ornatum*)**

2.2 KOALA SPOT ASSESSMENT TECHNIQUE (SAT) TESTS

Koala monitoring for the NBOA was undertaken by Kleinfelder as part of the requirements of section 5.2 of the of the Biodiversity Management Plan Tanilba Northern Dunes Extension (Kleinfelder, 2019).

2.2.1 Monitoring Methodology

Koala monitoring was undertaken using the Spot Assessment Technique (SAT) within the NBOA as described by Phillips and Callaghan (2011). The SAT test involves a radial survey of koala "activity" within the immediate area of a tree that is known or deemed to be utilised by koalas. In the field this the test is applied as follows:

- Locate and mark a tree (the centre tree) that meets one of more of the following criteria,
  - A tree of any species beneath which are one or koala fecal pellets and/or,

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- A tree in which a koala has been overserved and/or,
- Any other tree known or considered to be a potentially important for koalas.

- Identify and mark the nearest 29 trees to the centre tree,
- Undertake a search for koala fecal pellets beneath each of the 30 marked trees based on a cursory inspection of the undisturbed ground surface within a distance of 1m of the base of the tree. If no fecal pellets are found, a more thorough inspection of the leaf litter and ground cover is conducted.

The search beneath each tree is conducted for two person minutes or until a single pellet is found, whichever occurs first. A tree is defined as a live woody stem of any species (except for cycads, palms, tree ferns and grass trees) which has a diameter at breast height (dbh) greater than 10cm. Two Kleinfelder ecologists Mark Dean and Daniel O'Brien conducted SAT surveys on the 22 October 2020. A total of 15 SAT tests were conducted over the offset area (**Figure 1**).

2.2.2 Results and Discussion

The SAT surveys in 2020 found Koala activity in the NBOA to be slightly down from the 2019 data but still recorded an average of Low activity throughout the site. Please see **Table 3** and **Figure 3** for Koala activity levels for each SAT test for the NBOA. Within the NBOA, the greater activities were found to be within the Swamp Mahogany – Paperbark Swamp Forest in the north of the offset area where there are mature trees for feeding, although evidence of use was found throughout the extent of the NBOA.

The NBOA has good habitat suitability for the koala with plenty of mature *Eucalyptus robusta* (Swamp Mahogany), *Melaleuca quinquenervia* (Broad-leaved Paperbark) and *Casuarina glauca* (Swamp She-oak) to the north of the area, although parts of this area were hard to traverse due to of thick belt of *Lantana camara* (Lantana) dominating the understory which has the potential to hinder Koala movement through the site. The remaining southern areas of the NBOA are still regenerating but have shown promising signs of koala use which will continue to improve as the trees mature. This will provide koalas with more habitat and a greater food source in the future.

The assessed low activity levels within the NBOA suggest that koalas are not permanently resident within the site but use it to transition between other areas of higher populations. Despite the apparent suitability of the NBOA as habitat, a number of possible factors can be suggested as to why the site is not used at higher levels or even permanently. As alluded to

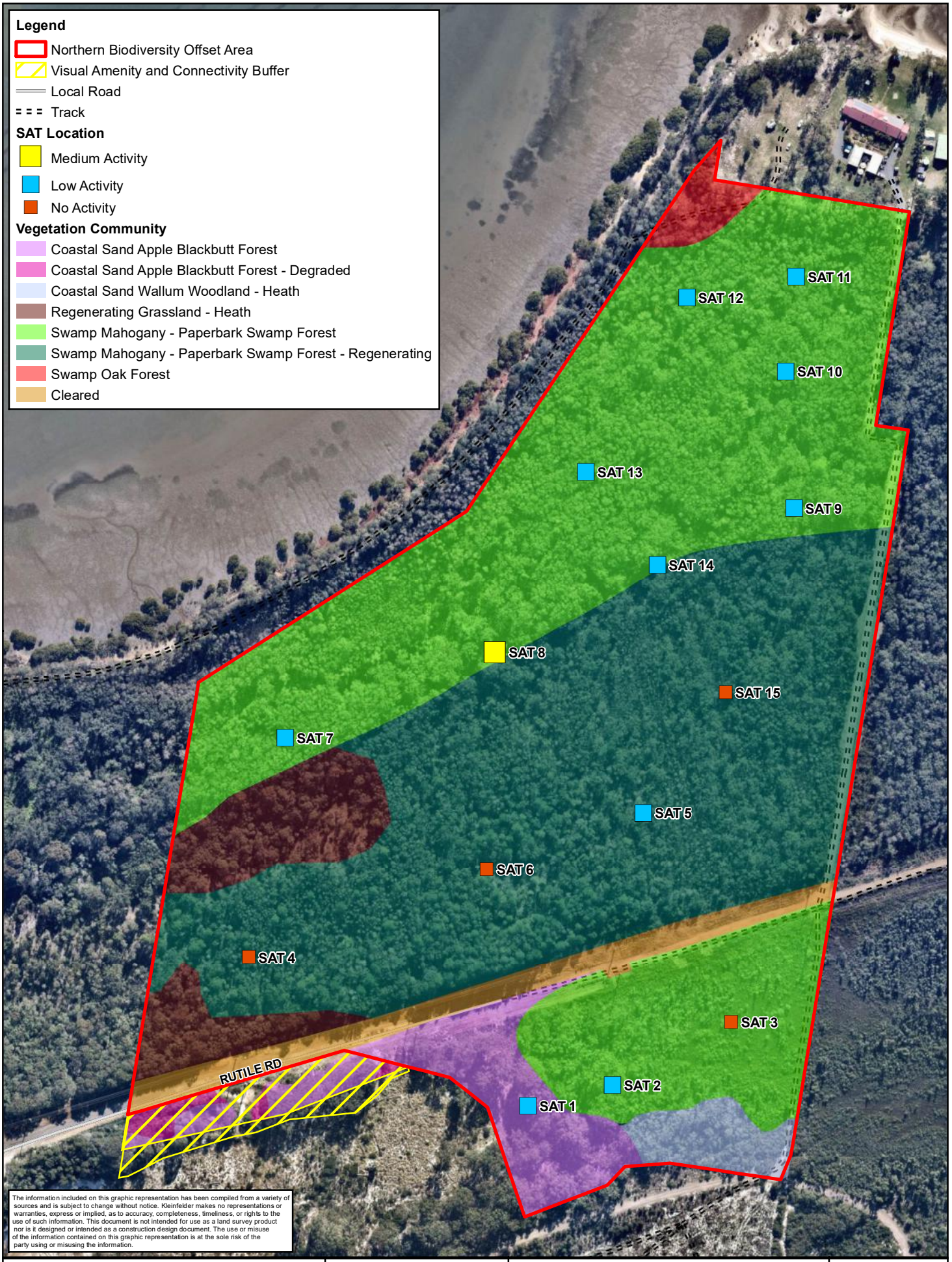
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above, there is a dense lanata understory that effectively separates the site in two (see Weed Mapping Section below). There have been historic and ongoing disturbance due to recent fires, and human activity including motorcycle riding, dog walking and rubbish dumping, although these activities within the NBOA have decreased as the vegetation has increased in density and made access to the site more difficult. More active management actions as instigated by Holcim will improve the suitability of the NBOA in the future.

Table 3 Koala activity levels from the Spot Assessment Technique.

Location	No Activity		Low Activity		Medium Activity		High Activity	
Northern Offset Area								
	2019	2020	2019	2020	2019	2020	2019	2020
1			+	+				
2			+	+				
3	+	+						
4		+	+					
5			+	+				
6		+	+					
7				+	+			
8					+	+		
9			+	+				
10			+	+				
11			+	+				
12			+	+				
13			+	+				
14			+	+				
15	+	+						

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Koala Survey

Holcim Australia
North Dunes Extension Offsets
Fauna & Vegetation Monitoring 2020

FIGURE:

3

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2.3 NEST BOX MONITORING

2.3.1 Background

In December 2015, Kleinfelder installed 52 nest boxes within the NBOA as per the offset requirements for the Tanilba Northern Dune Extension Project. The following types of nest boxes were installed within the Northern Offset Area:

- 16 Microchiropteran bat boxes,
- 34 Glider boxes, and
- 2 Possum boxes.

As per the Nest Box Installation and Monitoring Protocol within the Biodiversity Management Plan – Tanilba Northern Dune Extension (Kleinfelder 2019), the 52 nest boxes were required to be monitored annually for a period of six years (**Figure 4**). In 2018 fire destroyed six nest boxes (three Bat and three Glider boxes) which were replaced after the 2018 monitoring. This was the fourth survey conducted by Kleinfelder on behalf of Holcim (Australia) and the previous owners of the site, Sibelco Australia.

2.3.2 Monitoring methods

Two Kleinfelder Ecologists, Nigel Fisher and Jake McNeil, with experience and accreditation in handling animals and working at heights attended the site on 12 October 2020. Nest boxes were monitored using a wireless GoPro™ camera mounted on an extension pole capable of reaching heights of over 6 m. A live video feed is transferred wirelessly from the camera to an iPhone device capable of capturing still HD images or video. Images were captured in the field and processed in the office. A handheld Global Positioning System (GPS), pre-loaded with co-ordinates, was used to locate the boxes. Once a box was located, the pole camera was used to open the lid and to observe the contents. Status of the boxes were recorded as either:

- A – Animal present,
- E1 – Fresh evidence of use (i.e. fresh nest or scats),
- E2 – Moderately fresh evidence of use (i.e. green leaves but beginning to age),
- E3 – Old signs of use (i.e. old leaf nest, old scats),
- N – No evidence of use,
- NA – Not available for use, and
- X – Missing.

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If a box was found to be occupied, an attempt was made to capture the animal for positive identification, where required. Signs of use include the presence of hair, scats, nesting material or evidence of scratches/physical marks on the entrance of the nest box. Boxes which contained wasp nests or other pest species, had lids which were open or missing, or had fallen or were missing/destroyed were deemed to be not available for use by target animals.

2.3.3 Results

In 2020, the percentage of all nest boxes exhibiting any sign of use was 48% (25) (**Chart 1**). Eight percent (4) of the total number of nest boxes were determined to be unavailable for use resulting from occupation by pest species such as wasps or bees. This reduces the number of available boxes to 48, but the remaining statistics regarding usage are based upon the original number (52) to provide a more accurate comparison. Use of nest boxes by insects is generally a temporary feature, and as the insects move on, the box becomes available for use by vertebrates.

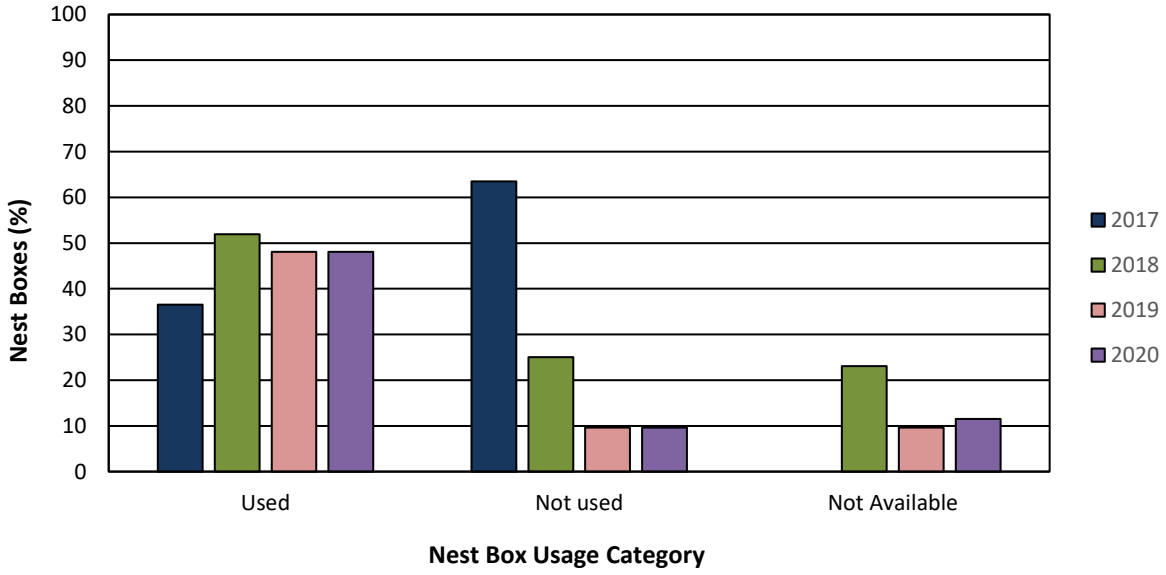


Chart 1: **General usage rates of nest boxes in 2020 and comparison to previous surveys**

In 2020, no boxes (0%) were observed to have animals present (A) as per the 2019 survey. There were no boxes showing recent evidence although one box was judged to be E2, “moderately fresh” category, and the total number of boxes showing old evidence was 24

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boxes, or 48% (**Chart 2**). A total of six boxes were categorised as either NA – not available due to insects as noted above, but one box - Glider box no 2 – was missing, believed stolen. This brought the total number of nest boxes available for fauna use to 46, one less than the 2019 survey.

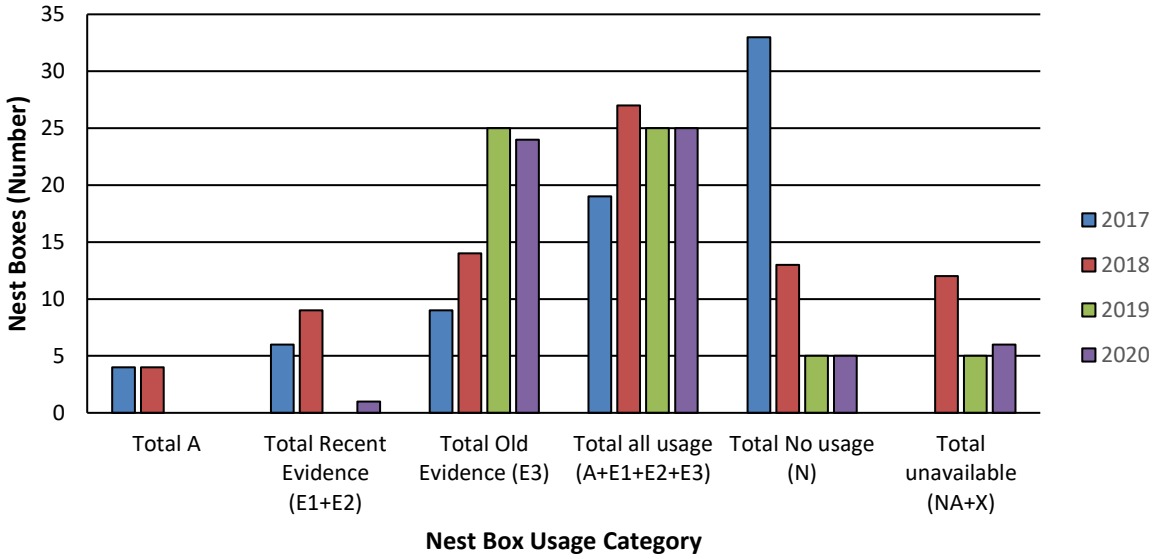


Chart 2: **Detailed usage by category of nest boxes for the 2020 survey and comparison to the previous surveys**

Usage of all ages per box type in 2020 is shown in **Chart 3**. None of the Possum boxes showed evidence of use, Glider boxes had a utilisation rate of 74% (25 out of 34 boxes) and none of the Bat boxes showed evidence of use.

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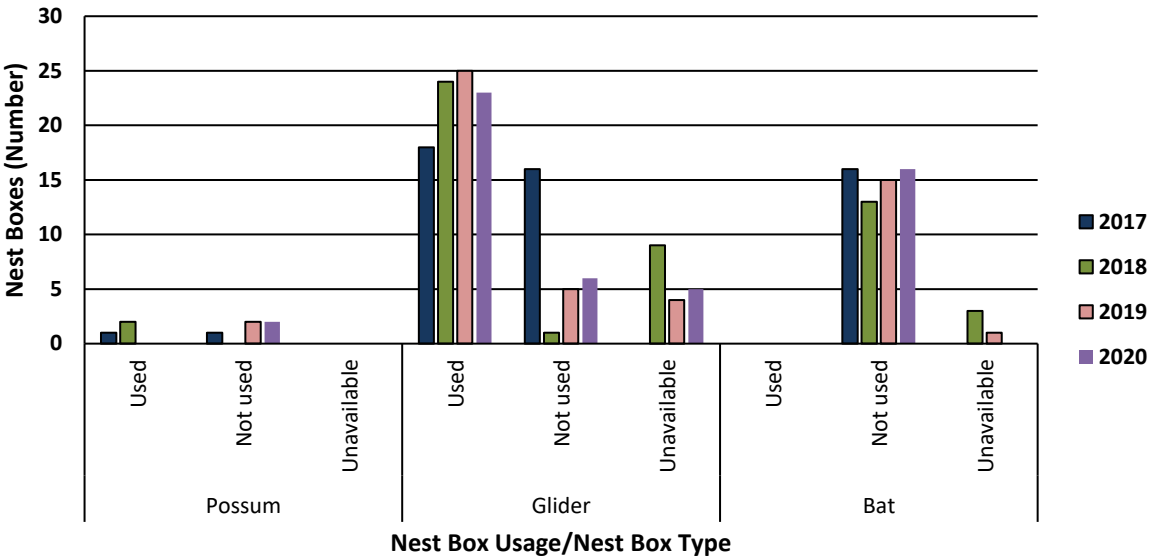
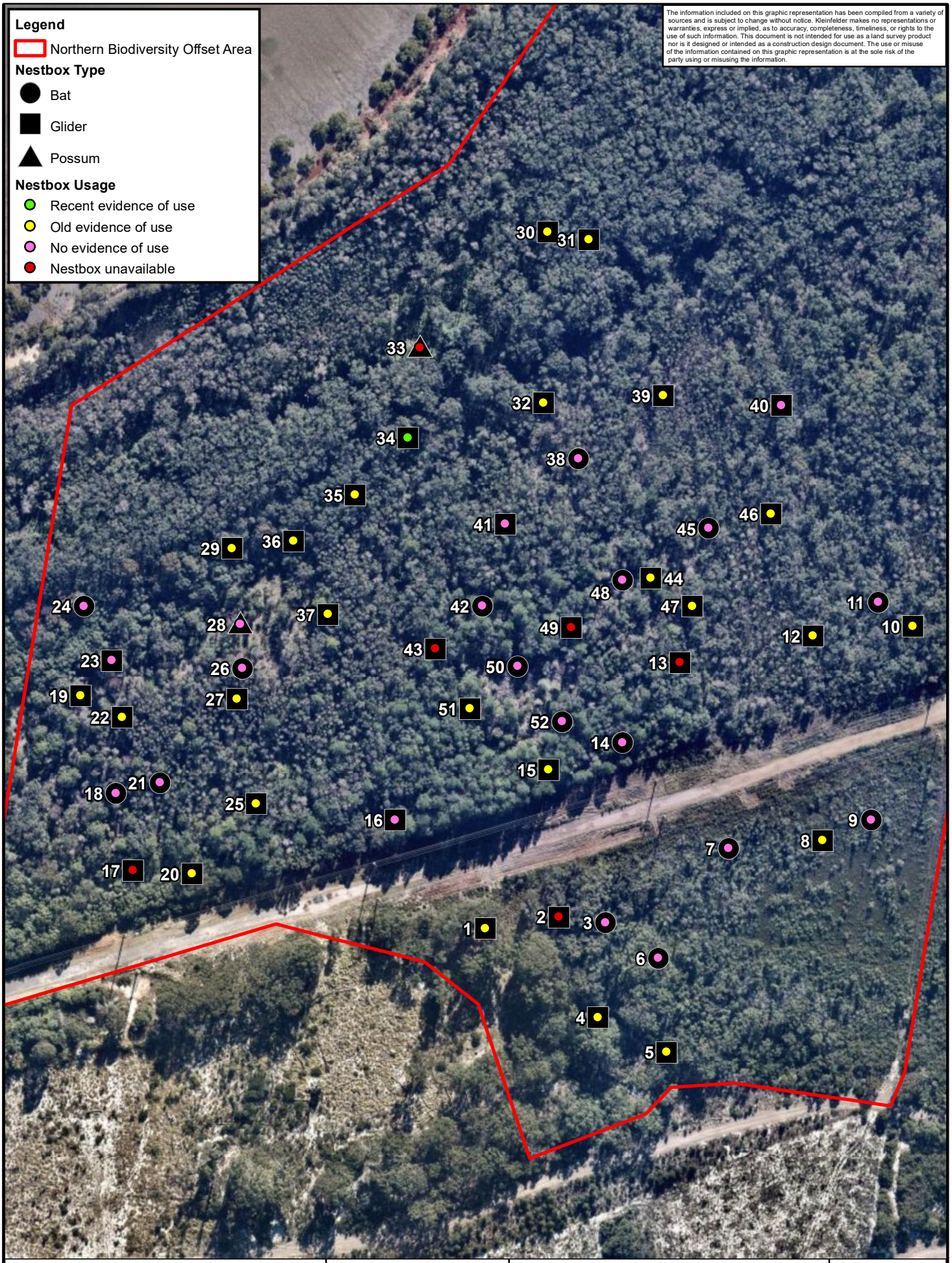


Chart 3: **Detailed usage per nest box type for the 2020 survey and comparison to the previous surveys**

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Nearmap - 2020

Nestbox Locations and Usage

Holcim Australia
North Dunes Extension Offsets
Fauna & Vegetation Monitoring 2020

FIGURE:
4

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2.3.4 Discussion

Fauna uptake of the nest boxes was successful in the first year of installation with several species of mammals and reptiles recorded occupying boxes, and evidence of usage across many more boxes. Since that initial survey, no fauna has been recorded in the boxes.

This year's survey was brought forward into the spring (October) to determine if the fauna were not using the nest boxes in the heat of the summer of the months. However, again no fauna were recorded occupying any of the nest boxes, with no evidence of usage (scratches or nesting materials) judged to be fresh, but one nest box (Glider box 34) was judged to be in the E2 category – moderately fresh, indicating some type of continuing usage.

It should be noted that for two of the box types – possum and bat – little evidence of usage will be apparent, unless an animal is actually recorded in the box as neither of the target fauna generally leave nesting materials behind, as with gliders.

It is suggested that the relatively recent fires may have acted as a deterrent to the fauna utilising the offsets, even though the offsets itself was not directly fire affected and the fauna has not yet recolonised the area. Kleinfelder ecologists have noted in nest box surveys at other sites that fauna usage of boxes can be periodic, with fauna absent for consecutive surveys.

Suggestions for further action are –

- Increase the survey effort to twice per year one in the autumn/winter and one in the following spring for a single year. This would indicate whether the Offsets nest boxes are being used seasonally or whether the Offsets are no longer being used for nesting, and following on from the above,
- Placing remote cameras in the offsets to determine if fauna are utilising the offsets for foraging and are simply not using the nest boxes, but utilising natural hollows in adjacent vegetation.

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3. VEGETATION CONDITION SURVEY

3.1 BACKGROUND

An annual inspection of the NBOA is to be conducted as per Section 5.1.3B of the Biodiversity Management Plan Tanilba Northern Dunes Extension (Kleinfelder, 2019). This survey was conducted on 27th January 2021.

As per the BMP, photo monitoring points were established, weed infestations were noted, locations of rubbish dumping were noted, establish and survey the regeneration and health of the *Eucalyptus robusta* along one transect, east to west across the NOA noting the size in classes of trees 1m either side of the transect, noting the extent and requirement of any revegetation works in the NOA.

3.2 RESULTS

3.2.1 General Condition

The vegetation condition of the NBOA is presented in **Figure 5.**

South of Rutile Rd, a small section of the NBOA abuts the extraction zone. Most of this area was affected by the 2018 fires but has recovered with increased rainfall in late 2020 and early 2021 (**Plate 4**). The condition improves moving east from Coastal Sand Apple Blackbutt Forest that fringes the extraction zone and Block Q2 which is quite weed infested until good condition Swamp Mahogany – Paperbark Forest is encountered. This area has some scattered Fishpole Bamboo (*Phyllostachys aurea*), Senna (*Senna pendula*) and Bugle Lily (*Watsonia borbonica*).

The 50m buffer zone of vegetation along Rutile Rd is quite weedy with exotic grasses, Lantana (*Lantana camara*) and some minor Blackberry (*Rubus fruticosus* spp. agg.) also observed.

North of Rutile Rd., the Swamp Mahogany – Paperbark Swamp Forest was assessed as regenerating. This area contains a number of weed species that are the subject of on-going control efforts (see Section 4) including Slash Pine (*Pinus elliottii*), Bugle Lily and Lantana

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(*Lantana camara*). Native species are present, and evidence of some regeneration is present with seedling and saplings apparent (**Plate 5**, **Plate 6**, **Plate 7** and **Plate 8**)

Regeneration within this community was assessed by measuring the health and size of *Eucalyptus robusta* trees within 1 m of a transect running East to West across the NBOA (**Figure 5**). The individual trees were divided into four height classes (<1m, 1-2m, 2-10m and >10m or mature trees) for determination of age. Trees <1m in height were classified as seedlings/saplings, trees 1-2m in height were classified as saplings, trees between 2 and 10m were classified as immature trees, while trees estimated to be over 10m in height were classified as mature (**Table 4**). A total of 81 trees were assessed along the transect that was approximately 400m long. The assessment found that there were no saplings <1m, only nine were estimated to be between 1-2m in height, with the remaining 72 trees estimated to between 2 and 10m. No trees were classified as mature.

Table 4: ***Eucalyptus robusta*** **trees surveyed in the Northern Dunes Offsets Area**

Tree No. (From East)	Tree Height (m)				Comments
	<1	1-2	2-10	Mature	
1			Y		Start at eastern edge of NOA
2			Y		
3			Y		
4			Y		
5			Y		
6			Y		
7			Y		
8			Y		
9		Y			
10			Y		
11		Y			
12			Y		
13			Y		
14		Y			
15		Y			
16			Y		
17			Y		
18		Y			
19		Y			
20			Y		
21			Y		
22			Y		
23			Y		
24			Y		
25			Y		
26			Y		
27			Y		
28			Y		
29			Y		

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Tree No. (From East)	Tree Height (m)				Comments
	<1	1-2	2-10	Mature	
30			Y		
31			Y		
32			Y		
33			Y		
34			Y		
35			Y		
36			Y		
37			Y		
38			Y		
39			Y		
40			Y		
41			Y		
42			Y		
43			Y		
44			Y		
45			Y		
46			Y		
47		Y			
48			Y		
49			Y		
50			Y		
51			Y		
52			Y		
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58			Y		
59			Y		
60			Y		
61			Y		
62			Y		
63			Y		
64			Y		
65			Y		
66			Y		
67			Y		
68			Y		
69			Y		
70			Y		
71			Y		
72			Y		
73			Y		
74			Y		Regen in the Grassy area
75			Y		
76			Y		
77			Y		
78			Y		
79			Y		End grassy regen area
80			Y		
81			Y		Dieback visible - Last Tree

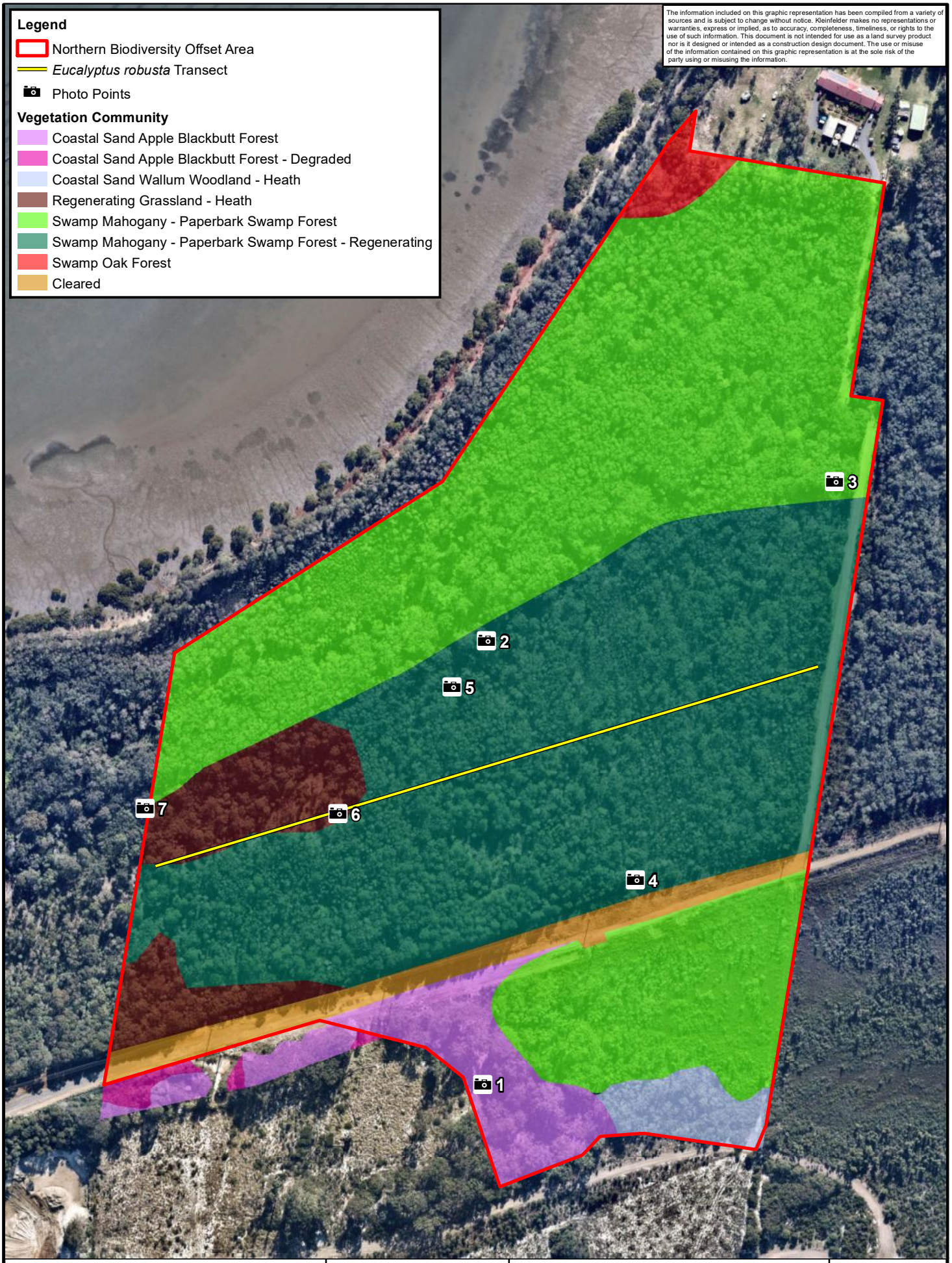
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Two areas at the western end of the NBOA are classified as regenerating grassland where the density of trees and shrubs is greatly reduced. Since the initial survey in 2013, natural regeneration has occurred, with many shrubs and some midstorey species self-seeding (**Plate 9**). However, very few *E. robusta* have established in these areas, and the southern-most section adjacent to Rutile Rd is a dense thicket of *Leptospermum laevigatum* (Coast Teatree) that will prevent any other re-growth of native species.

The northern most section of the NBOA has been classified as mature Swamp Mahogany – Paperbark Swamp Forest. This area contains mature *E. robusta* and *Melaleuca quinquenervia* trees with an understorey of Tall Saw-sedge (*Gahnia clarkei*) and other swamp flora. Lantana has colonised this section of the NOA with infestation levels varying from scattered individuals to very heavy (<75% cover), with a belt of dense Lantana acting to separate this section from the southern regenerating section of the NOA (**Plate 10**). Evidence of previous control works conducted by Kleinfelder is visible.

An access track is becoming overgrown at PP4. While access by the general public is not encouraged, there is historical illegal rubbish dumping along this track that requires removal.

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Nearmap - 2020

Vegetation Condition Monitoring

Holcim Australia
North Dunes Extension Offsets
Fauna & Vegetation Monitoring 2020

FIGURE:

5

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Plate 4: **PP1 looking north showing scattered Fishpole Bamboo (foreground)**



Plate 5: **PP2 looking north showing dense Lantana and previous control works**

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Plate 6: **PP3 looking north showing typical understorey and previous control works**



Plate 7: **PP4 looking north along access track showing Slash Pine infestation and control works**

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Plate 8: **PP5 looking north showin gdense Bugle Lily infestation**



Plate 9: **PP6 looking west showing the regenerating grassland area (north). note the shrubby regrowth and Slash Pine. The Slash Pine at the right of picture has been ring-barked**

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Plate 10: **PP7 looking north at the dense Lantana "belt" that separates the regenerating and mature Swamp Mahogany – Paperbark Swamp Forest.**

3.2.2 Weed Mapping

Weed mapping was conducted as part of the monitoring of the NOA (**Figure 6**). The key weed species recorded on site ad that have the potential to restrict revegetation or native fauna use are the Slash Pine, Lantana and Bugle Lily, all mentioned previously with minor occurrences of Senna and Pampas Grass (*Cortaderia selloana*).

The Slash Pine is concentrated along Rutile Rd in the regenerating Swamp Mahogany – Paperbark Swamp Forest, but seedlings and saplings have spread throughout this entire section of the NOA. The density has been mapped from medium to heavy in these areas and there are many scattered immature and mature trees in other areas. The Slash Pine is rapidly spreading through the NOA and does pose a threat to the viability of the area as an offset. Prolific seed production, rapid growth and production of pine needles that serves to suppress other vegetation acts to degrade the condition of the NOA, providing competition for the *Eucalyptus* species that are preferred koala feed trees. Native fauna – with the possible exception of bird species such as Glossy-Black Cockatoo and Sulphur Crested Cockatoo and other large seed eating birds - do not use the pines for foraging or habitat.

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The Bugle Lily is concentrated in the central portion of the regenerating Swamp Mahogany – Paperbark Swamp Forest with a large central dense infestation that becomes less dense towards the edges. This species is out-competing native species such as the Tall Saw-sedge.

Lantana is the major threatening weed in the NOA, forming dense thickets at ground level and climbing into the mature tree canopies and covering a substantial portion of the NOA (**Figure 6**). The infestation density covers the full spectrum from isolated or scattered individuals to the dense thicket or belt referred to earlier. At its most dense, these thickets have the potential to hinder movement of koalas through the NOA and effectively divides the Swamp Mahogany – Paperbark Swamp Forest into two sections.

3.2.3 Vegetation Condition Discussion and Recommendations

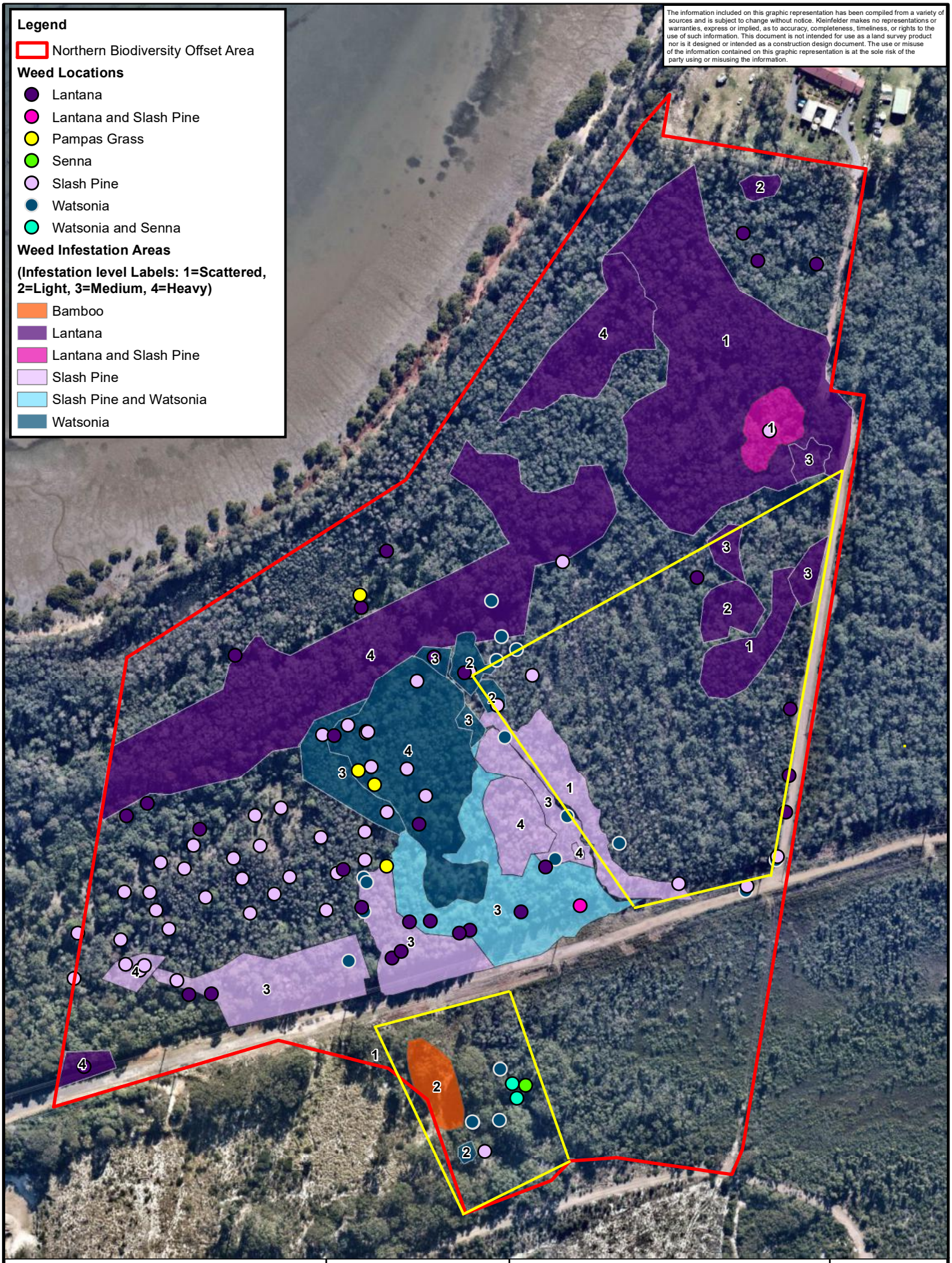
Where weed species have not become established the condition of the native vegetation is quite good. Native vegetation is generally in good health with no visible dieback observed amongst the canopy species on site. Seedlings of *E. robusta* have been observed away from the transect where the lack of mature trees indicate that the regenerating Swamp Mahogany – Paperbark Swamp Forest is indeed regenerating and not mature forest as is the case in the northern section of the BOA.

The regenerating grassland is slowly self-seeding with some native species such as Coastal Wattle (*Acacia longifolia*) and Coast Teatree, but would benefit from a modest planting program of tubestock installation of *E. robusta,* Red Bloodwood (*Corymbia gummifera*) and Smooth-barked Apple (*Angophora costata*).

Sibelco Australia (the previous owners) had commenced a modest weed control program, and Holcim (Australia) have continued this program. Further on-going and more intense weed control efforts will be required to improve the condition of the NOA. In particular, the Slash Pine infestation requires specialist arborist and tree removal subcontractors. Previous weed control efforts have used a “cut and drop” approach to controlling this species, but the density of trees is so high that it is necessary to remove the cut logs. This will however result in considerable damage to the surrounding native vegetation, including to mature Swamp Mahogany as it will be necessary to employ machinery to achieve this.

The access track at PP4 requires a locked gate to limit access. While it is acknowledged that this might attract attention that may facilitate illegal access, provision of access to the site for fire-fighting and weed control is desirable.

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Metres
0 10 20 40 60 80 100

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PROJECT REFERENCE: 20211345

DATE DRAWN: 2021/01/08 16:06 Version 1

DRAWN BY: GJoyce

DATA SOURCE:
NSW DFSI - 2020
NSW OEH - 2019
Nearmap - 2020

Weed Infestation Areas

Holcim Australia
North Dunes Extension Offsets
Fauna & Vegetation Monitoring 2020

FIGURE:

6

L:\GIS FOLDER\00 CLIENT FILES\131942_Holcim\AnnualMonitoring\20211345_Fauna_Veg_Monitoring_2020\Mapping\20211345_Fig5_WeedLocations.mxd

4. WEED CONTROL WORKS

Kleinfelder was engaged by Holcim (Australia) to conduct weed control works in the NOA during the 2020 reporting period. These works consisted of a team of two Land Management Technicians working on site for two rounds of two days each. Daily worksheets are provided in **Appendix 1**.

Works were performed on the 18th and 19th January and the following month on the 22nd and 23rd of February. **Figure 6** shows the areas targeted during these four days of works, outlined as the yellow boxes. The technicians were instructed to work from areas of low infestation towards higher infestation and concentrated on the southern and eastern sections of the NOA.

The January weed control effort targeted the Fishpole Bamboo, Senna, Lantana and Slash Pine. The bamboo was sprayed with 2% glyphosate using a backpack sprayer to minimise overspray. This stand of bamboo was substantial when operations at the site began and Sibelco initially used a small excavator to remove much of the bamboo before applying herbicide. This has reduced the stand to isolated small patches of plants that have been sprayed periodically with herbicide (**Plate 4**). These two weed events followed the same approach with two herbicide applications in quick succession. Senna and small lantana were hand pulled or if larger cut and painted. Slash Pine were cut using a battery powered reciprocating saw and the cut trees left where they fell. The infestations of lantana proved to be quite dense with individual plants very large (>2m tall). These were treated using the cut and paint method, whereby the main stump is located, cut using the reciprocating saw and then herbicide applied to the cut stump. The cut plant is left *in situ* to reduce disturbance.

The February weed control effort again applied herbicide to the bamboo before returning to treating the lantana and slash pine in the north-east section of the NAO. Works were completed in this section and the team continued with sweep through the entire regenerating section of the forest hand pulling slash pine seedlings.

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5. REFERENCES

Kleinfelder (2019a), *Biodiversity Management Plan – Tanilba Northern Dune Extension.* A report prepared by Kleinfelder on behalf of Sibelco Australia.

Kleinfelder (2019b), *Koala Monitoring within the Northern Dune Extension Biodiversity Offsets Areas.* Report prepared for Sibelco Australia by Kleinfelder.

Kleinfelder (2020a), *Targeted Nocturnal Fauna Monitoring within the Northern Dune Extension Biodiversity Offsets Areas.* Report prepared for Sibelco Australia by Kleinfelder.

Kleinfelder (2020b), 2019 Annual Nest Bx Monitoring at the Northern Offsets Area – northern Dune Extension Project. Report prepared for Sibelco Australia by Kleinfelder.

Phillips S and Callaghan J (2011). The *Spot Assessment Technique*: A tool for determining localised levels of habitat use by Koalas (*Phascolarctos cinereus*). Australia Koala Foundation. *Australian Zoologist* 35(3) 774-780.

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APPENDIX 1. WEED CONTROL WORKS DAILY WORKSHEETS

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DAILY ACTIVITY RECORD

Section:1.0

DETAILS				
Supervisors name: Jake Manger	Signature:	Location: Holcim Northern Dunes	Date: 18/1/21	Time: 7:30

Section:1.1

ATTENDANCE					
Print name: Emerson Hewitt	Print name:	Print name:	Print name:	Print name:	Print name:
Signature:	Signature:	Signature:	Signature:	Signature:	Signature:

Section:1.2

WEATHER						
Location:	Temp [Now]:	Humidity:	Temp [Fore]:	UV Rating:	Wind [Max}:	Current Warnings:
Oyster Cove	23,1	81	30	13	12	Nil

Section:1.3

GENERAL				
Site Access Requirements / Issues: Sign in at Office	Security Requirements: Covid-Check in	Emergency Muster Point: Vehicle		
Public Safety Issues:	Planned Meeting Point: Holcim Carpark	Break 1 Time: 10:00	Break 2 Time: 12:30	Break 3 Time:

Section:2.0

PRE-WORK SAFTEY REVIEW

Identified safety issues that have not been covered in the SWMS and is specific to changing site conditions.

Loss Prevention Self-Assessment (LPSA)
Before beginning any activity, task or job, and After any unusual incident or circumstance

Stop
Assess the risk.
What could go wrong?
What is the worst that could
Happen if something did go wrong?

Caution
Analyse how to reduce the risk.
Do I have the necessary training and
Knowledge to do this job safely?
Do I have the proper tools and
Personal protective equipment?

Be Proactive
Act to ensure safe operations.
Take necessary action to ensure
the job is done safely
Follow written procedures.
Ask for assistance if needed.

BEFORE WORK Basic Tasks	Hazards	Hazard Controls
Driving	Bogging, Rolling, Sliding Off Road - Driving, interaction with tracks	Max Tracks, Access Track before use, positive communication with others
Spraying	Spray Drift, Off target damage, self inhalation, Spills	Spill kits, adjust nozzle, monitor conditions for sprayng, correct PPE (respirator, gloves)
Sawing / Hand work	Cuts and abrasions, Aches and strains, repetitive task	Check tools before use, rotate tasks, correct PPE
	Weather	Monitor Conditions
	Slips, Trips and Falls	Watch footing, stay alert of surroundings
	Snakes, Ticks and Spiders	Bushmans, Gaiters

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Land Management Daily Worksheet/ Chemical Record

Date: 18/1/21	Project Name: Holcim Northern Dunes			Project No: 20211346
Site Location/Address: Rowtle Rd, Lemon Tree Passenge				
Supervisor: Jake Mauger	Applicator: Emerson Hurch	Applicator:	Applicator:	Applicator:
Signature:	Signature:	Signature:	Signature:	Signature:
Applicator:	Applicator:	Applicator:	Applicator:	Applicator:
Signature:	Signature:	Signature:	Signature:	Signature:

Safety Measures

☑ Risk Management; has the chemical SDS and label be checked and the appropriate controls in place?

☑ Are the weather conditions suitable for spraying i.e. light winds, with no rain predicted within 6 hours?

☑ Measures taken to minimise off target damage: i.e. pre-cleared around natives, adjusted nozzles to suit, etc.

☑ Equipment pre-checks, prepared area for chemical decant.

☑ Chemicals SDS in date and available	☑ Chemical Spill kit	☑ First Aid Kit	☑ Eye Rinse	☑ Potable Water	☐ Signage
☑ PPE; long sleeves and pants, washable hat, steel cap boots/ gumboots, chemical gloves, safety glasses				☐ Chem splash Apron	
☑ Respirator	☐ Googles	☐ Elbow length PVC gloves	☐ Chemical Overalls Disposable	☐ Face shield	☐

Chemical Application Details

Method of application:	Applicator Bottle	Backpack Spray	
Product name & rate used:	100% Glyph 360	2% Mix Glyph 360	
	60ml	30ml, 30m Dye	
Total volume	60ml	10L	

Product Name:	Glyph 360	Dye	Brushwet			
Undiluted amount used in mL:	260ml	30ml	30ml			

Herbicide:	Glyphosate 360	Metsulfuron	BrushWet	Dye	Garlon 600	Grazon Extra	Starane Advance
Label Rates:	50ml-200mls:10L	1-2g:10L	10-20ml:10L	10-15mls:10L	17-300mls:10L	35-50mls:10L	21-90mls:10L

Weather Details

☑ Clear Sky	☐ Light Cloud	☐ Overcast	☐ Showers	☐

Times: start/finish	Temp °C	Humidity %	Wind km/h	Direction	Beaufort Wind Scale
7:30	23.1	81	2	E	
2:30	29.7	63	12	NE	

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Land Management Daily Worksheet/ Chemical Record

Date: 18/1/21 Site name: Holcim Northern Dunes Project #: 20211346 Task #:

Supervisor: Jake Mauger Team members: Emerson Huuk

Start: 6am Onsite: 7:15 Offsite: 3pm Finish: 4pm Hours on site (less lunch): 7.5

☑ Vehicle pre-start check, First Aid, Supervisors Bag ☑ All Site Paperwork i.e. Site location, VMP, HASP, SWMS, SDS

☑ Equipment pre-start checks ☒ First Aid Kit used ☐ Vehicle issue noticed/ please note in comments

Works completed (primary / secondary / area or zone covered / maintenance weed control / target weed species and control technique/ revegetation / watering / mulching etc.)

Removal of slash pine using reciporator saw along edge of site adjacent to road site before sweeping along boundaries hand pulling lantana seedlings and cutting large bases of Lantana using cut/paint treatment

Backpack sprayed Bamboo seedlings using 2% glyphosphate mix on Southern zone of section across roadside, small infestations of Lantana, Senna and Slash Pine were treated

Chemicals used (undiluted): 260ml Glyphosphate 360, 30ml Brushnet, 30ml Dye

Fauna observations: Red Bellied Black Snake

Client liaison notes:

Comments/ future management recommendations/ WHS issues:

Equipment Used:

☑ Backpack Sprayer	☐ Chainsaw	
☐ Quick spray	☐ Auger	☐ Fuels; 2 stroke mix, unleaded, diesel

DAILY ACTIVITY RECORD

Section:1.0

DETAILS				
Supervisors name: Jake Manger	Signature:	Location: Holcim Northern Dunes	Date: 19/1/21	Time: 7:30

Section:1.1

ATTENDANCE					
Print name: Emerson Hinde	Print name:	Print name:	Print name:	Print name:	Print name:
Signature:	Signature:	Signature:	Signature:	Signature:	Signature:

Section:1.2

WEATHER						
Location:	Temp [Now]:	Humidity:	Temp [Fore]:	UV Rating:	Wind [Max}:	Current Warnings:
Oyster Cove	24.6	89	24	12	33	Marine Wind Warning

Section:1.3

GENERAL				
Site Access Requirements / Issues: Sign in at Office	Security Requirements: Co-vid Check in	Emergency Muster Point: Vechicle		
Public Safety Issues:	Planned Meeting Point: Holcim Site Carpark	Break 1 Time: 10:00	Break 2 Time: 12:30	Break 3 Time:

PRE-WORK SAFTEY REVIEW

Section:2.0

Identified safety issues that have not been covered in the SWMS and is specific to changing site conditions.

Loss Prevention Self-Assessment (LPSA)
Before beginning any activity, task or job, and After any unusual incident or circumstance

Stop
Assess the risk.
What could go wrong?
What is the worst that could
Happen if something did go wrong?

Caution
Analyse how to reduce the risk.
Do I have the necessary training and
Knowledge to do this job safely?
Do I have the proper tools and
Personal protective equipment?

Be Proactive
Act to ensure safe operations.
Take necessary action to ensure
the job is done safely
Follow written procedures.
Ask for assistance if needed.

BEFORE WORK Basic Tasks	Hazards	Hazard Controls
Driving	Bogging, Rolling, Off-Road Driving, On site - interaction with Trucks	Map Tracks, Access tracks before use, driver confident
Handwork/Hand-tooling	Aches and strains, repetitive task, cuts and abrasions	Correct PPE, rotate tasks, stretch before work
Sawing / Hand sawing Lantana	Cuts and abrasions, sharp blades, off target damage	Correct posture when sawing, check area before cutting down trees
	Snakes, Ticks and Spiders	Bushmans, Gaitors, Stay alert of surroundings
	Weather	Monitor conditions
	Slips, Trips and Falls	Watch footing, stay alert of surroundings

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Land Management Daily Worksheet/ Chemical Record

Date: 19/1/21 Site name: Holcim Northern Dunes Project #: 20211346 Task #:

Supervisor: Jake Manger Team members: Emerson Huuk

Start: 6am Onsite: 7:15 Offsite: 3pm Finish: 4pm Hours on site (less lunch): 7.5

☑ Vehicle pre-start check, First Aid, Supervisors Bag ☑ All Site Paperwork i.e. Site location, VMP, HASP, SWMS, SDS

☑ Equipment pre-start checks ☐ First Aid Kit used ☐ Vehicle issue noticed/ please note in comments

Works completed (primary / secondary / area or zone covered / maintenance weed control / target weed species and control technique/ revegetation / watering / mulching etc.)

Continuation of cut and paint Lantana sweeping through site and boundaries using power reciporator saw and chemical applicator bottle, heavy infestations of Lantana located on northern section resulted in slow progess

Chemicals used (undiluted): 720ml Glyphosphate 360

Fauna observations:

Client liaison notes:

Comments/ future management recommendations/ WHS issues: Follow up Treatment needed for northern section of zone due to heavy infestation of Lantana

Equipment Used:

Land Management Daily Worksheet/ Chemical Record

Date: 19/1/21	Project Name: Holcim Northern Dunes	Project No: 20211346
Site Location/Address:		

Supervisor: Jake Manger	Applicator:	Applicator:	Applicator:	Applicator:
Signature:	Signature:	Signature:	Signature:	Signature:
Applicator:	Applicator:	Applicator:	Applicator:	Applicator:
Signature:	Signature:	Signature:	Signature:	Signature:

Safety Measures

- ☑ Risk Management; has the chemical SDS and label be checked and the appropriate controls in place?
- ☑ Are the weather conditions suitable for spraying i.e. light winds, with no rain predicted within 6 hours?
- ☑ Measures taken to minimise off target damage: i.e. pre-cleared around natives, adjusted nozzles to suit, etc.
- ☑ Equipment pre-checks, prepared area for chemical decant.

☑ Chemicals SDS in date and available	☑ Chemical Spill kit	☑ First Aid Kit	☑ Eye Rinse	☑ Potable Water	☐ Signage
☑ PPE; long sleeves and pants, washable hat, steel cap boots/ gumboots, chemical gloves, safety glasses				☐ Chem splash Apron	
☑ Respirator	☐ Googles	☐ Elbow length PVC gloves	☐ Chemical Overalls Disposable	☐ Face shield	☐

Chemical Application Details

Method of application:	Applicator Bottle		
Product name & rate used:	100%		
	6 x 120ml Applicator		
	bottles		
Total volume	720ml		

Product Name:	Glyph 360					
Undiluted amount used in mL:	720ml					

Herbicide:	Glyphosate 360	Metsulfuron	BrushWet	Dye	Garlon 600	Grazon Extra	Starane Advance
Label Rates:	50ml-200mls:10L	1-2g:10L	10-20ml:10L	10-15mls:10L	17-300mls:10L	35-50mls:10L	21-90mls:10L

Weather Details

☐ Clear Sky	☐ Light Cloud	☑ Overcast	☐ Showers	☐

Times: start/finish	Temp °C	Humidity %	Wind km/h	Direction	Beaufort Wind Scale
7:30	21.6	89	12	S	
2:30	22.9	81	22	SE	

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DAILY ACTIVITY RECORD

Supervisors name:	Signature:	Location:	Date:	Time:
Jake Manger		Oyster Cove	22/2/21	7:30

Print name:	Print name:	Print name:	Print name:	Print name:	Print name:
Isabelle Cole					
Signature:	**Signature:**	**Signature:**	**Signature:**	**Signature:**	**Signature:**

Location:	Temp [Now]:	Humidity:	Temp [Fore]:	UV Rating:	Wind [Max]:	Current Warnings:
Lemon Tree Passage	21°C	93	28	11	25	-

GENERAL — Section 1.2

Site Access Requirements / Issues:	Security Requirements:	Emergency Muster Point:		
Sign in at Office		Vechicle		
Public Safety Issues:	**Planned Meeting Point:**	**Break 1 Time:**	**Break 2 Time:**	**Break 3 Time:**
	Vechicle	10:00	12:30	

PRE-WORK SAFTEY REVIEW — Section 2.0

Identified safety issues that have not been covered in the SWMS and is specific to changing site conditions.

Loss Prevention Self-Assessment (LPSA)
Before beginning any activity, task or job, and After any unusual incident or circumstance

Stop
Assess the risk.
What could go wrong?
What is the worst that could
Happen if something did go wrong?

Caution
Analyse how to reduce the risk.
Do I have the necessary training and
Knowledge to do this job safely?
Do I have the proper tools and
Personal protective equipment?

Be Proactive
Act to ensure safe operations.
Take necessary action to ensure
the job is done safely
Follow written procedures.
Ask for assistance if needed.

BEFORE WORK Basic Tasks	Hazards	Hazard Controls
Driving	Bogging, Rolling, Sliding	Max Tracks, Positive radio
	On site interaction	comms, obey traffic signage
	with trucks, graders	Driver confident in tracks
Handwork	Cuts and Abrasions,	Check tools before use, clear
	blunt tools, off target	area before cutting, correct
	damage	PPE (gloves, hat)
	Weather	Monitor conditions
	Slips Trips and	Watch footing, stay alert
	Falls	of surroundings
	Snakes, Ticks and	Bushmans, Gaitors
	Spiders	
	Fatigue, Heat and	Drink plenty of water, take
	Dehydration	regular breaks

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DAILY ACTIVITY RECORD

Supervisors name:	Signature:	Location:	Date:	Time:

Identified safety issues that have not been covered in the SWMS and is specific to changing site conditions.

Loss Prevention Self-Assessment (LPSA)
Before beginning any activity, task or job, and After any unusual incident or circumstance

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Do I have the proper tools and
Personal protective equipment?

Be Proactive
Act to ensure safe operations.
Take necessary action to ensure
the job is done safely
Follow written procedures.
Ask for assistance if needed.

Basic Tasks	Hazards	Hazard Controls

Land Management Daily Worksheet/ Chemical Record

Date: 22/2/21	Project Name: Oyster Cove Holcim			Project No: 20211346
Site Location/Address:	Routike Road, Oyster Cove			
Supervisor: Jake Mauger	Applicator: Isabelle Cole	Applicator:	Applicator:	Applicator:
Signature:	Signature:	Signature:	Signature:	Signature:
Applicator:	Applicator:	Applicator:	Applicator:	Applicator:
Signature:	Signature:	Signature:	Signature:	Signature:

Safety Measures

☑ Risk Management; has the chemical SDS and label be checked and the appropriate controls in place?

☑ Are the weather conditions suitable for spraying i.e. light winds, with no rain predicted within 6 hours?

☑ Measures taken to minimise off target damage: i.e. pre-cleared around natives, adjusted nozzles to suit, etc.

☑ Equipment pre-checks, prepared area for chemical decant.

☑ Chemicals SDS in date and available	☑ Chemical Spill kit	☑ First Aid Kit	☑ Eye Rinse	☑ Potable Water	☐ Signage
☑ PPE; long sleeves and pants, washable hat, steel cap boots/ gumboots, chemical gloves, safety glasses				☐ Chem splash Apron	
☐ Respirator	☐ Googles	☐ Elbow length PVC gloves	☐ Chemical Overalls Disposable	☐ Face shield	☐

Chemical Application Details

Method of application:	Applicator Bottle		
Product name & rate used:	5 x 120ml bottles		
	100%		
Total volume	600ml		

Product Name:	Glyphosphate 360				
Undiluted amount used in mL:	600				

Herbicide:	Glyphosate 360	Metsulfuron	BrushWet	Dye	Garlon 600	Grazon Extra	Starane Advance
Label Rates:	50ml-200mls:10L	1-2g:10L	10-20ml:10L	10-15mls:10L	17-300mls:10L	35-50mls:10L	21-90mls:10L

Weather Details

☐ Clear Sky	☐ Light Cloud	☐ Overcast	☐ Showers	☐

Times: start/finish	Temp °C	Humidity %	Wind km/h	Direction	Beaufort Wind Scale
~~7:39~~ 7:30	22.9	93	12	SE	
~~2:39~~ 2:30	27.6	56	20	S	

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Land Management Daily Worksheet/ Chemical Record

Date: 22/2/21 Site name: Oyster Cove Holcim Project #: 20211346 Task #:
Supervisor: Jake Manger Team members: Isabelle Cole

Start: 6am Onsite: 7:15 Offsite: 3pm Finish: 4pm Hours on site (less lunch): 8

☑ Vehicle pre-start check, First Aid, Supervisors Bag ☑ All Site Paperwork i.e. Site location, VMP, HASP, SWMS, SDS
☑ Equipment pre-start checks ☐ First Aid Kit used ☐ Vehicle issue noticed/ please note in comments

Works completed (primary / secondary / area or zone covered / maintenance weed control / target weed species and control technique/ revegetation / watering / mulching etc.)

Continuation of sweeping through North-Eastern Corner cutting and painting large Lantana bases and hand pulling seedlings Cut down several Slash pines remaining found in middle of site area

Chemicals used (undiluted): 600ml Glyphosphate 360
Fauna observations: Red Bellied Black Snake, Blue Tongue Lizard

Client liaison notes:

Comments/ future management recommendations/ WHS issues:

Equipment Used:		
☐ Backpack Sprayer	☐ Chainsaw	☐ Fuels; 2 stroke mix, unleaded, diesel
☐ Quick spray	☐ Auger	☐ Mowers hand/ride on
☐ Brush cutter	☐ Watering Cart/ Pump	☐ Splatter Gun
☐	☐	☐

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Land Management Daily Worksheet/ Chemical Record

Date: 22/2/21 Site name: Oyster Cove Holcim Project #: 20211346 Task #:
Supervisor: Jake Manger Team members: Isabelle Cole

Start: 6am Onsite: 7:15 Offsite: 3pm Finish: 4pm Hours on site (less lunch): 8

☑ Vehicle pre-start check, First Aid, Supervisors Bag ☑ All Site Paperwork i.e. Site location, VMP, HASP, SWMS, SDS
☑ Equipment pre-start checks ☐ First Aid Kit used ☐ Vehicle issue noticed/ please note in comments

Works completed (primary / secondary / area or zone covered / maintenance weed control / target weed species and control technique/ revegetation / watering / mulching etc.)

Continuation of sweeping through North-Eastern Corner cutting and painting large Lantana bases and hand pulling seedlings Cut down several Slash pines remaining found in middle of site area

Chemicals used (undiluted): 600ml Glyphosphate 360
Fauna observations: Red Bellied Black Snake, Blue Tongue Lizard

Client liaison notes:

Comments/ future management recommendations/ WHS issues:

Equipment Used:		
☐ Backpack Sprayer	☐ Chainsaw	☐ Fuels; 2 stroke mix, unleaded, diesel
☐ Quick spray	☐ Auger	☐ Mowers hand/ride on
☐ Brush cutter	☐ Watering Cart/ Pump	☐ Splatter Gun
☐	☐	☐

DAILY ACTIVITY RECORD

Supervisors name:	Signature:	Location:	Date:	Time:
Jake Manger		Oyster Cove	23/2/21	7:30

Print name:	Print name:	Print name:	Print name:	Print name:	Print name:
Isabelle Cole					
Signature:	**Signature:**	**Signature:**	**Signature:**	**Signature:**	**Signature:**

WEATHER Section 1.2

Location:	Temp [Now]:	Humidity:	Temp [Fore]:	UV Rating:	Wind [Max]:	Current Warnings:
Oyster Cove	20.5	86	23	16	14	

GENERAL Section 1.3

Site Access Requirements / Issues:	Security Requirements:	Emergency Muster Point:		
Sign in at Office		Vechicle		
Public Safety Issues:	**Planned Meeting Point:**	**Break 1 Time:**	**Break 2 Time:**	**Break 3 Time:**
	Vechicle	10:00	12:30	

PRE-WORK SAFTEY REVIEW Section 2.0

Identified safety issues that have not been covered in the SWMS and is specific to changing site conditions.

Loss Prevention Self-Assessment (LPSA)
Before beginning any activity, task or job, and After any unusual incident or circumstance

Stop
Assess the risk.
What could go wrong?
What is the worst that could
Happen if something did go wrong?

Caution
Analyse how to reduce the risk.
Do I have the necessary training and
Knowledge to do this job safely?
Do I have the proper tools and
Personal protective equipment?

Be Proactive
Act to ensure safe operations.
Take necessary action to ensure
the job is done safely
Follow written procedures.
Ask for assistance if needed.

BEFORE WORK Basic Tasks	Hazards	Hazard Controls
Driving	Bogging, Rolling, Sliding	Max Tracks, Driver confident,
	Interaction with other	Access Track before use, positive
	contractors	comms with other contractors
Handwork	Cuts and abrasions, blunt	Check tools before use, rotate
	tools, repetitive task,	tasks, clear area before cutting
	off target damage	
	Weather	Monitor Conditions
	Slips, Trips and	Watch footing, stay alert of
	Falls	surroundings
	Fatigue, Heat and	Drink plenty of water, seek shade
	Dehydration	Take regular breaks
	Snakes, Ticks and	Bushmens, Gaitors
	Spiders	

DAILY ACTIVITY RECORD

Supervisors name:	Signature:	Location:	Date:	Time:

Identified safety issues that have not been covered in the SWMS and is specific to changing site conditions.

Loss Prevention Self-Assessment (LPSA)
Before beginning any activity, task or job, and After any unusual incident or circumstance

Stop
Assess the risk.
What could go wrong?
What is the worst that could
Happen if something did go wrong?

Caution
Analyse how to reduce the risk.
Do I have the necessary training and
Knowledge to do this job safely?
Do I have the proper tools and
Personal protective equipment?

Be Proactive
Act to ensure safe operations.
Take necessary action to ensure
the job is done safely
Follow written procedures.
Ask for assistance if needed.

Basic Tasks	Hazards	

Land Management Daily Worksheet/ Chemical Record

Date: 23/2/21	Project Name: Oyster Cove Holcim Weed Control			Project No: 20211346
Site Location/Address:	Rutile Rd, Oyster Cove			
Supervisor: Jake Manager	Applicator: Isabelle Cole	Applicator:	Applicator:	Applicator:
Signature:	Signature:	Signature:	Signature:	Signature:
Applicator:	Applicator:	Applicator:	Applicator:	Applicator:
Signature:	Signature:	Signature:	Signature:	Signature:

Safety Measures

☑ Risk Management; has the chemical SDS and label be checked and the appropriate controls in place?

☑ Are the weather conditions suitable for spraying i.e. light winds, with no rain predicted within 6 hours?

☑ Measures taken to minimise off target damage: i.e. pre-cleared around natives, adjusted nozzles to suit, etc.

☑ Equipment pre-checks, prepared area for chemical decant.

☑ Chemicals SDS in date and available	☑ Chemical Spill kit	☑ First Aid Kit	☑ Eye Rinse	☑ Potable Water	☐ Signage
☑ PPE; long sleeves and pants, washable hat, steel cap boots/ gumboots, chemical gloves, safety glasses				☐ Chem splash Apron	
☐ Respirator	☐ Googles	☐ Elbow length PVC gloves	☐ Chemical Overalls Disposable	☐ Face shield	☐

Chemical Application Details

Method of application:	Applicator Bottle		
Product name & rate used:	100%		
	7x120 ml bottles		
Total volume	840ml		

Product Name:	Glyphosphate 360					
Undiluted amount used in mL:	840ml					

Herbicide:	Glyphosate 360	Metsulfuron	BrushWet	Dye	Garlon 600	Grazon Extra	Starane Advance
Label Rates:	50ml-200mls:10L	1-2g:10L	10-20ml:10L	10-15mls:10L	17-300mls:10L	35-50mls:10L	21-90mls:10L

Weather Details

☐ Clear Sky	☐ Light Cloud	☑ Overcast	☐ Showers	☐

Times: start/finish	Temp °C	Humidity %	Wind km/h	Direction	Beaufort Wind Scale
7:30	26.5	86	10	S	
2130	21.1	85	20	SE	

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Bright People. Right Solutions.

Land Management Daily Worksheet/ Chemical Record

Date: 23/2/21 Site name: Oyster Cove Weed Control Project #: 20211386 Task #:

Supervisor: Jake Manger Team members: Isabelle Cole

Start: 6am Onsite: 7:15 Offsite: 3pm Finish: 4pm Hours on site (less lunch): 7.5

☑ Vehicle pre-start check, First Aid, Supervisors Bag ☑ All Site Paperwork i.e. Site location, VMP, HASP, SWMS, SDS

☑ Equipment pre-start checks ☐ First Aid Kit used ☐ Vehicle issue noticed/ please note in comments

Works completed (primary / secondary / area or zone covered / maintenance weed control / target weed species and control technique/ revegetation / watering / mulching etc.)

Continuation of sweeping heavy Lantana infestation in north-eastern corner cutting and painting large bases and placed back on stump to minimise disturbance

Started sweeping back section of site clearing moderate infestations of Lantana with cut and paint technique

Chemicals used (undiluted): 840ml Glyphosphate 360

Fauna observations: Blue Tongue Lizard, Goanna

Client liaison notes:

Comments/ future management recommendations/ WHS issues:

Equipment Used:		
☐ Backpack Sprayer	☐ Chainsaw	☐ Fuels; 2 stroke mix, unleaded, diesel
☐ Quick spray	☐ Auger	☐ Mowers hand/ride on
☐ Brush cutter	☐ Watering Cart/ Pump	☐ Splatter Gun
☐	☐	☐

APPENDIX 2. STAFF CONTRIBUTIONS

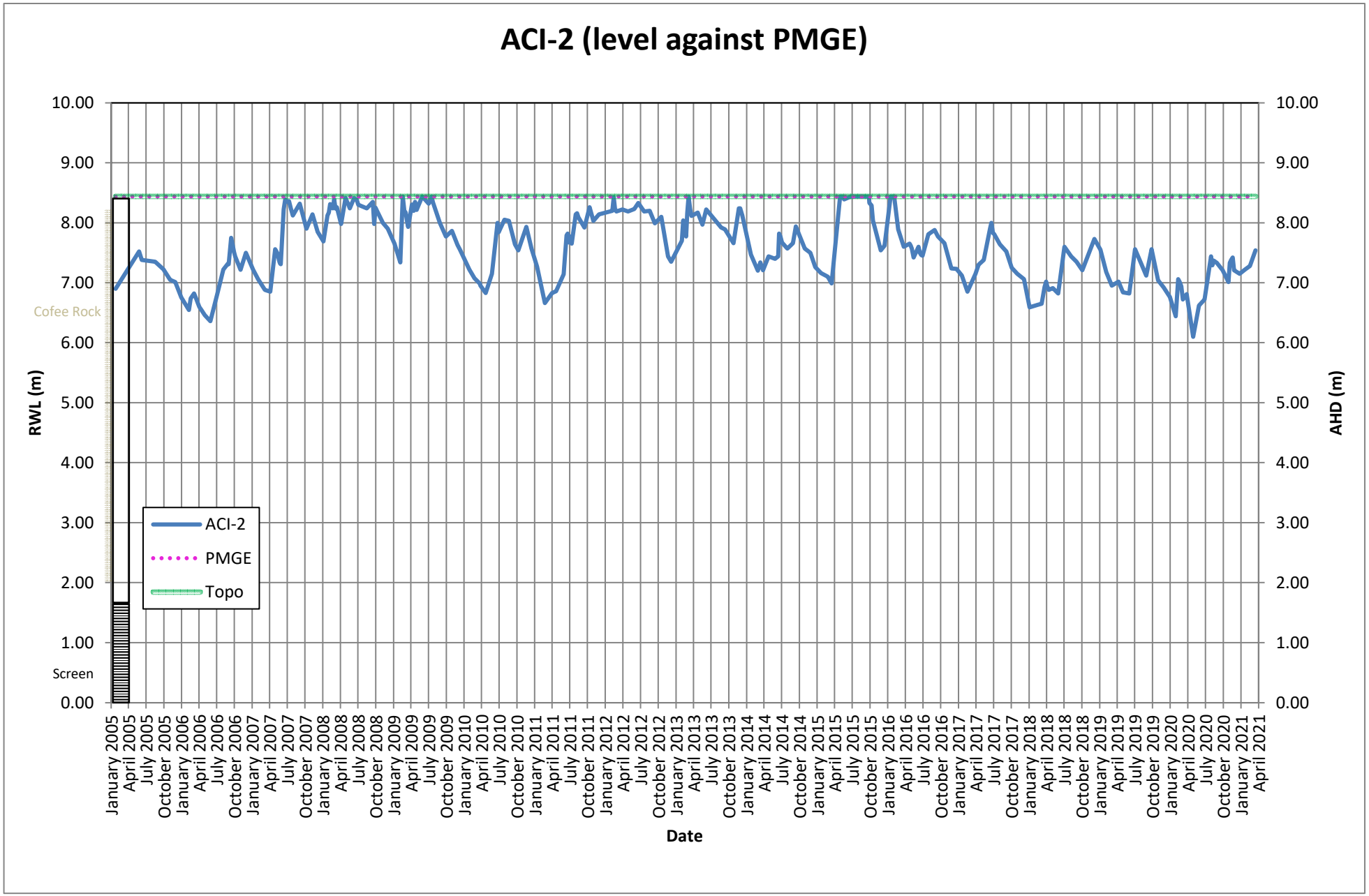
The following staff were involved in the works required for the compilation of this report.

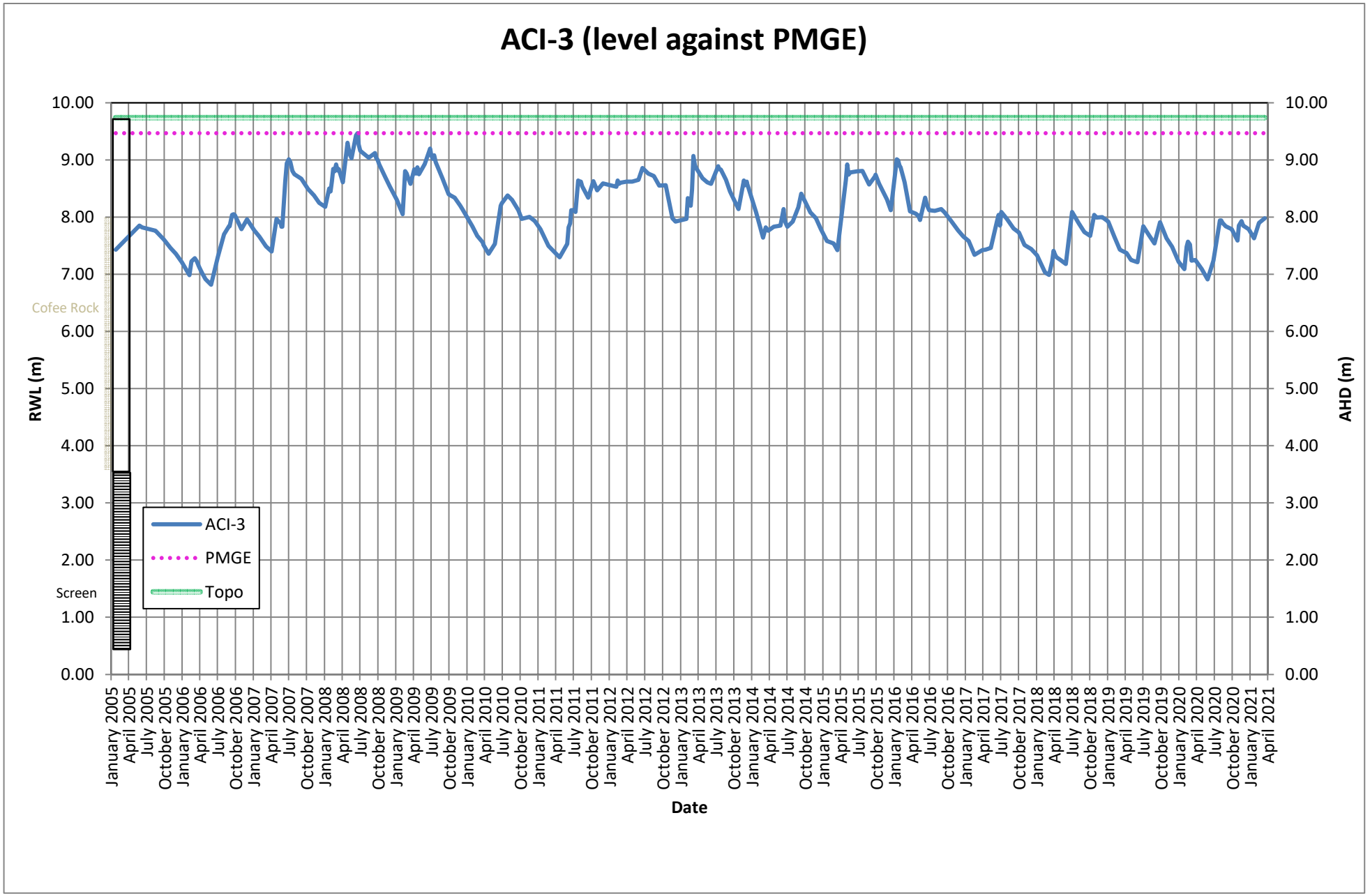
Name	Qualification	Title/Experience	Contribution
Gayle Joyce	BSc Forestry – Hons 1	GIS Specialist	Figures and mapping
Daniel O'Brien	BEnvSc & Mgt (Hons) PhD	Ecologist	Field work and Reporting
Nigel Fisher	BSc (Hons) PhD	Senior Soil Microecologist	Project Management, Field work and Reporting
Mark Dean	BEnvSc & Mngt	Ecologist	Field work and Reporting
Ben Stewart	BSc, MSc	Ecologist	Field work
Jacob McNeill	BEnvSc & Mngt	Junior Ecologist	Field work
Jake Maugher	BEnvSc & Mngt	Land Mgt Supv	Field work
Emerson Huuk	Land Con Cert	Land Mgt Technician	Field work
Isabelle Cole	Land Con Cert	Land Mgt Technician	Field work

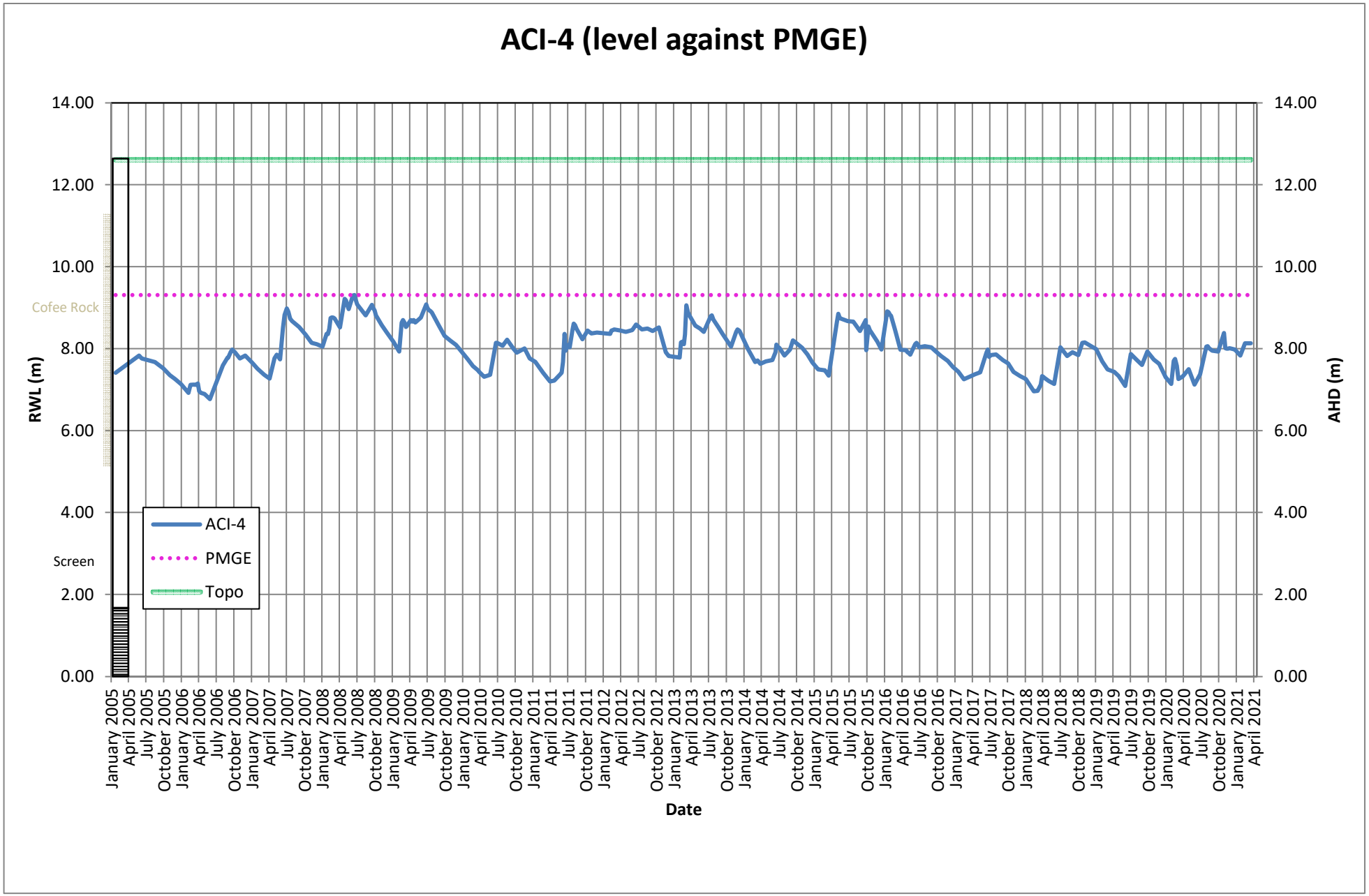
Copyright 2021 Kleinfelder

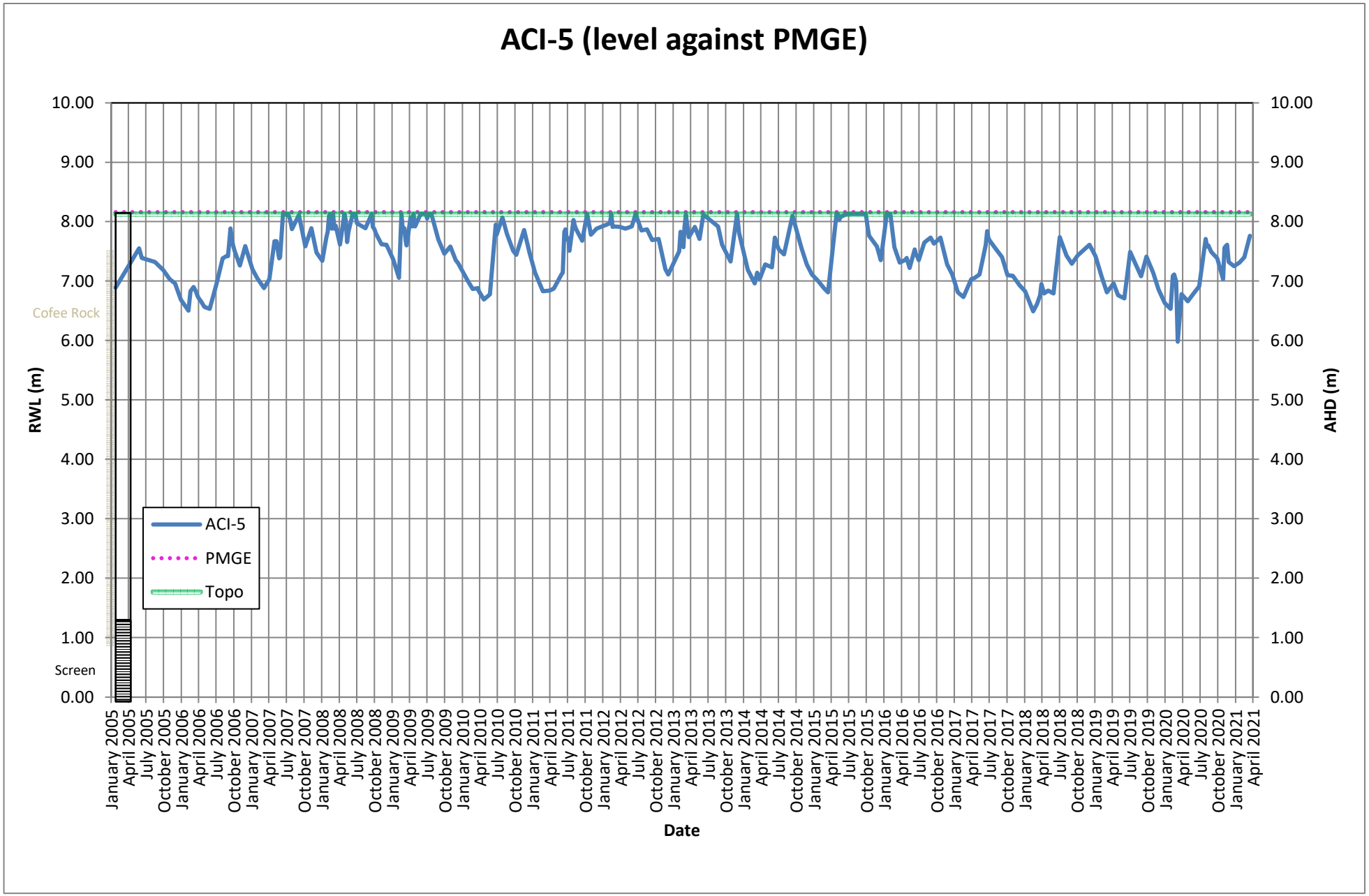
APPENDIX 3

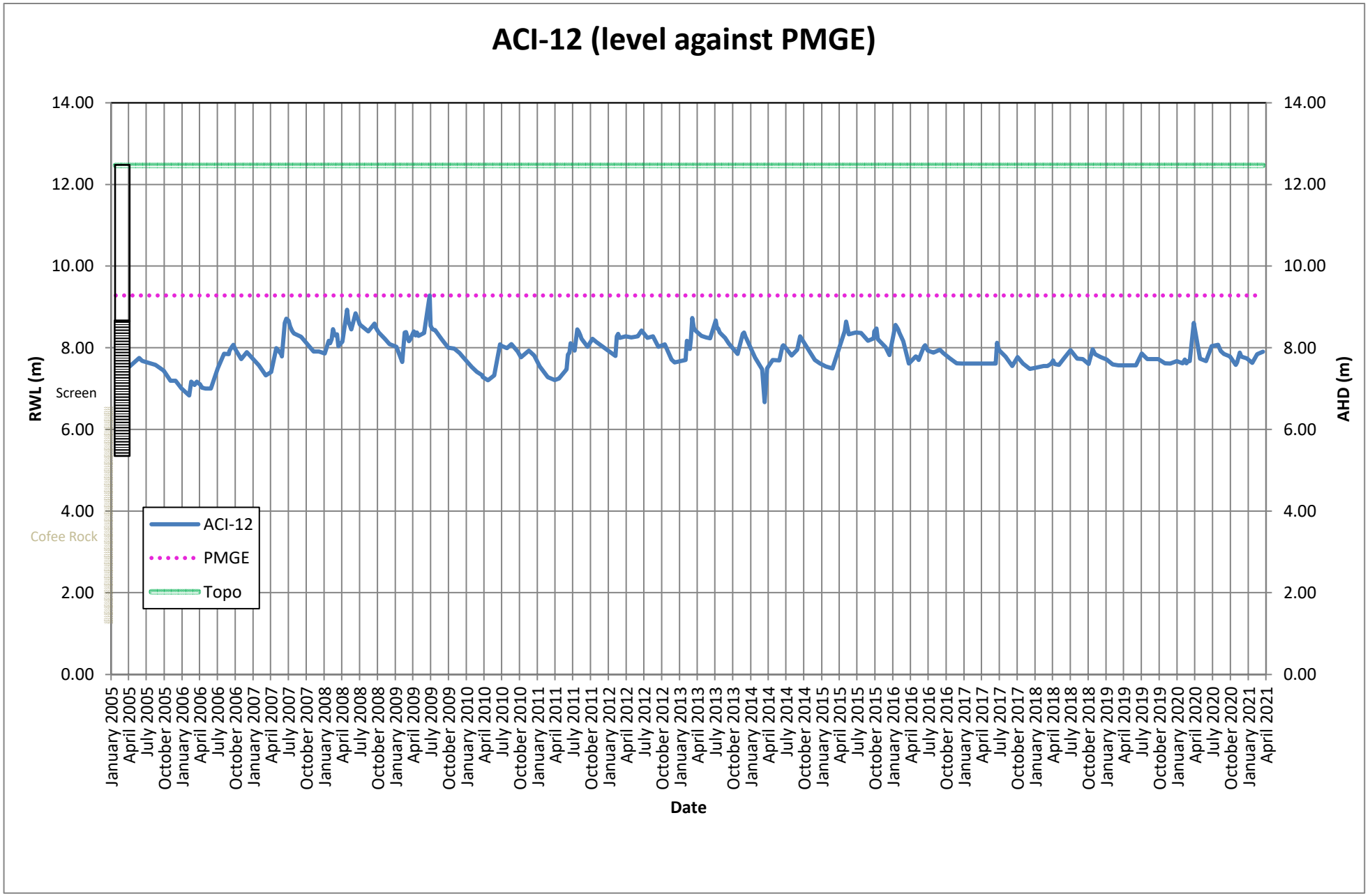
GROUNDWATER LEVEL TREND HYDROGRAPHS

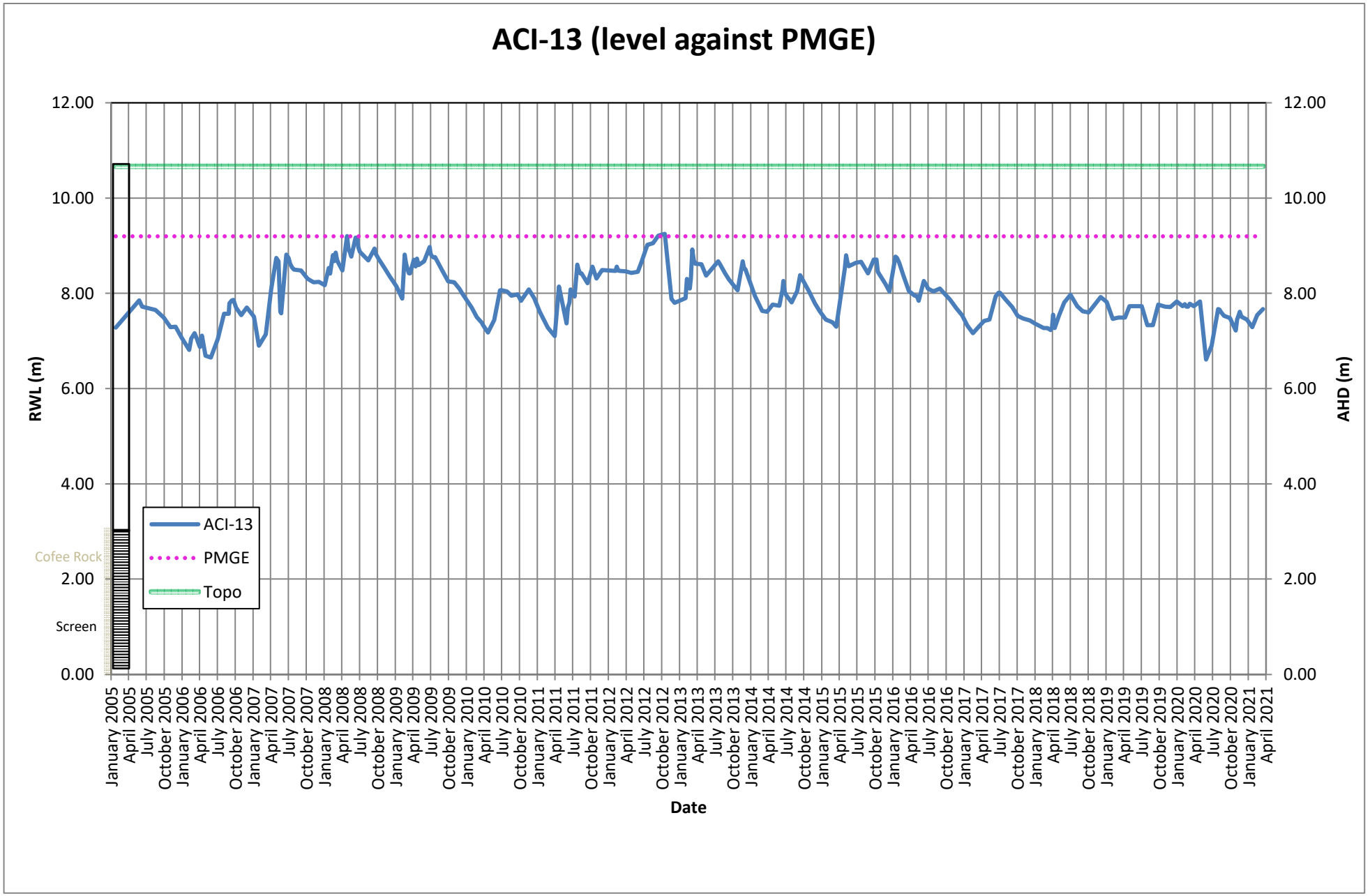

ACI-2 (level against PMGE)
RWL (m)
AHD (m)
10.00
9.00
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ACI-3 (level against PMGE)
RWL (m)
AHD (m)
10.00
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ACI-4 (level against PMGE)
RWL (m)
AHD (m)
14.00
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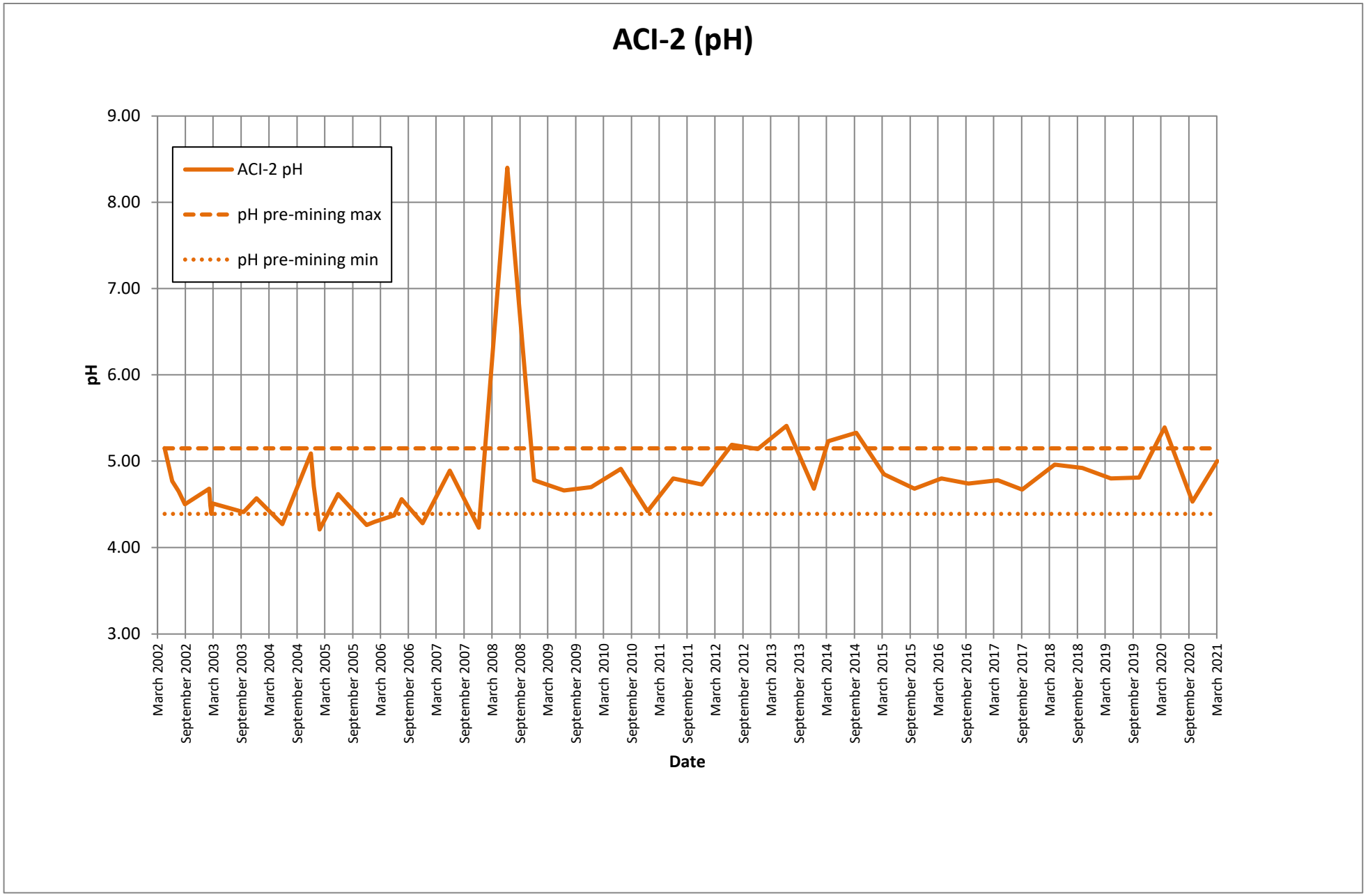

ACI-5 (level against PMGE)
RWL (m)
AHD (m)
10.00
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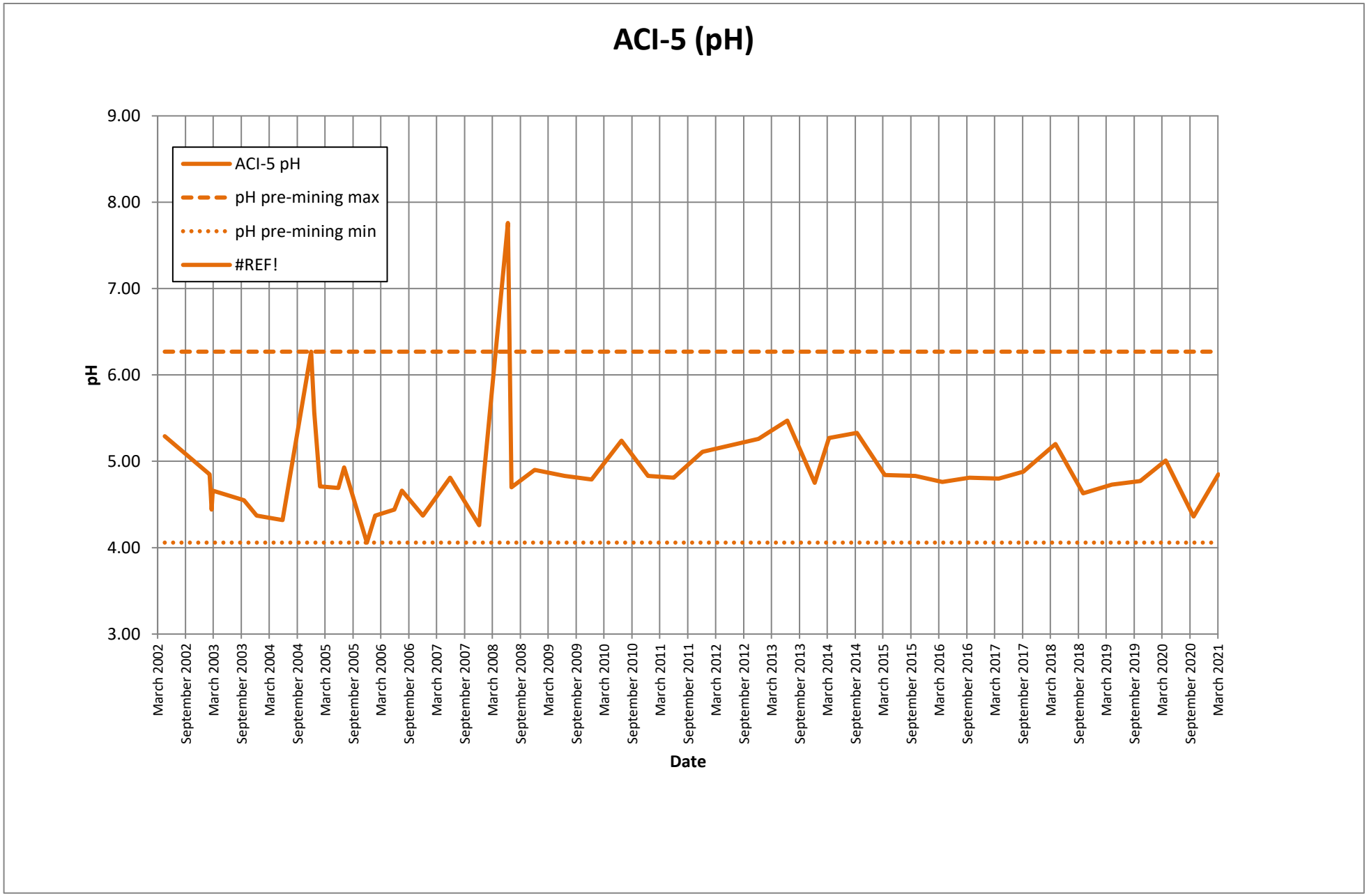

ACI-12 (level against PMGE)
RWL (m)
AHD (m)
14.00
12.00
10.00
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Screen
Cofee Rock
ACI-12
PMGE
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January 2005
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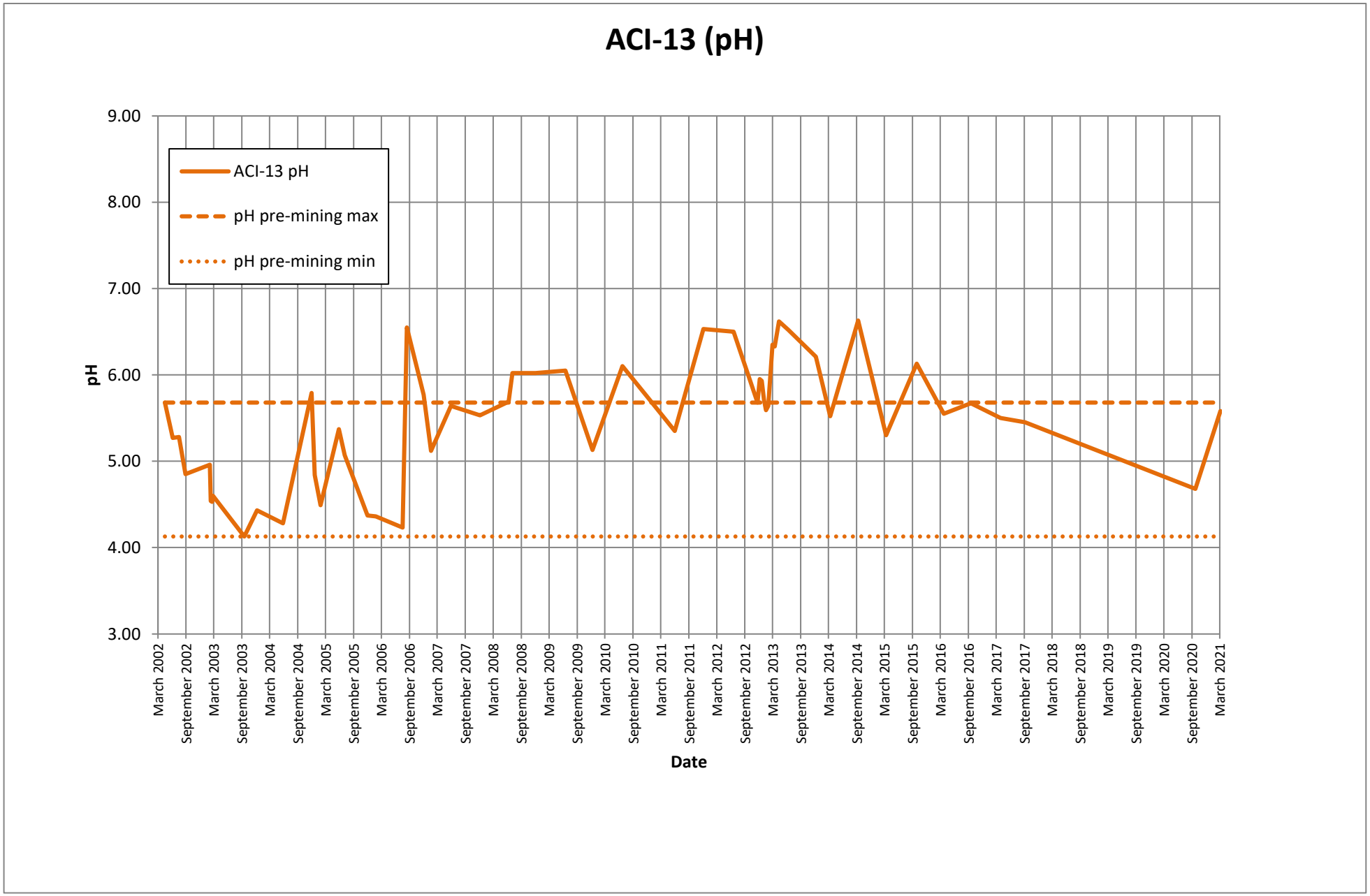

ACI-13 (level against PMGE)
RWL (m)
AHD (m)
12.00
10.00
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0.00
Cofee Rock
Screen
ACI-13
PMGE
Topo
January 2005
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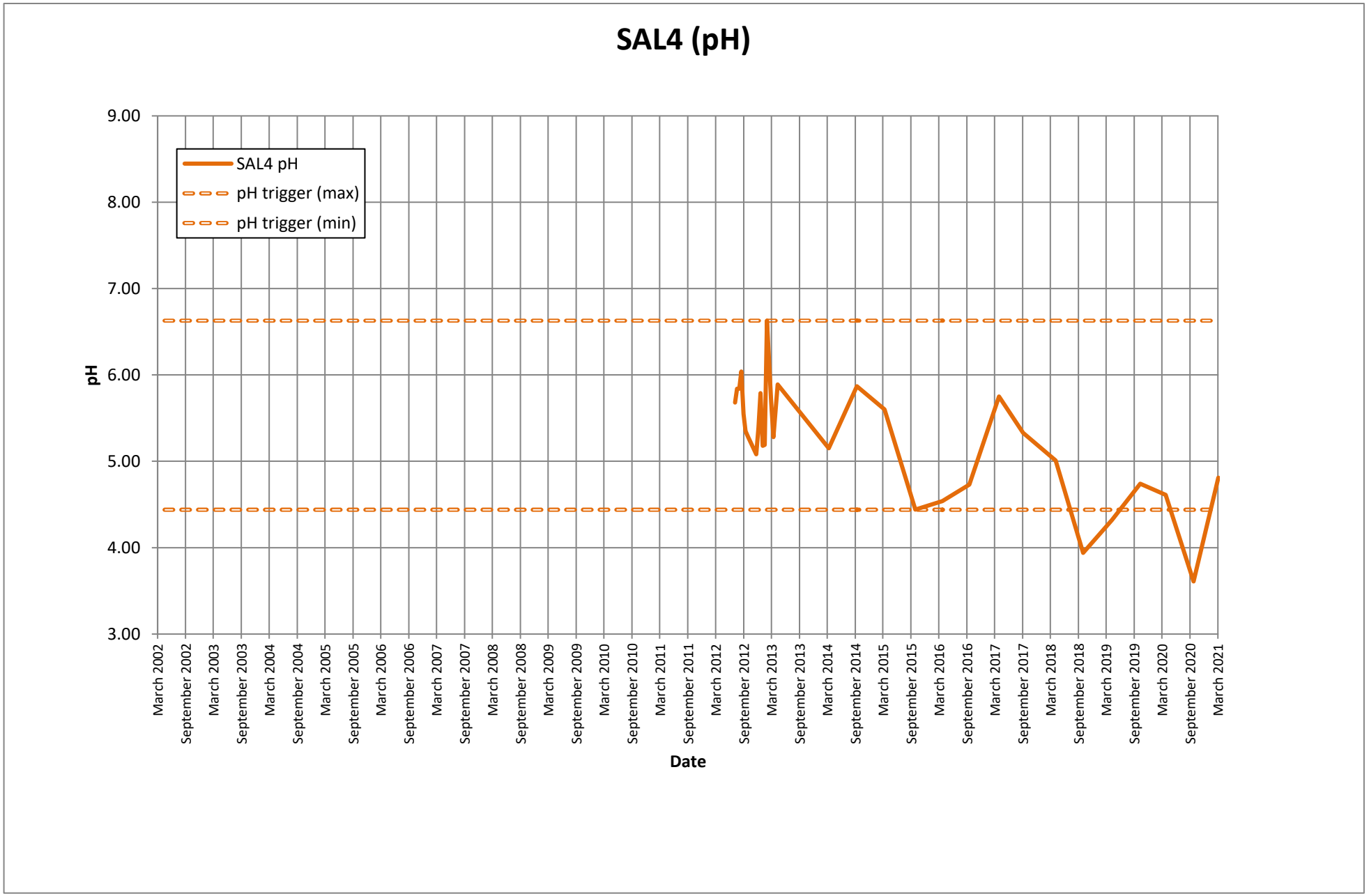
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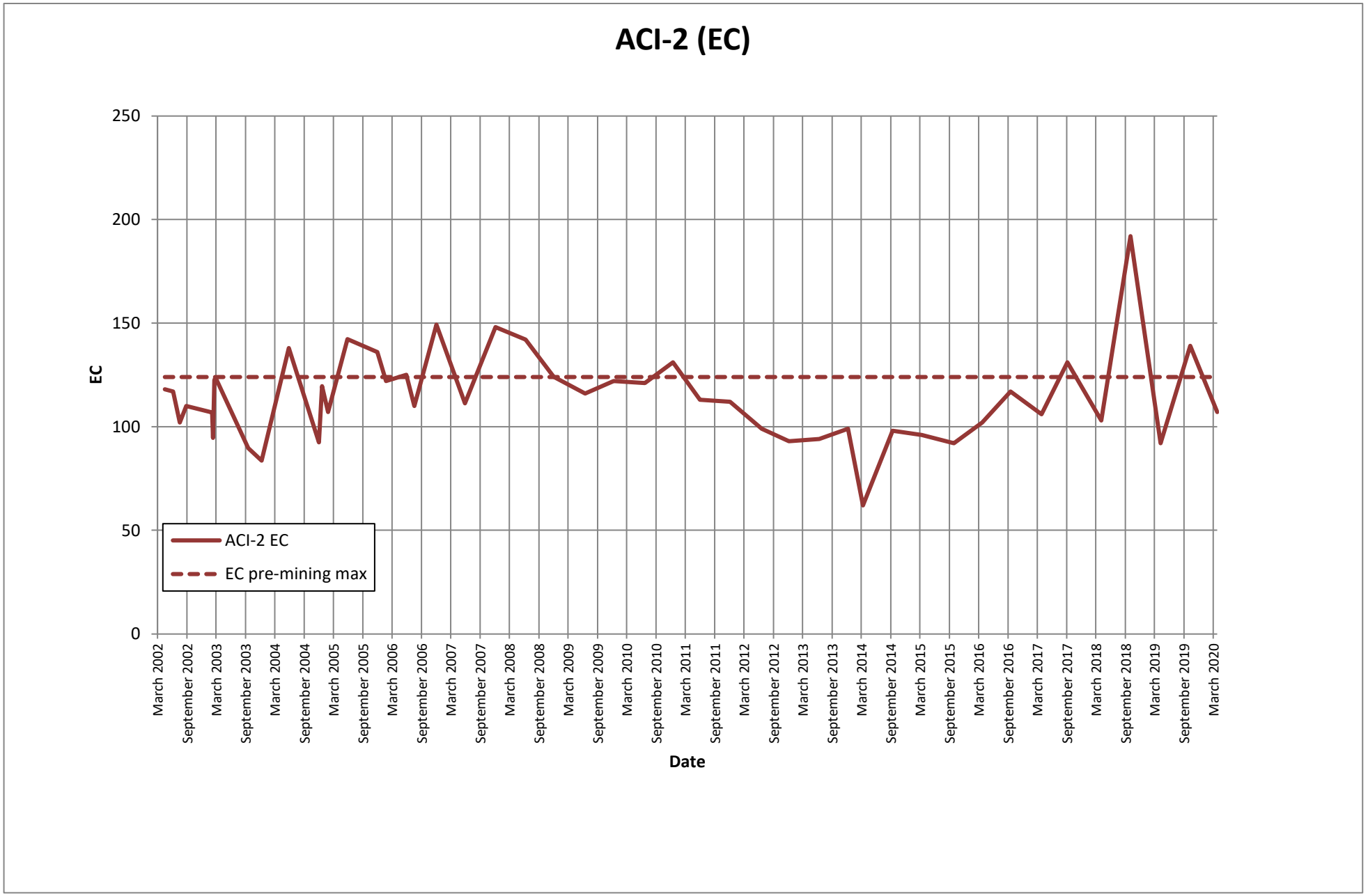
GROUNDWATER QUALITY TREND HYDROGRAPHS (QUALITY VS. TRIGGER VALUES)

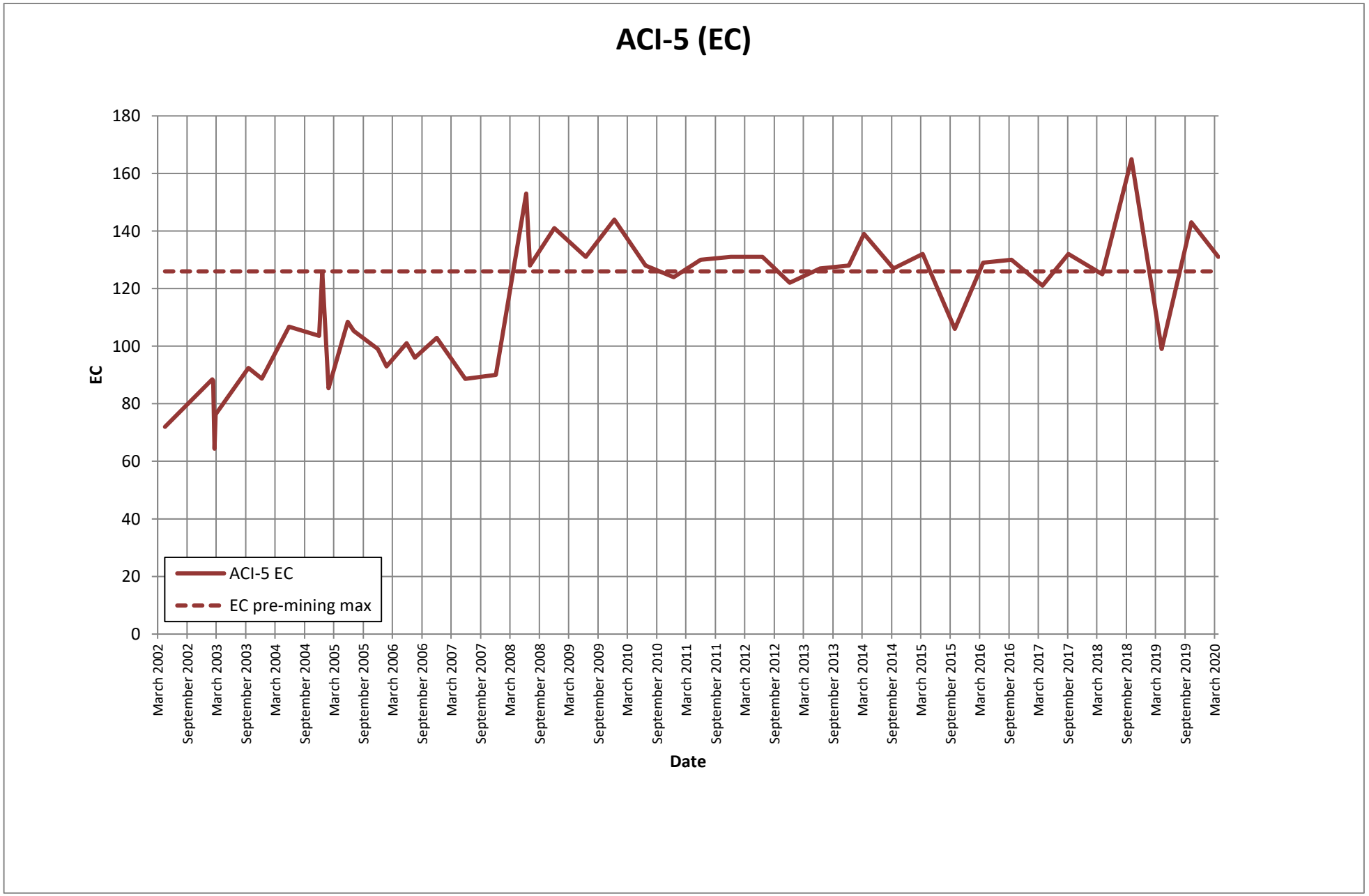

ACI-2 (pH)
ACI-2 pH
pH pre-mining max
pH pre-mining min
pH
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March 2002
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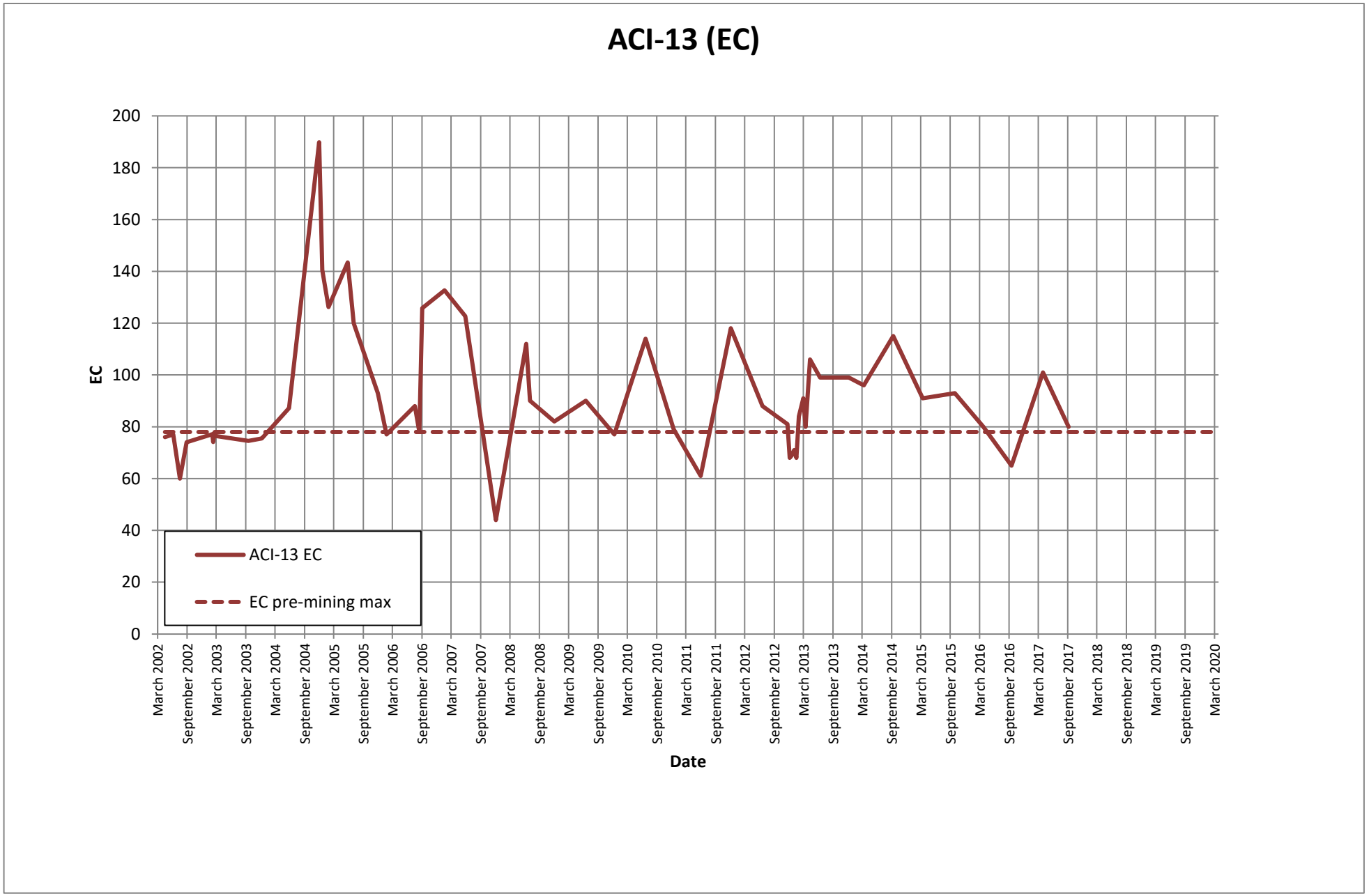

ACI-5 (pH)
ACI-5 pH
pH pre-mining max
pH pre-mining min
#REF!
pH
9.00
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4.00
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March 2002
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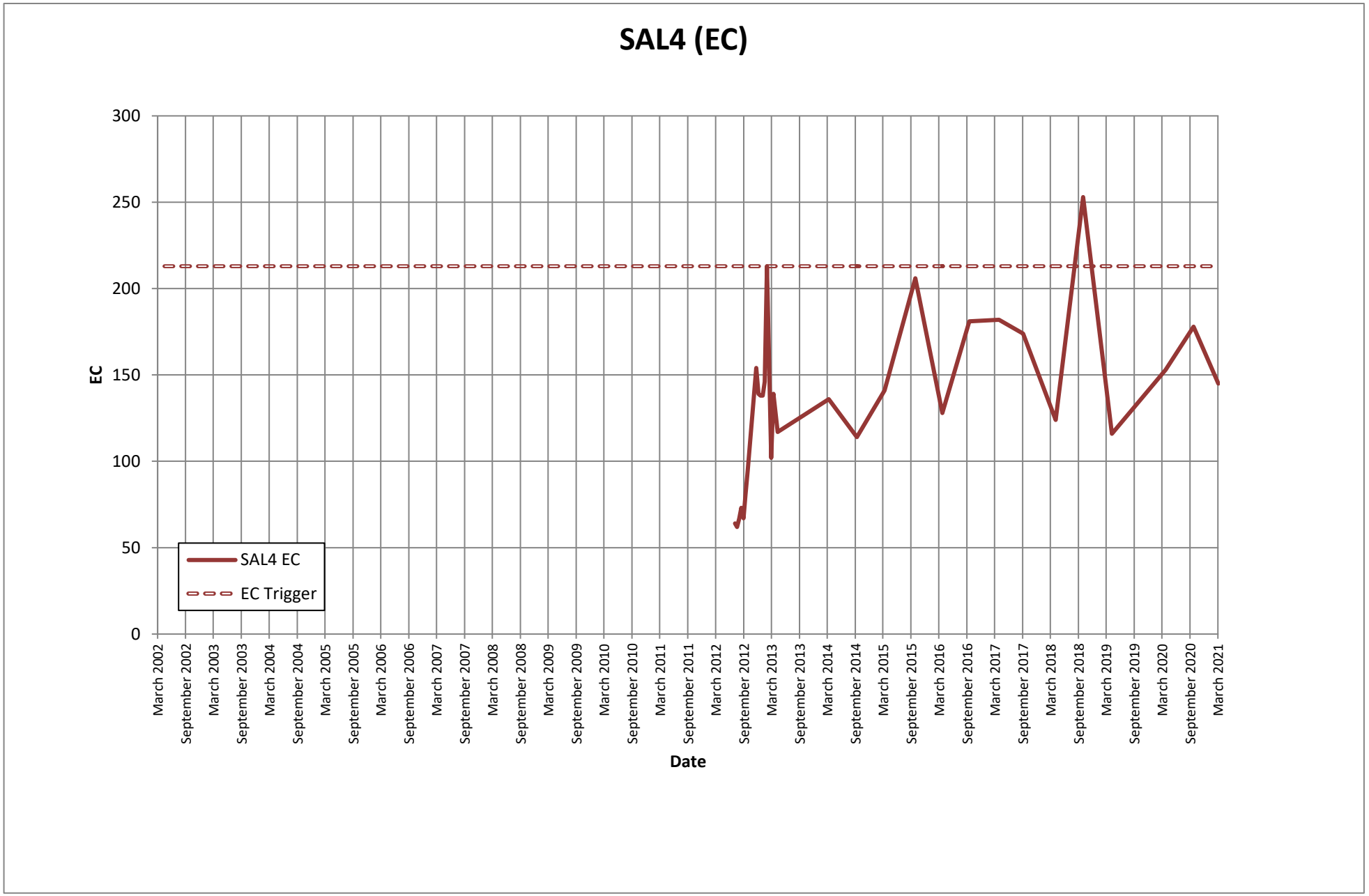

ACI-13 (pH)
ACI-13 pH
pH pre-mining max
pH pre-mining min
pH
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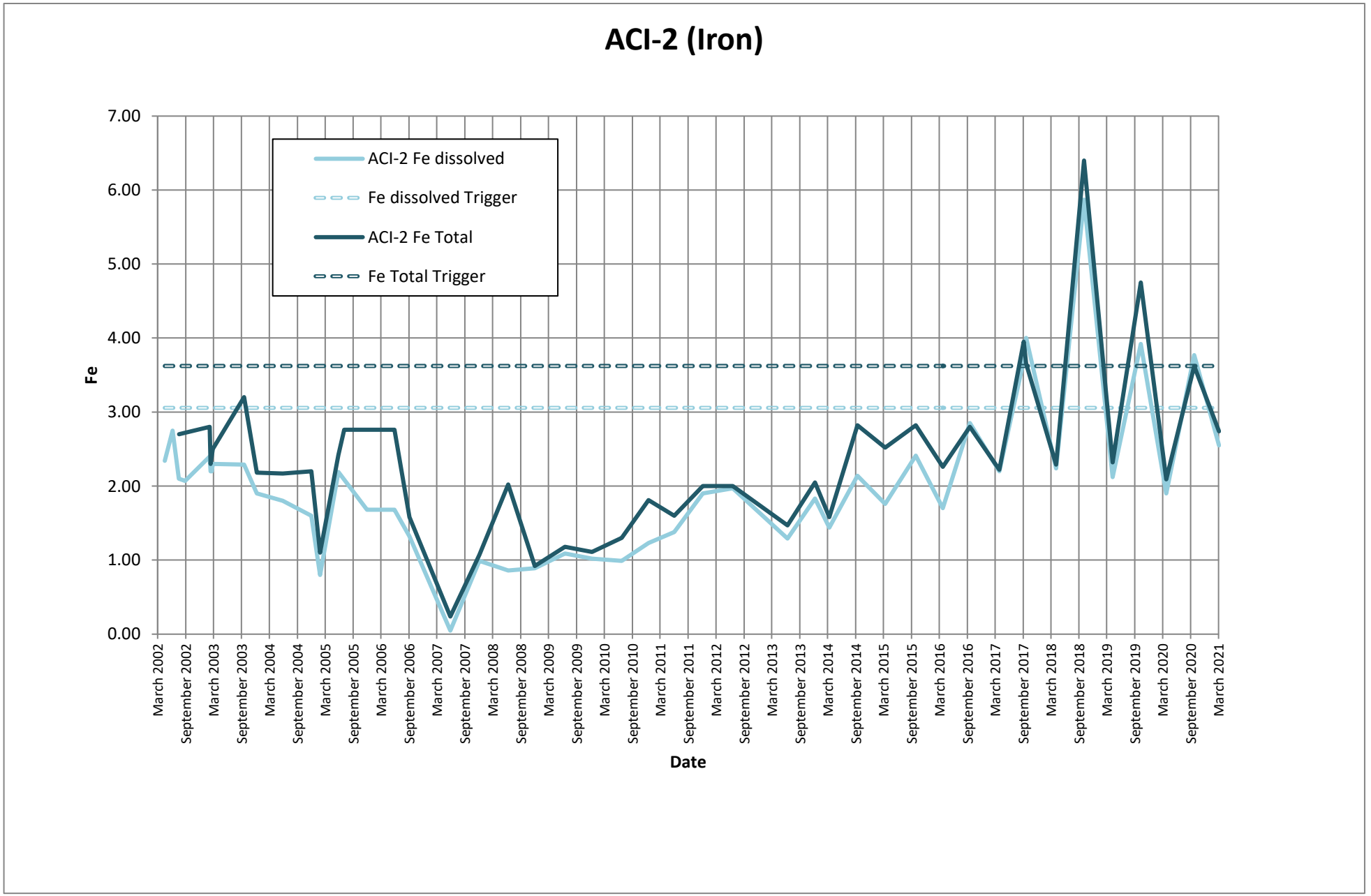

SAL4 (pH)
SAL4 pH
pH trigger (max)
pH trigger (min)
pH
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March 2002
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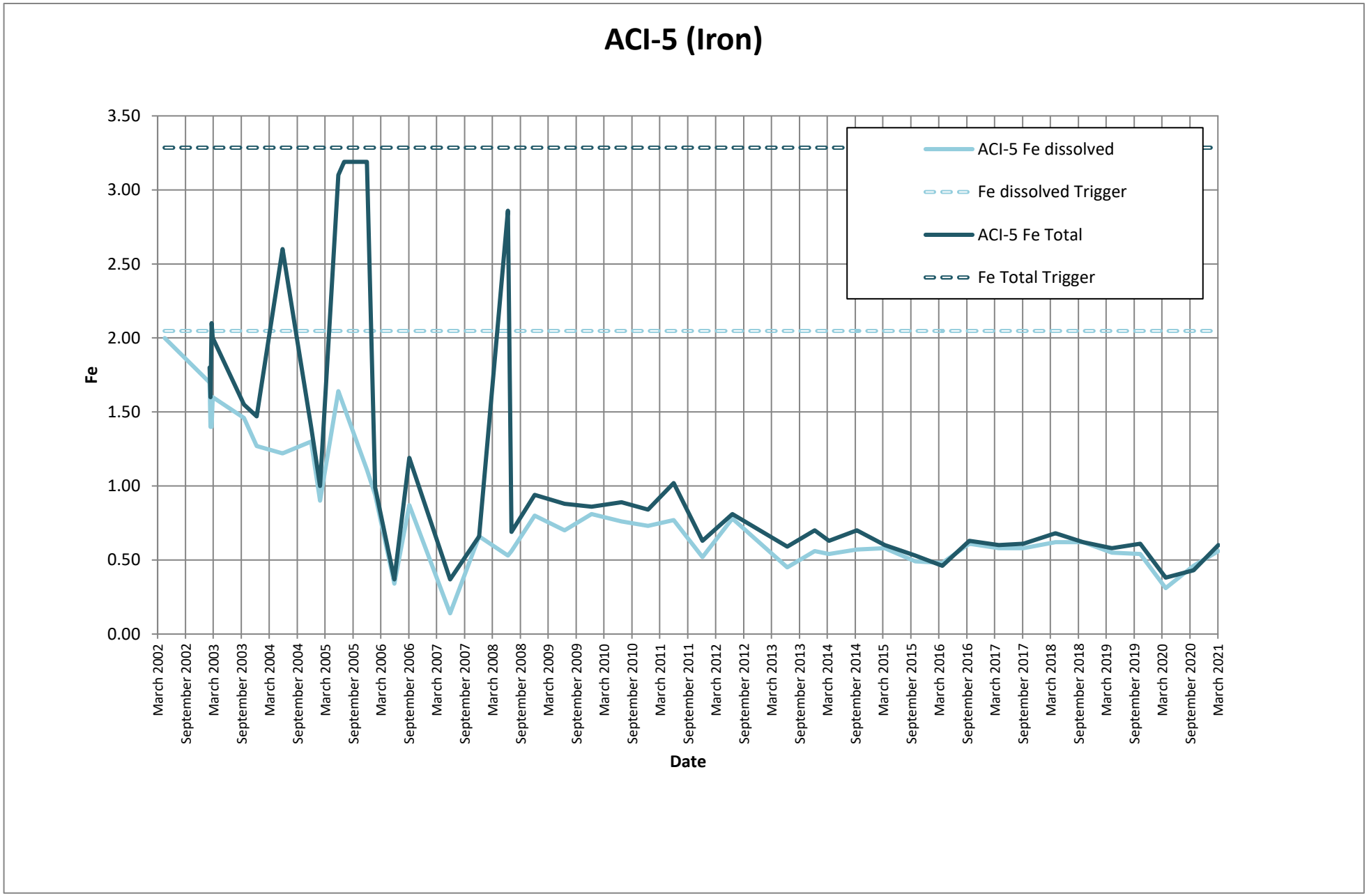

ACI-2 (EC)
EC
250
200
150
100
50
0
ACI-2 EC
EC pre-mining max
March 2002
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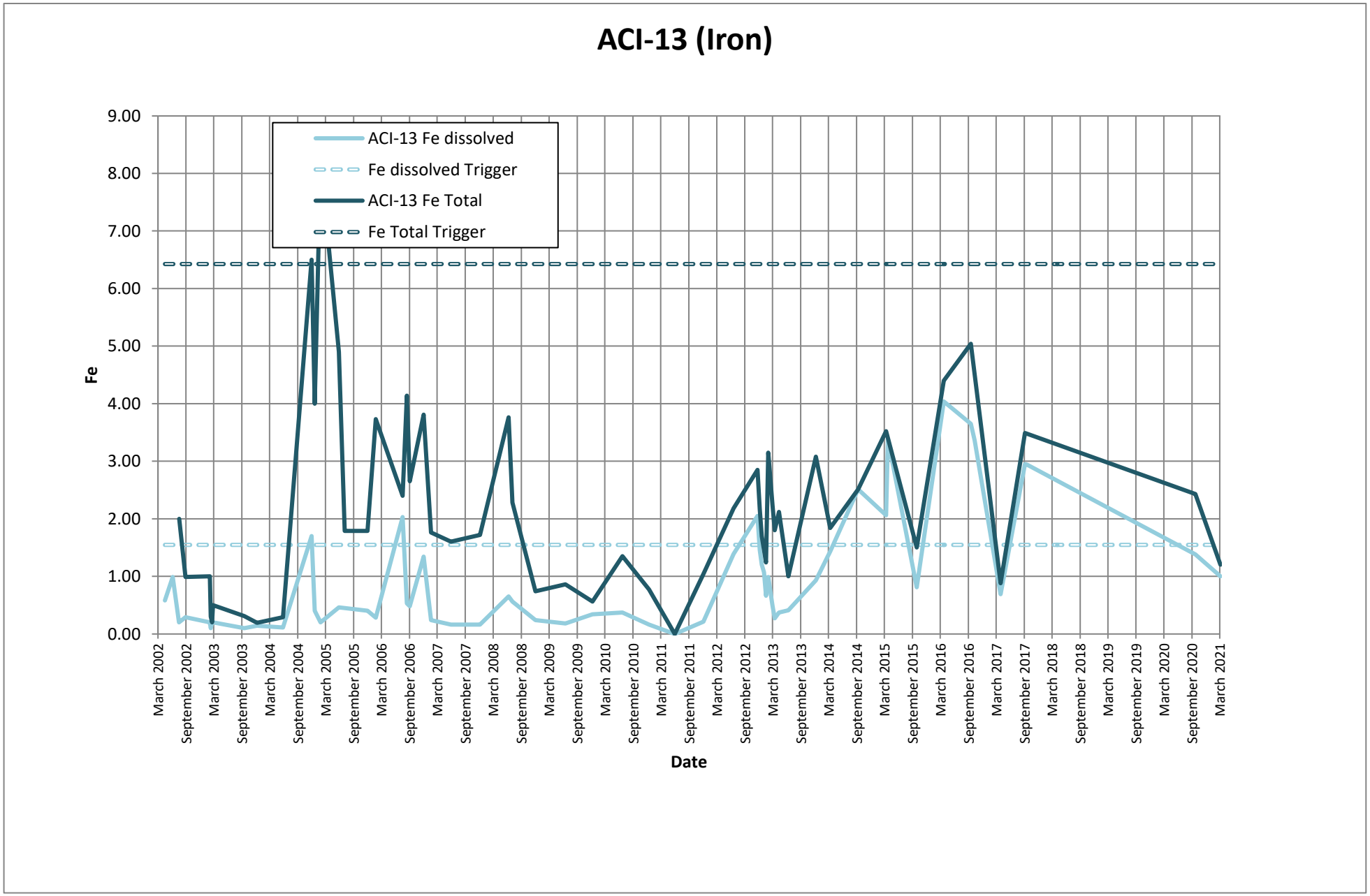

ACI-5 (EC)
EC
180
160
140
120
100
80
60
40
20
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ACI-5 EC
EC pre-mining max
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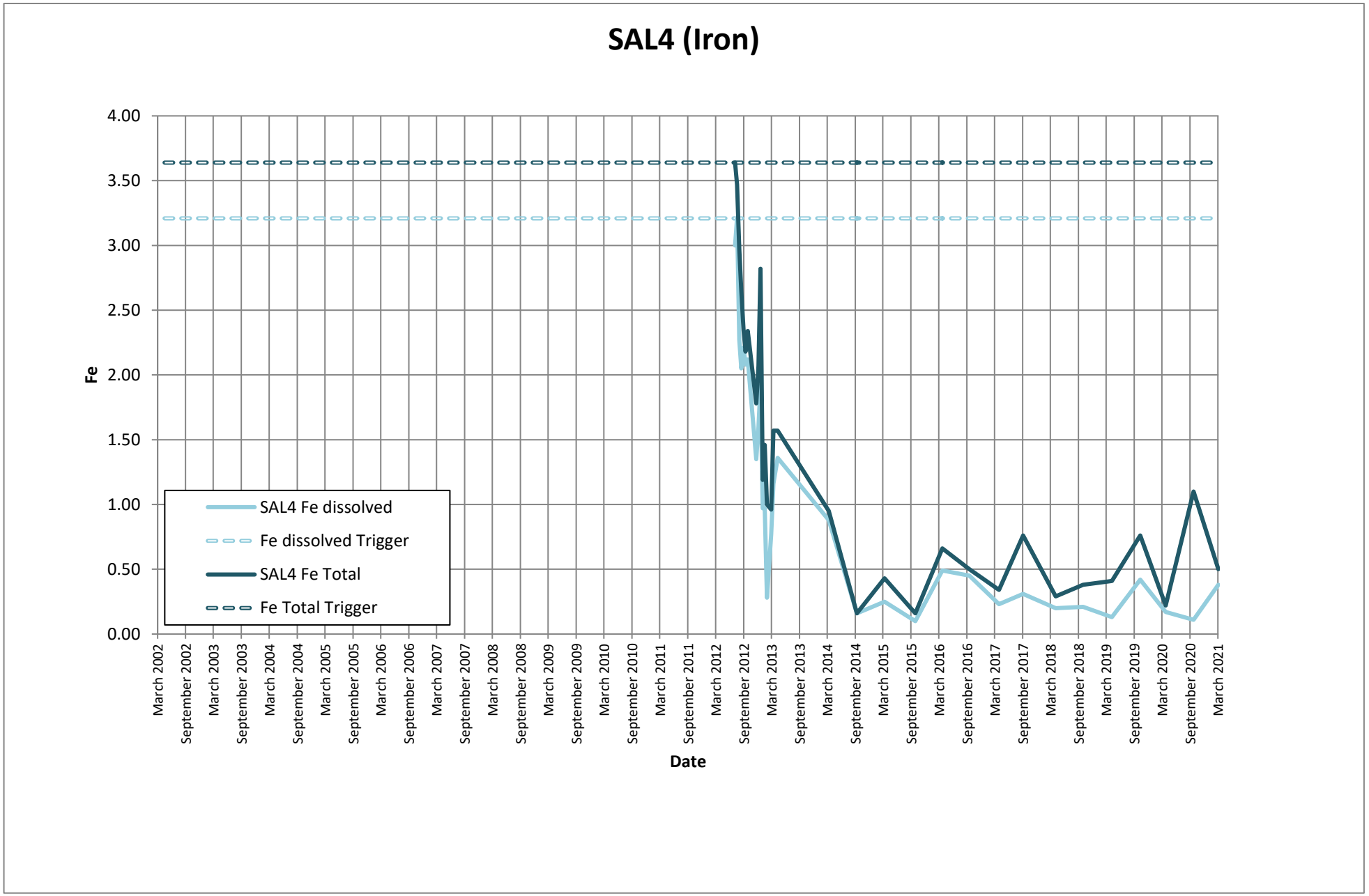

ACI-13 (EC)
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ACI-13 EC
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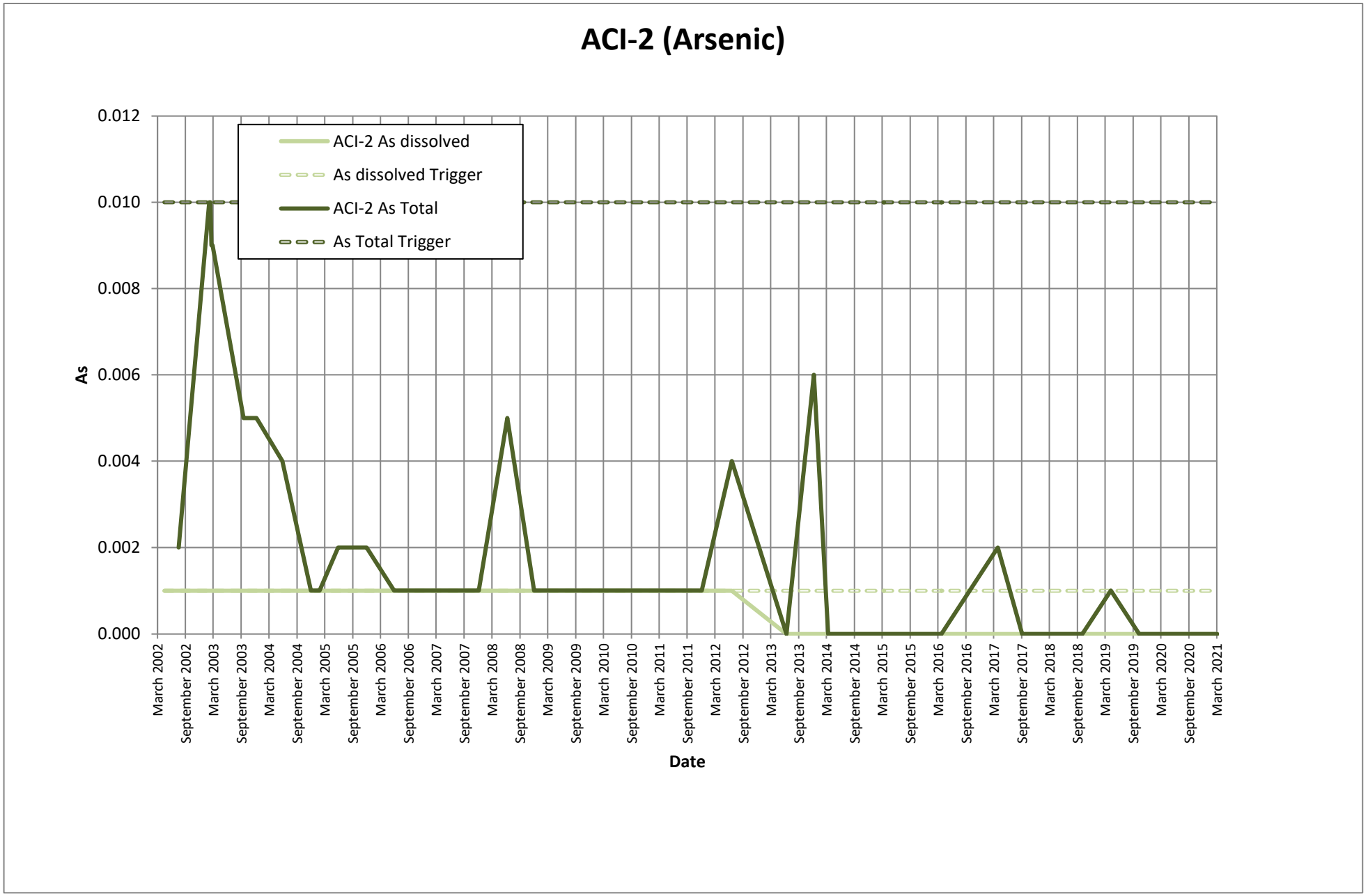

SAL4 (EC)
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SAL4 EC
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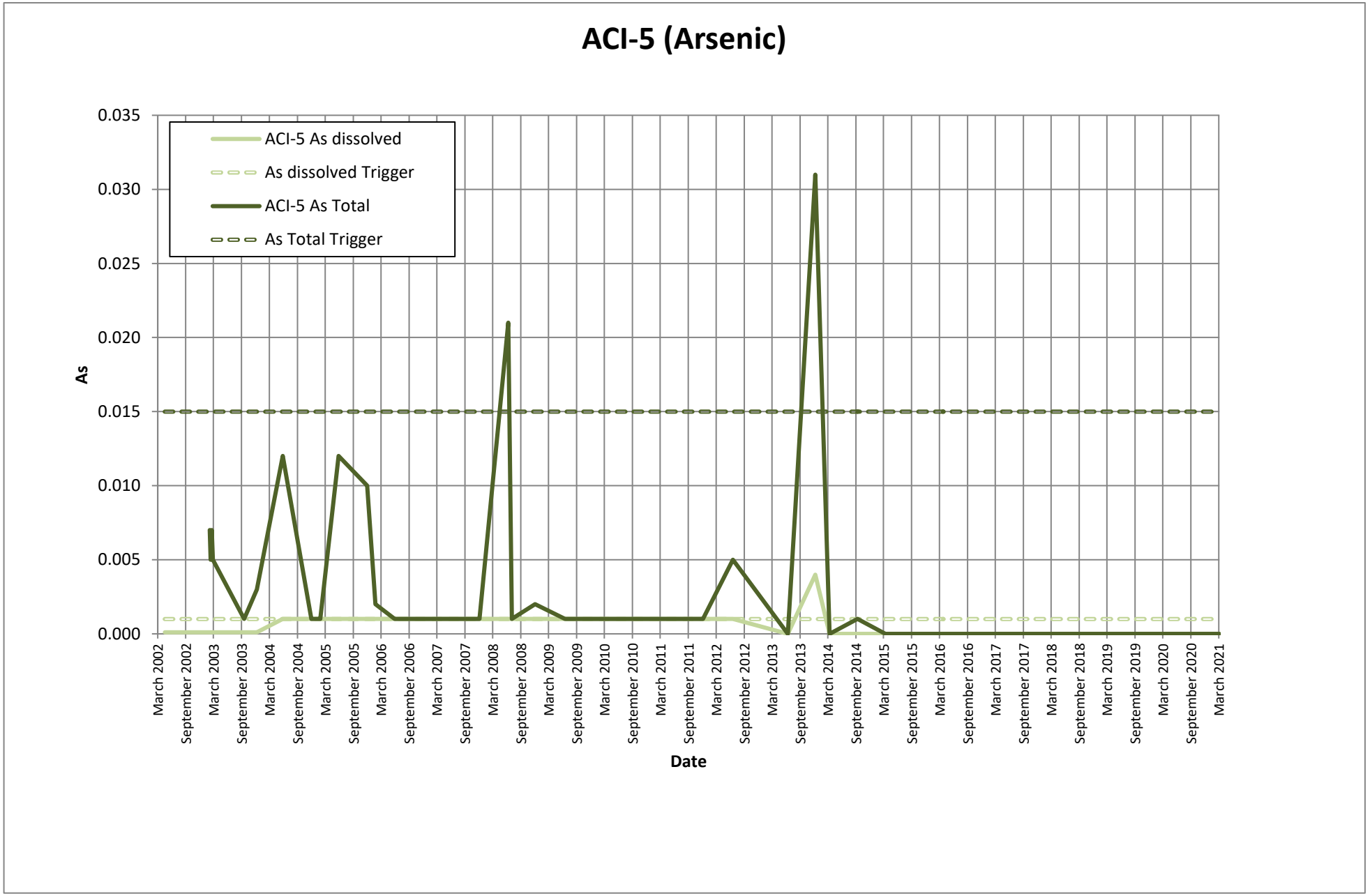

ACI-2 (Iron)
ACI-2 Fe dissolved
Fe dissolved Trigger
ACI-2 Fe Total
Fe Total Trigger
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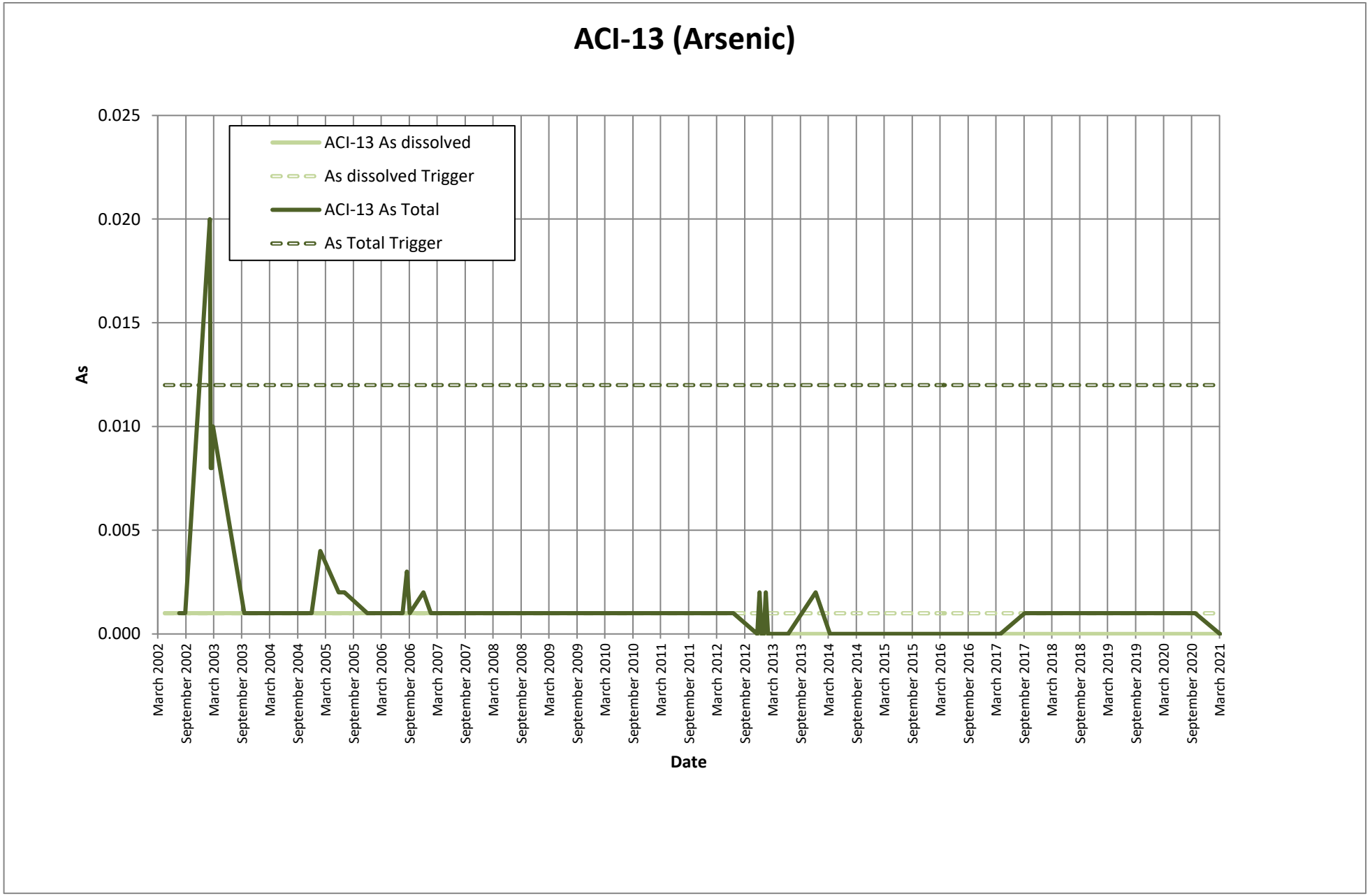

ACI-5 (Iron)
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2.50
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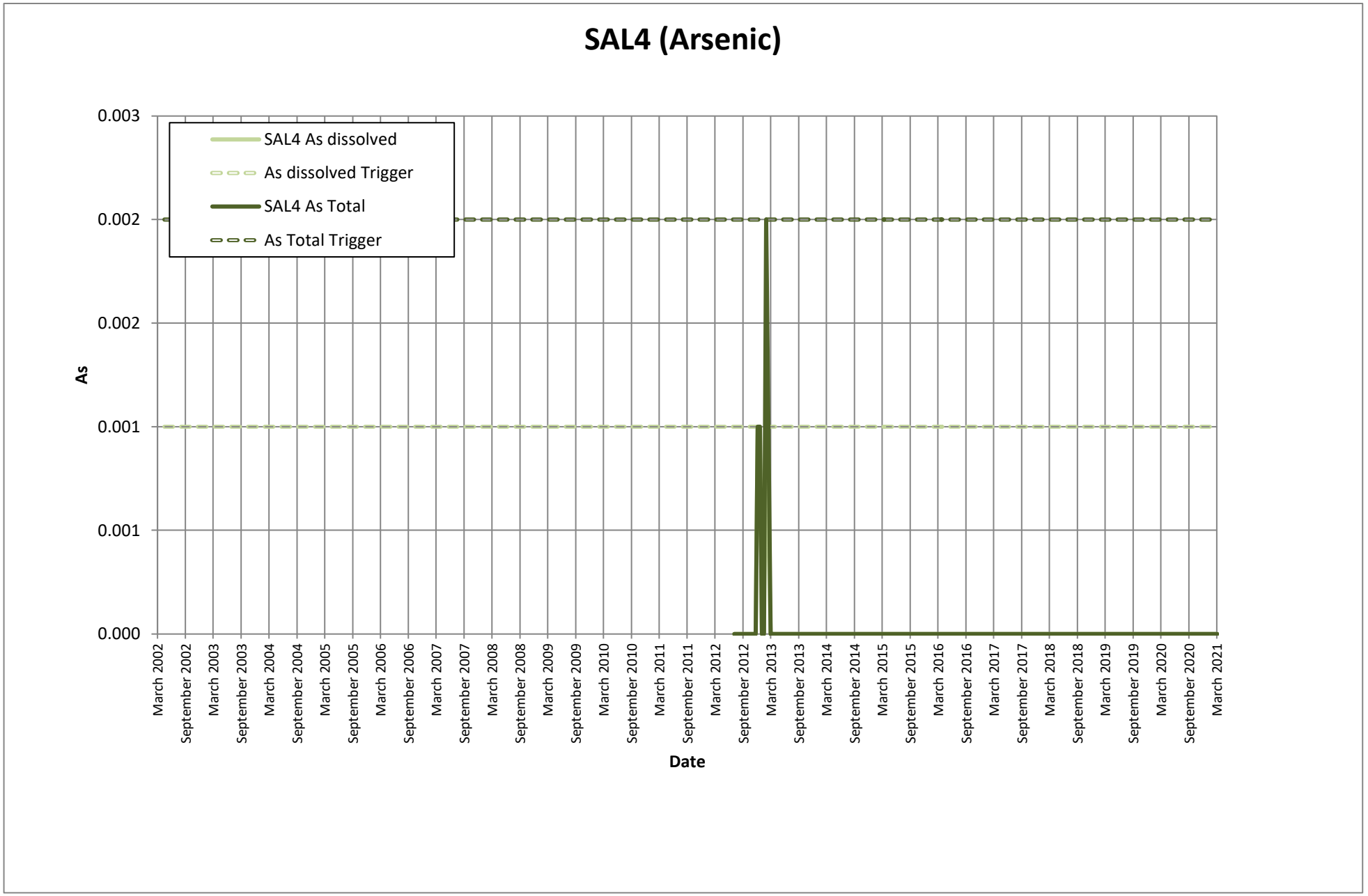

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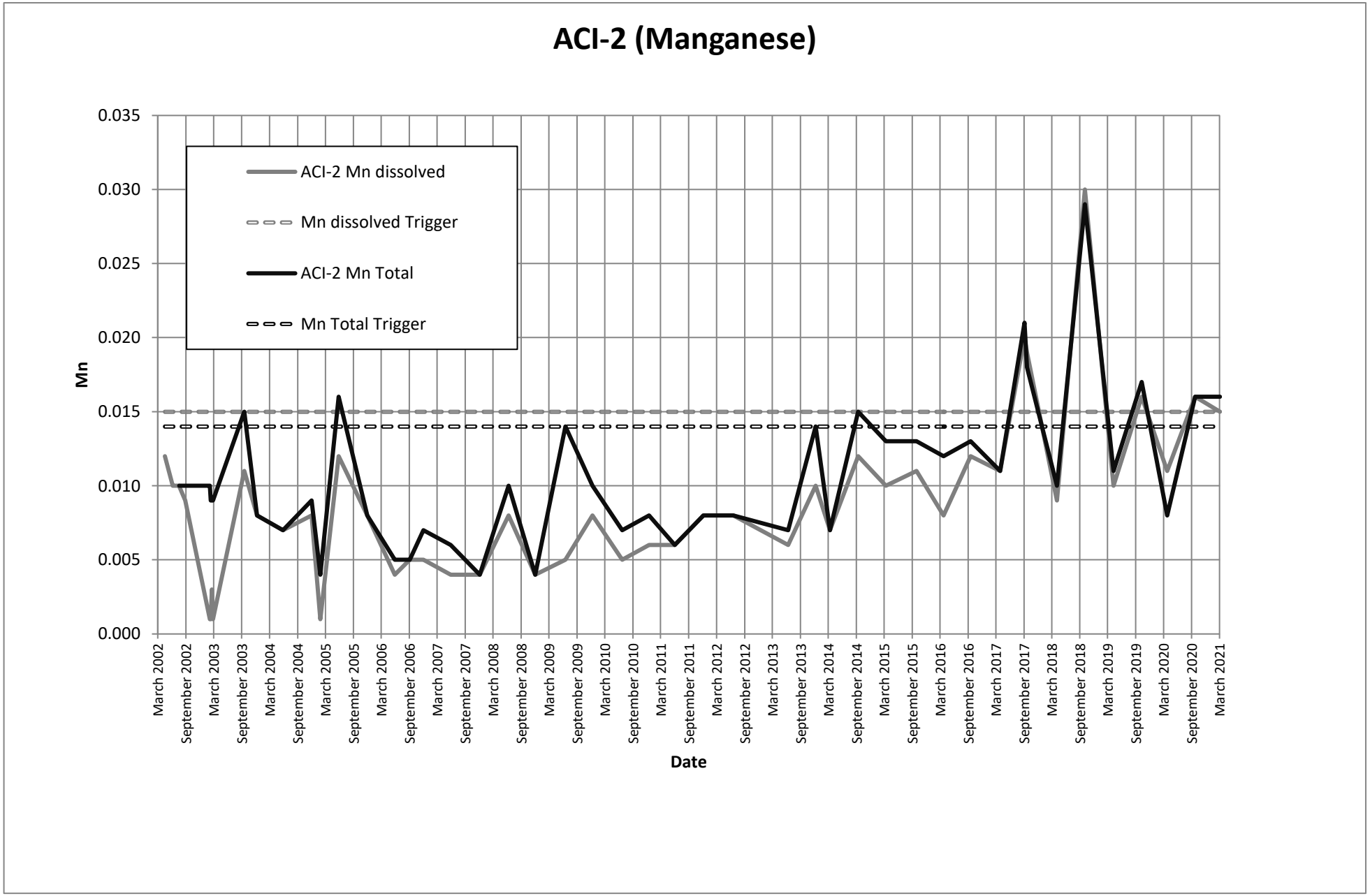

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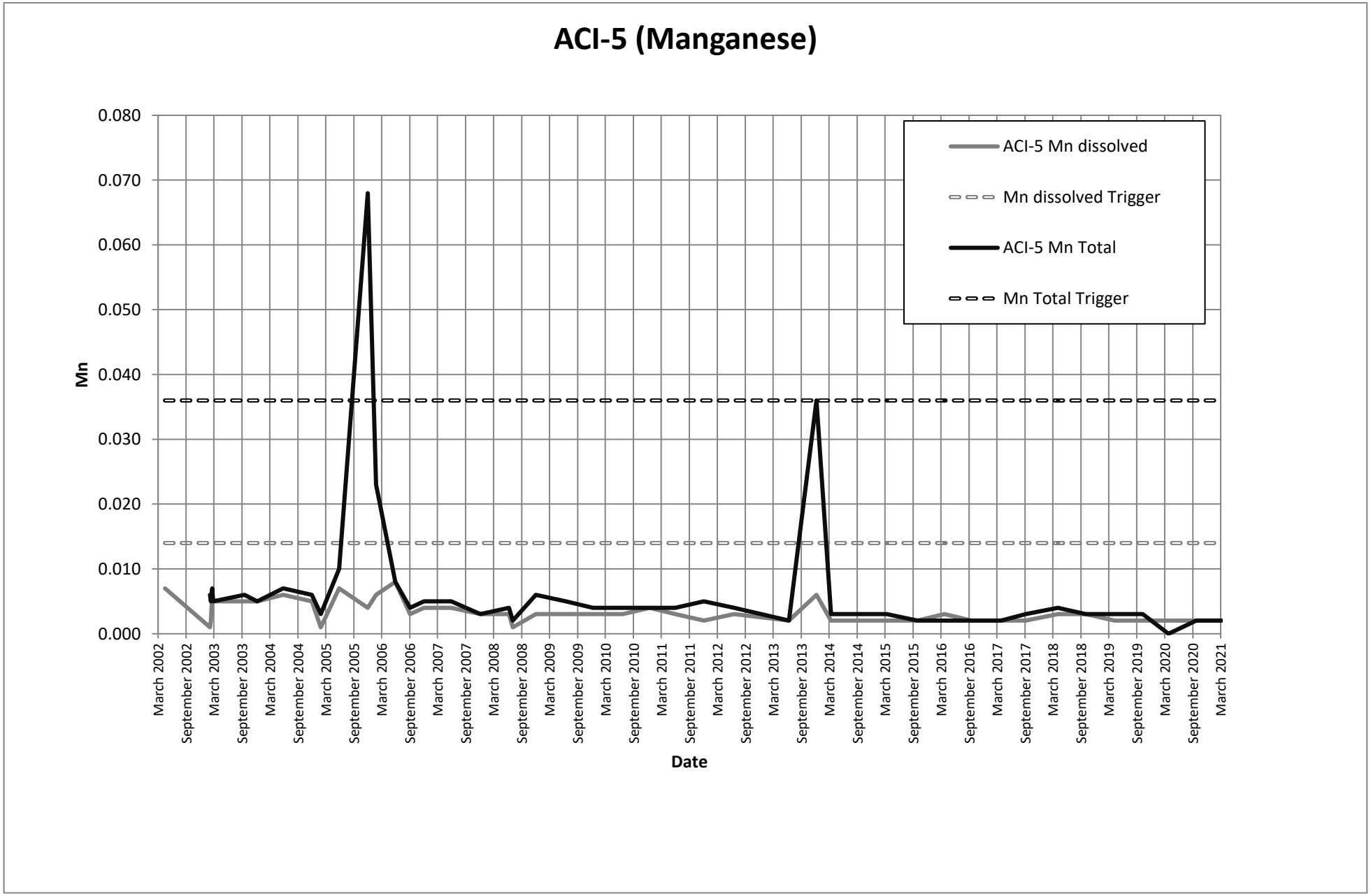

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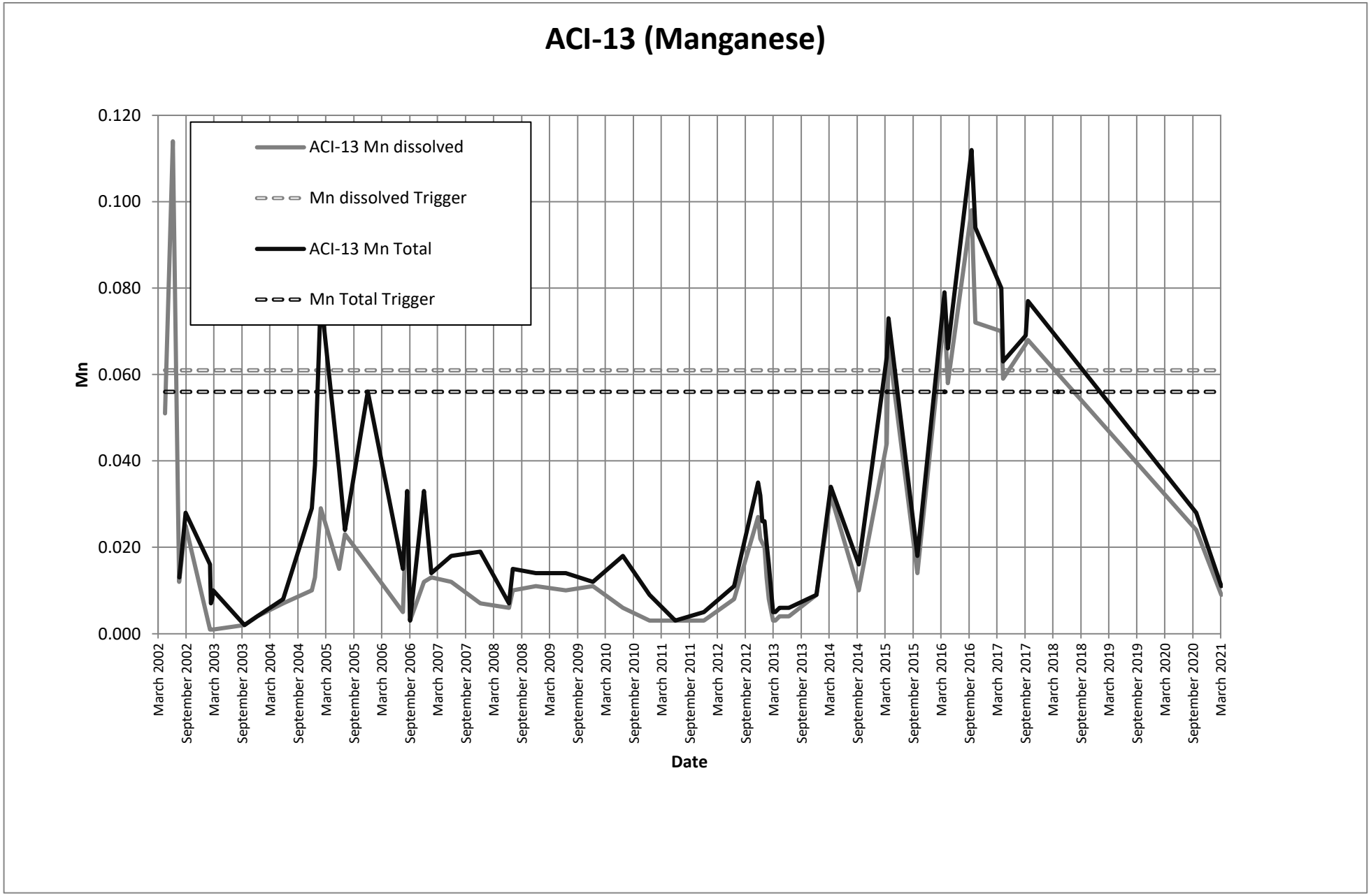

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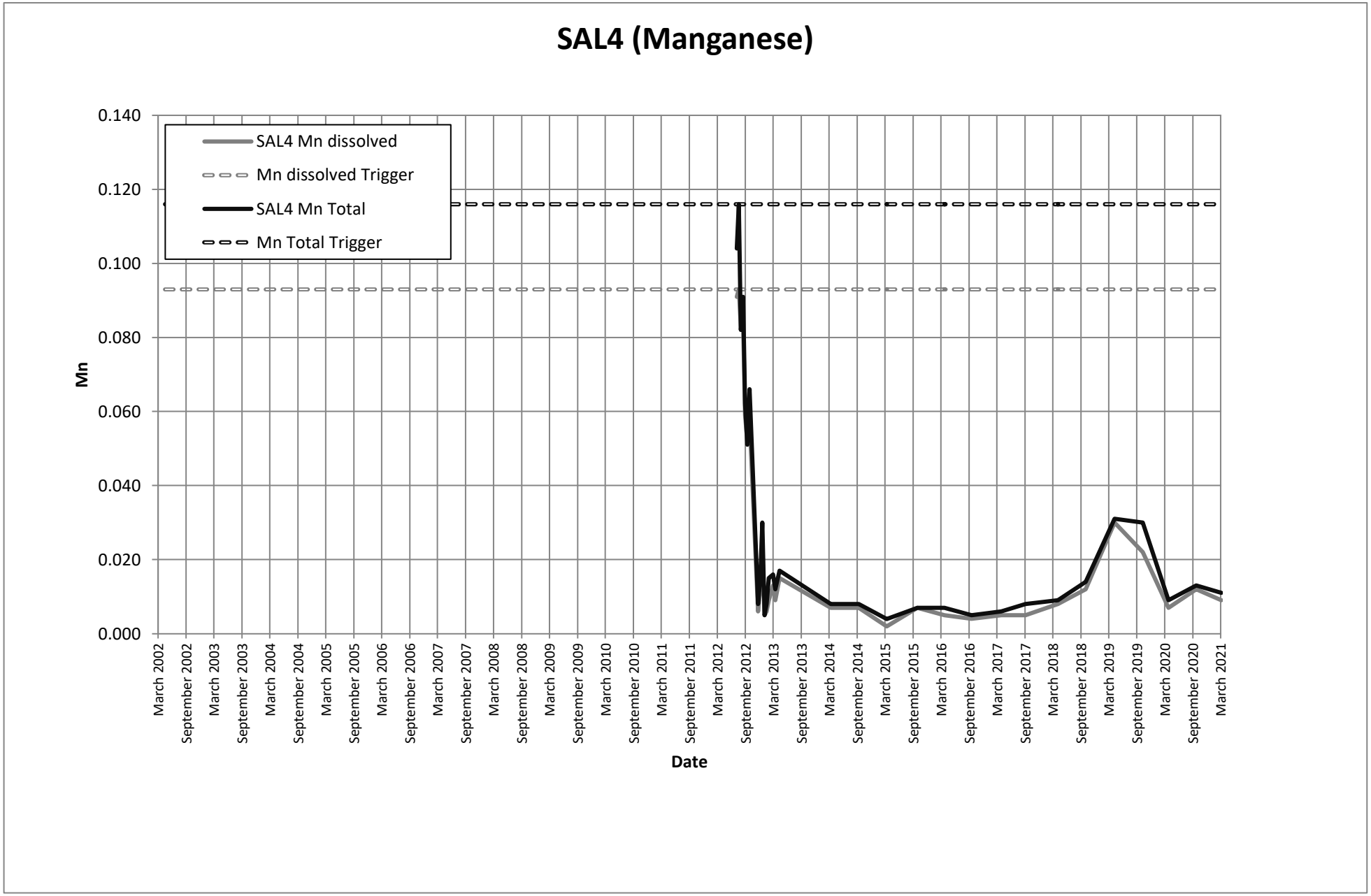

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ACI-2 Mn Total
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APPENDIX 5
REHABILITATION MONITORNG REPORT

KLEINFELDER
Bright People. Right Solutions.

2021 Annual Vegetation Rehabilitation Monitoring Report



Holcim Australia PTY LTD

Tanilba North Dune Extension Sand Mining Extraction Operation
Oyster Cove Rd, Tanilba Bay

16 April 2021

2021 Annual Vegetation Rehabilitation Monitoring Report

Tanilba North Dune Extension Sand Mining Extraction Operation
Oyster Cove Rd, Tanilba Bay

Kleinfelder Document Number: NCA21R121915
Project No: 20211342
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Prepared for:

HOLCIM AUSTRALIA PTY LTD

SALT ASH, NSW 2318

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Document Control:

Version	Description	Date	Author	Technical Review	Peer Review
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Final	Final	16 April 2021	Nigel Fisher		

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EXECUTIVE SUMMARY

Holcim Australia (formerly Sibelco Australia) was granted consent to extract white silica sand from the Tanilba North Dune Extension located in the Oyster Cove area, in the Port Stephens Council Local Government Area extracting sand from 9 ha in an area bounded by Rutile Rd to the north and previous sand extartction operations at Tanilba North Dune. This project is labelled the Tanilba North Dune Extension Project (the Extension) and is located within Lots 11, 12 and 13 DP 601306; Lot 408 DP 1041934; and Lots 1 and 2 DP 408240.

An annual report is prepared in autumn to support the Annual Environmental Management Report (AEMR). Monitoring is performed biannually to determine if significant changes are occurring. The Extension has been subdivided into several smaller blocks for ease of data collection. This report provides details for the monitoring of the revegetation of Blocks Q1, Q2, Q3, Q4, Q5 and Q6 for the Northern Dunes Extension. Rehabilitation blocks are prepared and biannually surveyed after 6 months of growth, for a period of 3 years. Monitoring was conducted over four days – 27th of January and the 3rd to the 5th of February 2021.

As set out in Section 4.6 Monitoring Protocol of the Landscape Management Plan – Tanilba Northern Dune Extension (Kleinfelder, 2013), the objective of the rehabilitation is to progressively re-establish original vegetation community types after sand extraction and completion of landform rehabilitation. The plan sets out to achieve a standard of tree and shrub growth, and recovery in species richness and abundance, as close as possible to that of the original vegetation, within the limits of current best practice techniques, final landform and a reasonable period of post-extraction monitoring. The current monitoring design monitors 2% of the total area and aims to attain accurate information from across the whole area and increase the ability to identify important site characteristics that would not be identified using fewer, larger quadrats. Each Block had points overlaid in a grid fashion at approximately 15 m intervals using a GIS program. These points represent a single sample quadrat, each 2 x 2 m (4 m^2). This results in approximately 45 plots/hectare. Plot points were confirmed in the field during the first monitoring event, to ensure each point occurred within the extraction area. These confirmed points are retained and used for following monitoring events until completion after 3 years.

In summary the survey indicated that the northern half of Block Q1, and all of Blocks Q2 and Q5 are generally below targets in the all the key plant growth parameters except for average plant height and average number of fire-resistant species. Therefore, average cover, average

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number of plants and the average species richness are all below target for these blocks (or portions of block) and have suffered reductions as a result of the combination of the drought and weed infestation. Target species numbers are generally below target despite the planting program undertaken by Holcim, apart from Corymbia gummifera which has been planted densely and is well above target. Holcim have undertaken a controlled burn and a scalping of topsoil in Blocks Q1 and Q5, followed by additional planting of key species. These are positive actions but do serve to "reset" some of the rehabilitation parameters for these areas.

Block Q3 plant growth parameters have rebounded since the previous surveys, displaying a degree of ecological resilience that bodes well for the future of rehabilitation om this block. Average cover, average plant height, average numbers of fire-resistant species have increase since the previous survey. Species richness is recovering and remains above target. Stratum proportions are consistent with other good rehabilitation - the proportion of shrub species is above target while ground species are below target and the midstorey and overstorey strata are about on target. Key species numbers are mixed, Leptospermum polygalifolium was again not recorded on the block and it must be assumed that this species is no longer present. L. trinervium not recorded this survey, with C. gummifera numbers are considerably above target. The grass weed species Melinis repens was recorded inside the rehabilitation block for the first time suggesting that further weed control works are required.

Block Q4 has improved its plant growth parameters further and with Bl Q3 represent excellent rehabilitation. Target species numbers are mixed with C. gummifera and Eucalyptus piperita above target. Other species were below target, and L. trinervium has rebounded from the January 22020 survey where no individuals of this species were recorded.

Block Q6 was surveyed for the third time this survey and plant growth parameters and numbers of target species are progressing satisfactorily and are on target at this early stage of rehabilitation. Some weeds are colonising the newly rehabilitated areas centred on the old road base that was not removed after extraction was completed. Encroachment of grasses from Block Q5 is also evident.

Grassy and some woody weeds have come to dominate Blocks Q2, Q5 and the northern section of Q1. The grass Eragrostis curvula (African Lovegrass) is still the main species, although several other weed species were present. This has resulted in a decrease in shrub species with native species being largely restricted to planted midstorey and overstorey species and few hardy natives such as Acacia longifolia (Coastal Wattle), which has become the dominant shrub species and is quickly becoming a threat to further diversity itself. Weeds

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were also observed to be colonising some areas of Blocks Q4, Q3 and Q6 with the haul road edges also observed to have weeds encroaching. Holcim has conducted weed control works including conducting controlled burns of the denser E. curvula infestations and scalping of the topsoil with replating of key species.

Apart from ongoing and regular weed control efforts other management actions recommended for the North Dunes Extension include instigation of another seeding program – especially of shrubs and ground cover species. Additional planting of target species was also suggested to improve rehabilitation.

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1. INTRODUCTION

1.1 BACKGROUND

Holcim Australia (formerly Sibelco Australia) was granted consent to extract white silica sand from the Tanilba North Dune Extension located in the Oyster Cove area, in the Port Stephens Council Local Government Area. While sand extraction operations have now ceased, consent conditions require the vegetative rehabilitation of mined areas following sand extraction. An ongoing vegetation monitoring program has been established to aid in management of the rehabilitation project.

The extraction of sand was granted by the Minister for Planning and Infrastructure (DP&I) for quarrying activities to occur over 9 ha in an area bounded by Rutile Rd to the north and previous sand extartction operations at Tanilba North Dune. This project is labelled the Tanilba North Dune Extension Project (the Extension) and is located within Lots 11, 12 and 13 DP 601306; Lot 408 DP 1041934; and Lots 1 and 2 DP 408240. The extension project was a Major Project assessment and is considered under Part 3A of the *Environmental Planning and Assessment Act 1979* (EP&A Act). Kleinfelder was appointed by the former owners, Sibelco Australia to conduct the rehabilitation monitoring for this project in January 2017, and the new owners Holcim Australia Pty Ltd, appointed Kleinfelder to continue the monitoring program from July 2020.

An annual report is prepared in autumn to support the Annual Environmental Management Report (AEMR). Monitoring is performed biannually to determine if significant changes are occurring.

1.2 SCOPE

The Extension has been subdivided into several smaller blocks for ease of data collection. This report provides details for the monitoring of the revegetation of Blocks Q1, Q2, Q3, Q4, Q5 and Q6 for the Northern Dunes Extension (**Figure 1**). Rehabilitation blocks are prepared and biannually surveyed after 6 months of growth, for a period of 3 years. Details of each block surveyed for the 2021 annual report are shown in **Table 1**. Biannual monitoring was completed on Block Q1 in July 2020 at the biannual monitoring event, and that data is presented in this

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report. Monitoring of the remaining blocks was conducted over four days – 27th of January and the 3rd to the 5th of February 2021.

Table 1: Block preparation and survey details for the North Dunes Extension Rehabilitation Blocks for the 2021 Annual report

Block	Prepared	First Biannual Survey Conducted	Last Biannual Survey (Due)	Comments
Q1	December 2016 - July 2017	January 2018	July 2020	Biannual Monitoring completed
Q2	July 2018	January 2019	July 2021	One further Biannual Monitoring event is planned
Q3	July 2018	January 2019	July 2021	
Q4	July 2018	January 2019	July 2021	
Q5	July 2018	January 2019	July 2021	
Q6	July 2019	January 2020	July 2022	Three more Biannual Monitoring events scheduled

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Legend

- 2021 Monitoring Blocks
- Other Blocks
- Sub-arterial Road
- Local Road
- = = : Track

Metres
0 50 100 200 300 400 500

N

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PROJECT REFERENCE:	20211342
DATE DRAWN:	2021/03/20 00:31 Version 1
DRAWN BY:	GJoyce
DATA SOURCE:	NSW DFSI - 2020 Nearmap - 2021

Block Locations

Sibelco Australia
2021 Annual Vegetation Rehabilitation Monitoring Report
North Dune Extension Sand Mining Extraction Operation
Oyster Cove Rd, Tanilba Bay

FIGURE:

1

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2. METHODS

2.1 DESIGN

The sampling scheme conducted during the biannual monitoring is as established in Section 4.6 Monitoring Protocol of the Landscape Management Plan – Tanilba Northern Dune Extension (Kleinfelder, 2013).

As set out in Section 4 – Rehabilitation Management Plan, the objective of the rehabilitation is to progressively re-establish original vegetation community types after sand extraction and completion of landform rehabilitation. The plan sets out to achieve a standard of tree and shrub growth, and recovery in species richness and abundance, as close as possible to that of the original vegetation, within the limits of current best practice techniques, final landform and a reasonable period of post-extraction monitoring.

To achieve this stated objective the RMP will aim at re-establishing:

- Stable and sustainable native vegetation cover, free of erosion,
- The original vegetation community types, although at different proportions due to lowered post-extraction landform,
- The structural components and dominant species of vegetation, comparable with pre-extraction vegetation at similar elevations, and
- Similar species composition to pre-extraction at similar elevations.

Efforts will also be made to re-establish all other structural components of the vegetation including canopy, sub-canopy, understorey, groundcover, and litter, though not necessarily in the same proportions as pre-extraction vegetation at similar elevations, and within the above limits.

The current monitoring design monitors 2% of the total area, and aims to attain accurate information from across the whole area and increase the ability to identify important site characteristics that would not be recorded and quantified when using the pre-determined survey methods in the EMP.

Each Block had points overlaid in a grid fashion at approximately 15 m intervals using a GIS program. These points represent a single sample quadrat, each 2 x 2 m (4 m^2). This results in approximately 45 plots/hectare. Plot points were confirmed in the field during the first

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monitoring event, to ensure each point occurred within the extraction area. These confirmed points are retained and used for following monitoring events until completion after three years. **Table 2** details the data type and the value of the data collected within each sample plot.

Table 2: Details of data collected for each sample 2m x 2m plot.

Parameter	Details	Description
Species (as per EMP)	The total number of different species of plant present.	A measure of biodiversity.
Plants (as per EMP)	The total number of plants present.	A measure of plant density.
Stratum proportions – ground, shrub, midstorey and overstorey species (as per EMP)	The proportion of species which will become ground, shrub, midstorey and overstorey layers.	A measure of the stage of vegetation development and community structure.
Height (as per EMP)	The average height of all plants in the quadrat.	An indicator of overall growth.
Cover (as per EMP)	An estimate of the total quadrat area having plant cover-percentage of area.	A measure of the total green cover for the rehabilitation area.
Fire resistant species (as per ecobiological, 2005)	The proportion of fire-resistant species to total species present.	An indicator of the potential resilience of the new vegetation to a fire event.

2.2 SAMPLING METHODOLOGY

The pre-confirmed 2 m x 2 m plot locations are uploaded onto a hand-held GPS unit. A qualified ecologist then visits each of these plot locations using the GPS. Once the point is located, four 2 m poles are laid on the ground around the point to define the sample area and the data outlined in **Table 2** is collected at each point.

A total of 220 plots were surveyed for the purpose of the current annual report, consisting of:

- 69 plots in Q1 (only surveyed in July 2020 for this report),
- 15 plots on Block Q2,
- 27 plots on Block Q3,
- 75 plots on Block Q4,
- 41 plots on Block Q5, and,

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- 62 plots on Block Q6.

The total area of rehabilitation surveyed as part of the present annual monitoring period was approximately 4.98 ha, and the total area of sampling plots was 0.088 ha and **Figure 2** shows the total surveyed rehabilitation area for the 2021 annual report within the former sand extraction area. The location of all plots and rehabilitation blocks and photo monitoring points has also been detailed.

At each survey event a photograph of the regrowth on the blocks is taken from a consistent location. **Appendix 1** contains the photographic monitoring records for the current blocks.

2.3 MONITORING

2.3.1 Defining Targets

The desired outcome for the vegetation rehabilitation of the sand extraction areas is to achieve a vegetative structure and composition comparable to that of the surrounding areas which have a similarly shallow elevation above the water table. The data collected from monitoring events has been compared with targets for these parameters. The target figures for the ideal outcome for the parameters described in **Table 2** were determined from two 20 m x 20 m (400 m^2 each) sample plots located in the undisturbed vegetation either side of the extraction area near Block A of the Tanilba North Dunes Sand Extraction Project in 2005. The target figures from these two survey plots have been used for all rehabilitation blocks.

2.3.2 Assessment of Rehabilitation Parameters

Previous reports have included data from the sample quadrats that was extrapolated for the whole of the rehabilitation area in a GIS system. The resulting modelling figures were usually displayed in the Appendices, and were developed to illustrate the growth parameters, and whether the rehabilitation area demonstrates consistent growth and development, or where and when any significant deficiencies for each growth parameter exist within the rehabilitation blocks. These have now been discontinued as it was felt they did not add value to the reporting of the success of the rehabilitation and have been replaced by maps showing the plots where target species were recorded. Each species is shown separately with these figures in **Appendix 2**.

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The total averages for each parameter at 6-month intervals, for each block, have been shown in charts (**Appendix 3**). These charts compare the similarity and divergences between blocks by analysing the recorded data for each block against the same time-line (i.e. 3 years).

Predictive trends for height and foliage cover growth out to the end of operations has been analysed by plotting the initial data from the data recorded to date and extrapolating this inclination until it meets the targeted parameter (i.e. height or foliage cover targets). The results are given in **Appendix 4**.

A total species list for each rehabilitation block is detailed in **Appendix 5**.

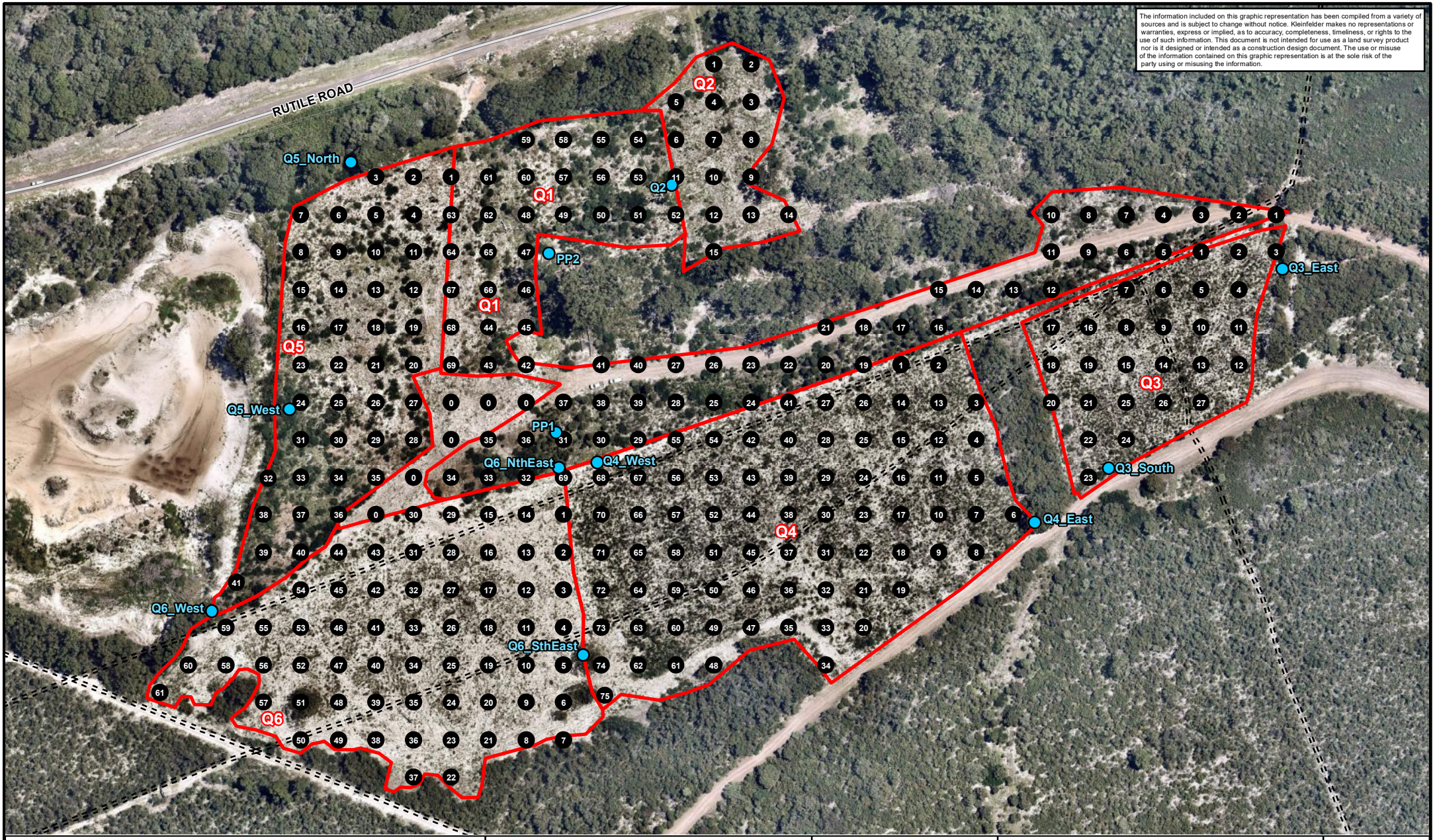
2.4 ANNUAL RAINFALL 2020

The annual monthly rainfall recorded at the Williamtown RAAF weather station (BOM, weather station number 61078) for 2020 is compared to the mean monthly rainfall. As can be seen overall rain was slightly above the average historical rainfall. The last three months of 2020 recorded higher than average rain, while January 2021 (the month of surveys) was also above the mean for that month with 186.8 mm recorded.

Table 3: Monthly rainfall recorded from the Williamtown RAAF weather station for 2020 compared to the mean annual rainfall (millimetres)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Mean	98.3	117.8	120.9	110.6	108.7	125.2	70.3	73.2	60.6	73.5	81.9	77.5	1118.0
2020	67.2	171.6	106.2	53.6	105.6	81.6	242.6	38.8	28	252	58.2	156.2	***1361.6***
2021	186.8												

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Legend

- Survey Plots
- Photo Points
- 2021 Monitoring Blocks
- Local Road
- Track

Metres
0 10 20 40 60 80 100
N

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PROJECT REFERENCE: 20211342
DATE DRAWN: 2021/03/20 00:37 Version 1
DRAWN BY: GJoyce

DATA SOURCE:
NSW DFSI - 2020
Nearmap - 2021

Survey Plots

Sibelco Australia
2021 Annual Vegetation Rehabilitation Monitoring Report
North Dune Extension Sand Mining Extraction Operation
Oyster Cove Rd, Tanilba Bay

FIGURE:
2

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3. RESULTS

The following tables and charts show the rehabilitation status results over the previous monitoring events and assess the current status against the projected target figures.

3.1 BLOCK Q1

3.1.1 Growth Parameters

Block Q1 data presented in **Table 4, Chart 1** and **Chart 2** relate to information collected from the July 2020 survey and compares progress to the previous surveys and against targets. This is the sixth and last of the biannual surveys for this block and represents 36 months of growth after the start of rehabilitation of this block.

Average plant cover has decreased to 44.13%, which is a continuation of a trend of reduced vegetation cover since the July 2019 survey when cover was 65.36%. This reflects the combination of natural dieback from succession and the effects of the drought in early spring, with lack of replacement species. Average plant height has increased to 72.35cm this survey, a slight increase over the previous two surveys. The average plant density has decreased from 24.74 plants/4m^2 in January 2019 to 11.44 plants/4m^2 and is well below the target of 40 plants/4m^2. The average number of Fire Tolerant Species was recorded at 1.56 plants/4m^2 and is still above target but has been on a downward trajectory from a high of 2.41 plants/4m^2 recorded for the January 2019 survey. The average plant species richness of 3.76 species/4m^2 is also below the target of 12 species/4m^2 and again has decreased from the high of 9.3 species/4m^2 recorded in the January 2019 survey.

The ground and shrub stratum proportions have changed considerably since the January 2020 survey. Ground stratum species now make up 20.47% of the total species in this block, well down from the 43.54% recorded in January 2020, and has now fallen below target. It should be pointed out here that the higher percentage was due to a large presence of exotic grasses and other exotic ground cover species. while the proportion of midstorey and overstorey species has also remained relatively stable.

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This block being slightly older than the others is beginning to show some signs of self-recruitment with examples of *Banksia aemula* and several of the larger *Eucalyptus* species flowering and/or seeding (**Plate 1**).

Table 4: Progression of average monitoring parameter data and target projections for Block Q1 over the course of the rehabilitation

Parameter	Target	Rehab status Jan 2018	Rehab status Jul 2018	Rehab status Jan 2019	Rehab status Jul 2019	Rehab status Jan 2020	Rehab status Jul 2020	Percentage Target Achieved (Jul 20)
Average Cover (%)	**80**	36.09	36.38	55.20	65.36	57.71	44.13	55.16
Average height (cm)	**230**	29.9	33.15	43.01	63.33	66.62	72.35	31.46
Ave. No. of plants (plants/4 m^2)	**40**	23.2	16.38	27.74	23.78	17.14	11.04	27.61
Ave. No. Fire resistant species (plants/4 m^2)	**1**	1.9	1.80	2.41	1.78	1.46	1.56	156.52
Ave. Species Richness (species/4 m^2)	**12**	9.3	7.30	9.38	8.46	6.04	3.76	31.40
Ave. Ground stratum proportion (%)	**27**	25.91	14.96	25.43	25.78	43.54	20.47	75.83
Ave. Shrub stratum proportion (%)	**61**	39.67	36.94	40.02	45.17	29.40	29.32	48.07
Ave. Midstorey stratum proportion (%)	**7**	11.89	19.17	12.24	12.01	14.60	13.47	192.43
Ave. Overstorey stratum proportion (%)	**5**	8.03	12.99	6.36	11.25	12.47	10.65	212.98

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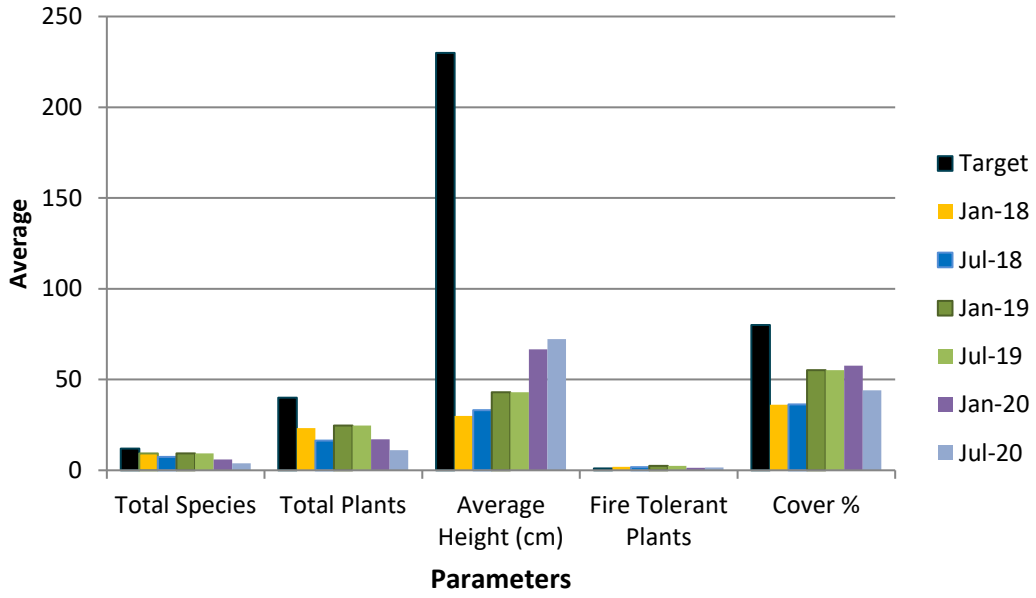


Chart 1: **The average key rehabilitation parameters over the course of the surveys for Block Q1 and comparison to rehabilitation targets**

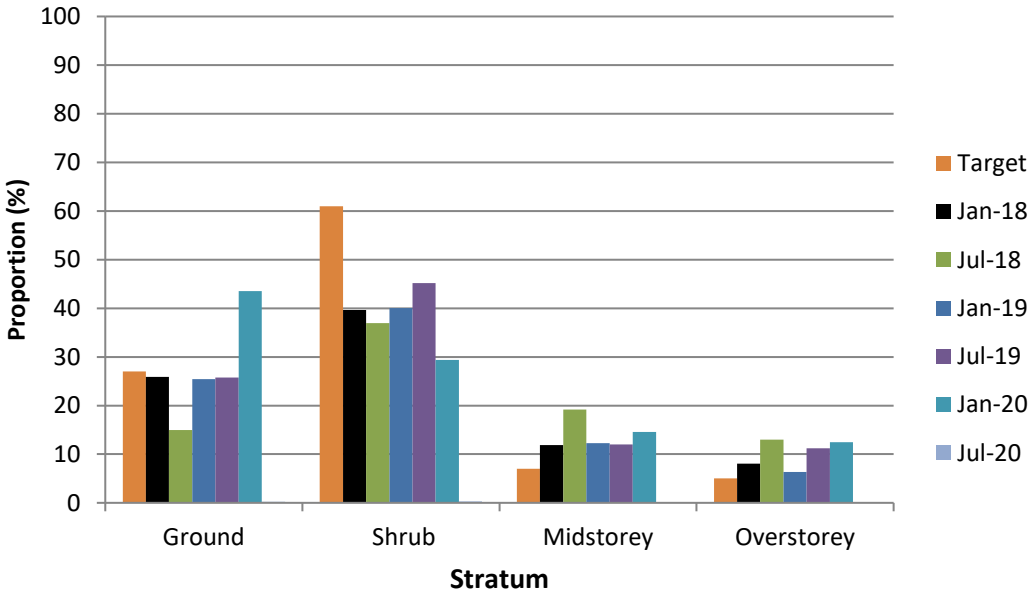


Chart 2: **The average proportion of species that will occupy each stratum for Block Q1 and comparison to rehabilitation targets over the course of the biannual surveys.**

3.1.2 Target Species

As at the January 2020 survey the following numbers of target species have been estimated to be on this block (**Table 5**). As can be seen from the table, *C. gummifera* is well above target

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(1132%) with 1348 plants estimated to growing. The two species of *Banksia* are at 54% of target, while *L. polygalifolium* is at 27% of target. The remaining two species *L. trinervium* and *M. nodosa* are still well below target numbers.

In addition to the above seven target species, additional species of *Eucalyptus* have been planted, while natural recruitment of *Angophora costata* (Smooth-barked Apple) from the adjoining remnant vegetation adds diversity to, and/or replace some of the above species. Previous reports included the native species *Leptospermum laevigatum* (Coast Teatree) as a desirable species substituting for *Leptospermum polygalifolium*, but this has been re-assessed, and this species is now considered a weed species colonising from the road reserve.

Table 5: **Total estimated numbers for target species and additional similar species for Block Q1 and comparison to target numbers and for the previous surveys. Note – additional species numbers have not been calcuated for previous surveys**

Species	Target Number	Est No. Jan-2018	Est No. Jul-2018	Est No. Jan - 2019	Est No. Jul - 2019	Est No. Jan - 2020	Est No. Jul - 2020	Target Ach this Survey (%)
Banksia aemula/serrata	3869	2588	2750	2642	1995	2103	1671	43.2
Corymbia gummifera	119	1402	1456	1725	1887	1078	1348	1132.2
Eucalyptus piperita	446	0	162	54	108	108	108	24.2
Leptospermum polygalifolium	1786	1995	1510	1348	1563	270	485	27.2
Leptospermum trinervium	2024	1617	0	377	1402	0	162	8.0
Melaleuca nodosa	4166	1995	1456	1186	1671	1563	1132	27.2
Xanthorrhoea glauca	No target	216	270	377	323	539	108	No target
Eucalyptus robusta	No target	-	-	-	-	54		No target
Angophora costata	No target	-	-	-	-	108		No target
Eucalyptus spp.	No target	-	-	-	-	162		No target

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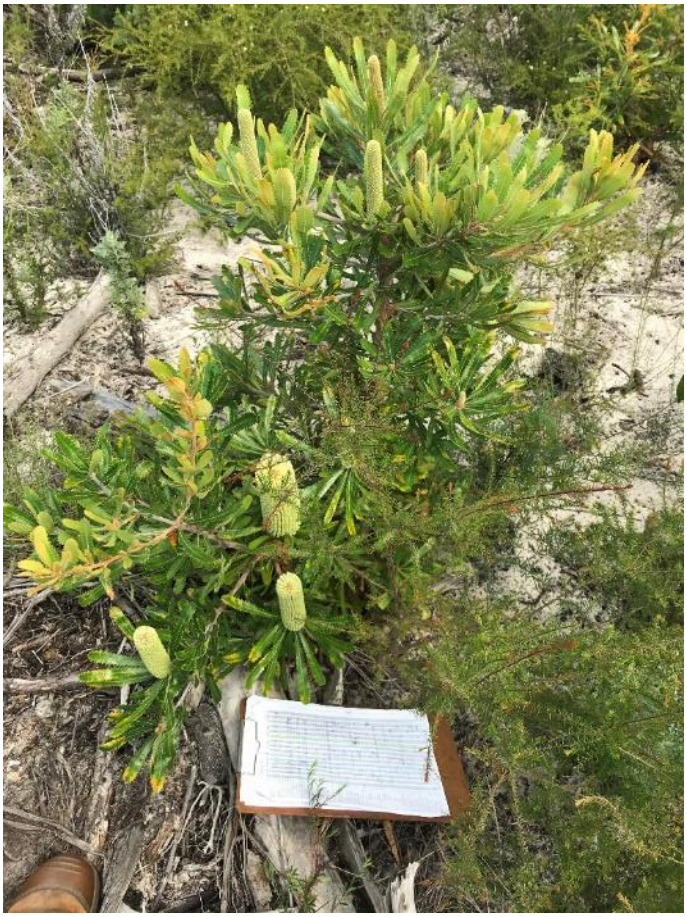


Plate 1: **Block Q1, Plot 14 – *Banksia aemula* in flower.**

3.2 BLOCK Q2

3.2.1 Growth Parameters

This block is a small block located adjacent to Bl Q1 and suffers from relatively poor species diversity, with many of the species present exotic weeds. This block is relatively older than the remaining blocks (Q3 – Q6) and this is reflected in the average height and cover parameters. This block was also the subject of extensive weed control works during the reporting period.

Table 6, **Chart 4** and **Chart 3** show details of the measured parameters against rehabilitation targets. Average plant cover was recorded as 54.33%, a slight decrease from the January 2020 survey, but a huge increase for the July 2020 survey. Average plant height has increased over the previous surveys and is now at 65.83cm. The average number of Fire Tolerant Species was remained constant at 1.46 plants/4m^2, for the past three surveys and remains above target. The average plant density has decreased markedly from 32.67 plants/4m^2

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recorded in January 2019 down to 13.86 plants/4m^2 in July 2020 but has now increased somewhat to 23.60 plants/4m^2. This is still below the target of 40 plants/4m^2 and largely consists of seedlings of species that are currently in the plots, rather than new species. The average plant species richness has also decreased from 8.73 species/4m^2 recorded for the January 2019 survey to 5.90 species/4m^2, unchanged for the past three surveys, below the target of 12 species/4m^2. This supports the contention that the increased number of plants are not new species. The stratum proportions have returned to levels recorded early in the rehabilitation with ground stratum species making up about half (48.62%) of the total species. It should be noted that with a very low number of species, stratum proportions are subject to large fluctuations if species die back during the rehabilitation and thus these observations are as informative compared to rehabilitation where greater numbers of species are present.

Table 6: Progression of average monitoring parameter data and target projections for Block Q2 over the course of the rehabilitation

Parameter	Target	Rehab status Jan 2019	Rehab status Jul 2019	Rehab status Jan 2020	Rehab status Jul 2020	Rehab status Jan 2021	Percent Target Achieved (Jan 21)
Average Cover (%)	**80**	53.30	61.33	59.00	37.00	54.33	67.92
Average height (cm)	**230**	41.62	37.19	54.65	41.77	65.68	28.56
Ave. No. of plants (plants/4 m^2)	**40**	32.67	27.73	18.86	13.86	23.60	59.00
Ave. No. Fire resistant species (plants/4 m^2)	**1**	1.27	0.53	1.46	1.46	1.46	146.67
Ave. Species Richness (species/4 m^2)	**12**	8.73	6.6	6.0	5.8	5.9	49.44
Ave. Ground stratum proportion (%)	**27**	50.77	41.20	46.59	49.82	48.62	180.07
Ave. Shrub stratum proportion (%)	**61**	34.36	40.09	19.25	21.80	32.79	53.75
Ave. Midstorey stratum proportion (%)	**7**	13.31	16.93	25.19	16.13	8.92	127.44
Ave. Overstorey stratum proportion (%)	**5**	1.56	1.78	8.97	5.58	9.67	193.44

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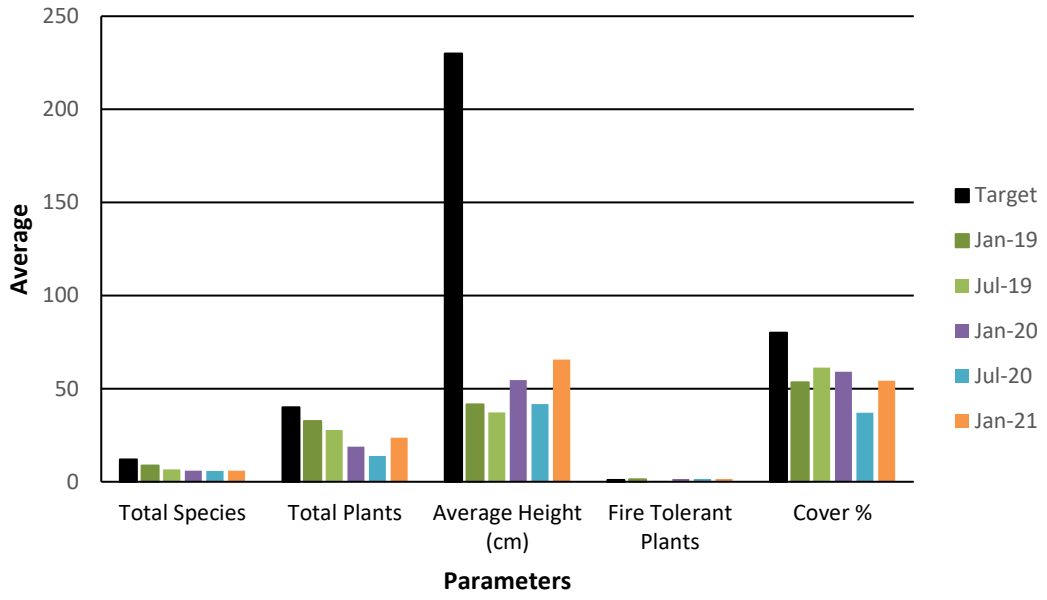


Chart 3: **The average key rehabilitation parameters for Block Q2 and comparison to rehabilitation targets over the course of the monitoring surveys**

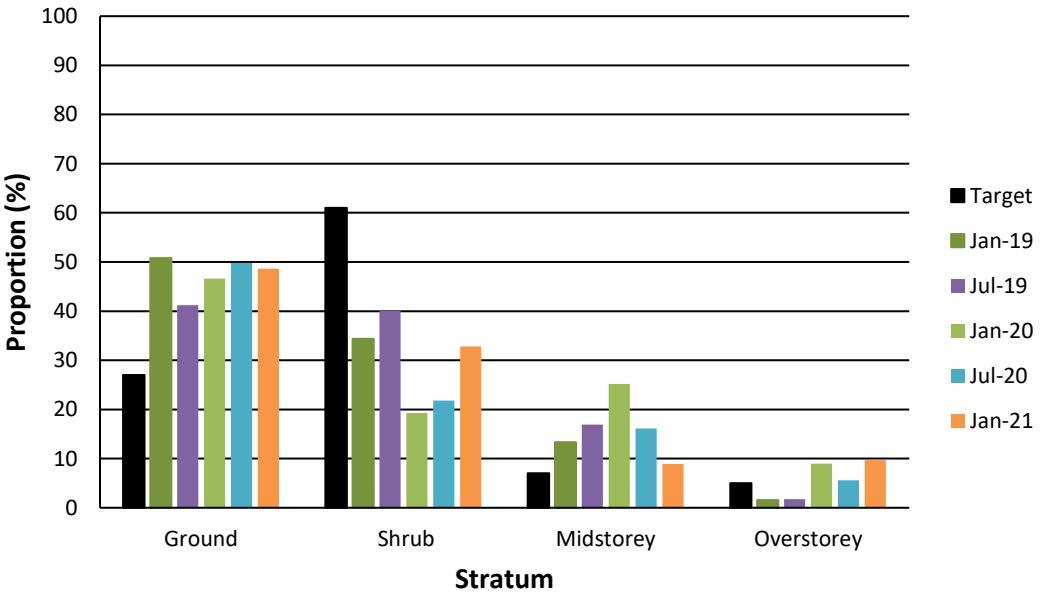


Chart 4: **The average proportion of species that will occupy each stratum for Block Q2 and comparison to rehabilitation targets over the course of the biannual surveys.**

3.2.2 Target Species

As at the January 2021 survey the following numbers of target species have been estimated to be on this block (**Table 7**). Five of the target species were recorded from this block with *C.*

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gummifera being over target with 160 plants (625% of target numbers). Other species if present were well below target densities, with *L. trinervium* not being recorded at all this survey suggesting that the drought has caused severe die-off.

Table 7: Total estimated numbers of target species and additional species and comparison to targets for Block Q2. Note – additional species a have not been calculated for previous surveys.

Species	Target Number	Est No. Jan-19	Est No. Jul-19	Est No. Jan-20	Est No. Jul-20	Est No. Jan-21	Target Achieved this Survey (%)
Banksia aemula/serrata	832	533	267	213	267	213	25.64
Corymbia gummifera	26	0	0	0	0	160	625.00
Eucalyptus piperita	96	0	0	0	0	0	0.00
Leptospermum polygalifolium	384	320	373	53	160	213	55.56
Leptospermum trinervium	435	213	373	107	0	0	0.00
Melaleuca nodosa	896	0	0	0	53	107	11.90
Xanthorrhoea glauca	No target	160	53	107	160	160	-
Eucalyptus robusta	No target	-	-	53	53	107	-
Angophora costata	No target	-	-	-	213	107	-
Eucalyptus spp.	No target	-	-	-	0	0	-

3.3 BLOCK Q3

3.3.1 Growth Parameters

Block Q3 has been rehabilitated for approximately 30 months and appears to have recovered from the die back that was observed during the January 2020 survey. Rehabilitation parameters are detailed in **Table 8**, **Chart 5** and **Chart 6**. Average plant cover was recorded has increased to 66.29%, a significant increase from the previous surveys, and now at its

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highest level recorded. Average plant height has increased slightly from the July survey, and increased substantially from the previous January survey. The average plant density of 32.85 plants/4 m^2 has increased slightly from the previous surveys but is still below the target of 40 plants/4 m^2. The average number of Fire Tolerant Species was recorded at 1.62 plants/4m^2. This also decrease from the previous surveys but is still above target. The average plant species richness of 14.2 species/4m^2 is also a slight decrease from the previous survey but remains slightly above the target of 12 species/4m^2.

Table 8: Results of the initial rehabilitation monitoring for Block Q3

Parameter	Target	Rehab status Jan 2019	Rehab status Jul 2019	Rehab status Jan 2020	Rehab status Jul 2020	Rehab status Jan 2021	Percentage Target Achieved (Jan 21)
Average Cover (%)	**80**	33.70	42.10	27.03	46.29	66.29	82.87
Average Height (cm)	**230**	21.42	28.75	27.49	40.40	47.40	20.61
Ave. No. of plants (plants/4 m^2)	**40**	56.70	52.27	29.00	35.88	32.85	82.13
Ave. No. Fire resistant species (plants/4 m^2)	**1**	2.04	2.10	1.74	1.62	2.22	222.22
Ave. Species Richness (species/4 m^2)	**12**	15.44	17.34	13.00	15.96	14.92	124.38
Ave. Ground stratum proportion (%)	**27**	5.98	5.30	8.31	8.38	8.28	30.66
Ave. Shrub stratum proportion (%)	**61**	82.75	81.39	79.04	78.78	79.85	130.90
Ave. Midstorey stratum proportion (%)	**7**	5.17	4.65	6.31	6.24	3.84	54.85
Ave. Overstorey stratum proportion (%)	**5**	6.09	5.21	6.33	6.60	8.04	160.72

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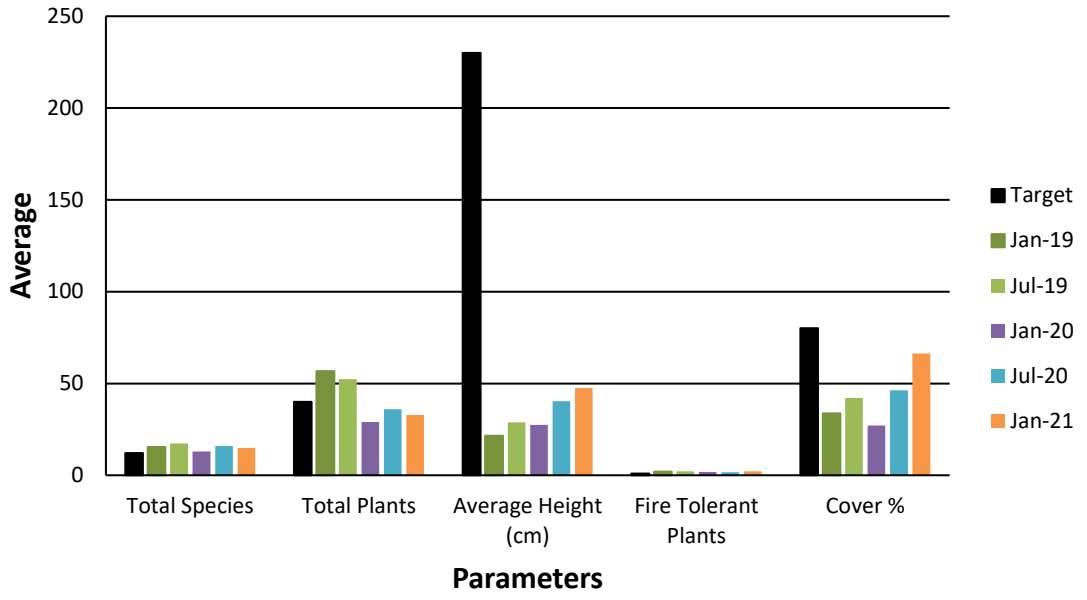


Chart 5: **The average key rehabilitation parameters over the course of the surveys for Block Q3 and comparison to rehabilitation targets**

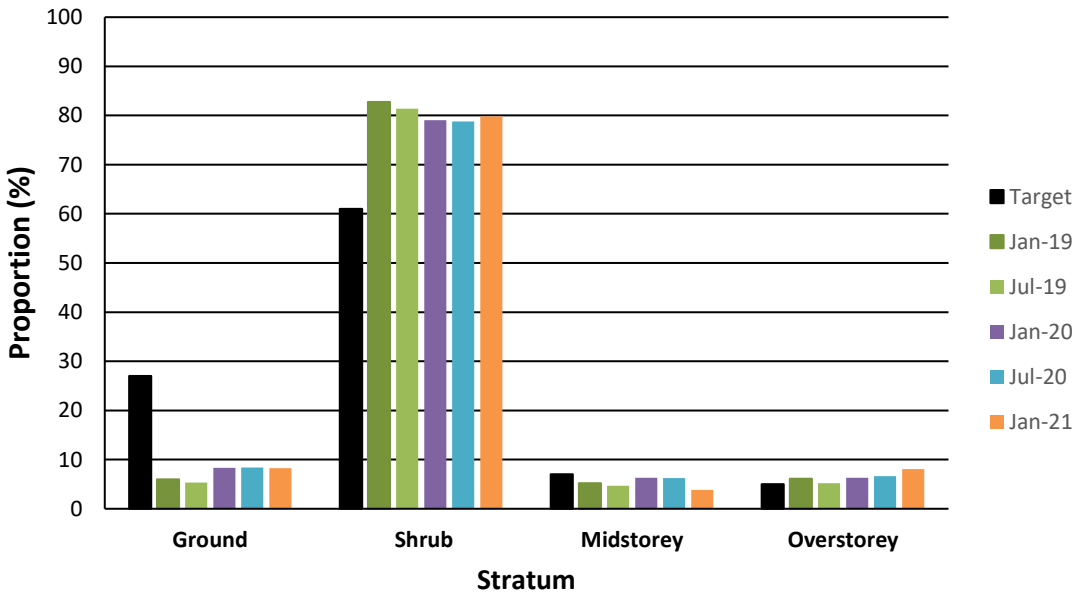


Chart 6: **The average proportion of species that will occupy each stratum for Block Q3 and comparison to rehabilitation targets over the course of the biannual surveys.**

3.3.2 Target Species

The target species for Block Q3 are detailed in **Table 9** below. Six of the target species have been identified on this block. *B. aemula* and *M. nodosa* are both calculated to be 46.3% and

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52.91% of target, respectively. *Corymbia gummifera* has been calculated to be many times over target. It is safe to assume that many of the plants identified as *C. gummifera* are other species (but not *E. piperita*). This block has an abundance of canopy plants and will form a dense woodland or open forest if the majority of them survive to maturity. The major omissions are the total absence of *L. polygalifolium* and the very low numbers of *L. trinervium.* Both species should be planted and/or seeded into this block to increase numbers.

Table 9: Total estimated numbers of target species and additional species and comparison to targets for Block Q3. Note – additional species a have not been calculated for previous surveys.

Species	Target Number	Est No. Jan-19	Est No. Jul-19	Est No. Jan-20	Est No. Jul-20	Est No. Jan-21	Target Achieved this Survey (%)
Banksia aemula/serrata	1612	1033	748	689	631	746	46.30
Corymbia gummifera	50	804	374	344	804	402	810.19
Eucalyptus piperita	186	57	267	0	0	57	30.86
Leptospermum polygalifolium	744	57	53	0	0	0	0.00
Leptospermum trinervium	843	115	267	0	230	57	6.81
Melaleuca nodosa	1736	919	802	746	804	919	52.91
Xanthorrhoea glauca	No target	287	481	402	115	459	-
Eucalyptus robusta	No target	-	-	230	0	631	-
Angophora costata	No target	-	-	0	0	0	-
Eucalyptus spp.	No target	-	-	0	0	0	-

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3.4 BLOCK Q4

3.4.1 Growth Parameters

This is the third survey undertaken on Block Q4. The rehabilitation parameters for this block have improved over the of the course of the monitoring as detailed in **Table 10**, **Chart 7** and **Chart 8**.

Average cover, height, species density, species richness and number of fire tolerant species have all either increased or remained near previous survey results. Stratum species proportions have changed numerically but remain in the same ratios i.e. the shrub stratum is over target, with a slight increase in the proportion of ground stratum species to 8.39%, with the remaining strata near or above targets. This block represents an excellent rehabilitation result.

Table 10: Results of the initial rehabilitation monitoring for Block Q4

Parameter	Target	Rehab status Jan 2019	Rehab status Jul 2019	Rehab status Jan 2020	Rehab status Jul 2020	Rehab status Jan 2021	Percent Target Achieved (Jan 21)
Average Cover (%)	**80**	2.48	20.48	41.84	48.38	66.96	83.70
Average height (cm)	**230**	13.84	10.02	13.86	36.16	44.70	19.44
Ave. No. of plants (plants/4 m^2)	**40**	12.83	18.26	29.97	34.96	32.48	81.40
Ave. No. Fire tolerant species (plants/4 m^2)	**1**	1.13	1.57	1.41	1.74	1.97	197.33
Ave. Species Richness (species/4 m^2)	**12**	5.11	7.64	10.94	13.68	14.23	118.56
Ave. Ground stratum proportion (%)	**27**	2.28	2.88	7.47	6.51	8.39	31.07
Ave. Shrub stratum proportion (%)	**61**	75.97	74.67	78.02	77.58	76.55	125.49
Ave. Midstorey stratum proportion (%)	**7**	6.34	10.21	8.07	7.10	6.32	90.35
Ave. Overstorey stratum proportion (%)	**5**	11.40	12.23	6.44	8.80	8.74	174.78

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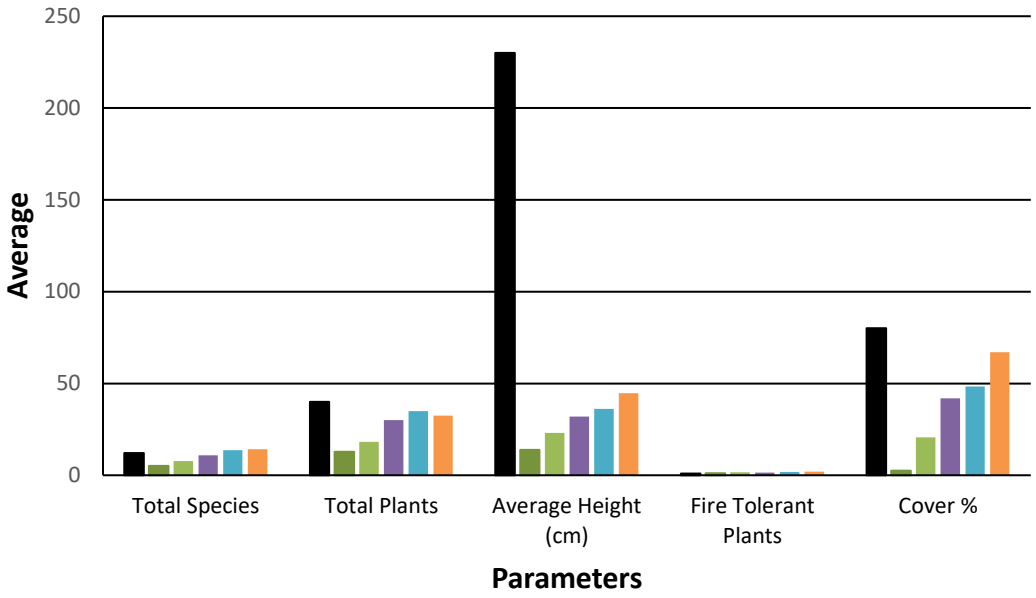


Chart 7: **The average key rehabilitation parameters over the course of the surveys for Block Q4 and comparison to rehabilitation targets**

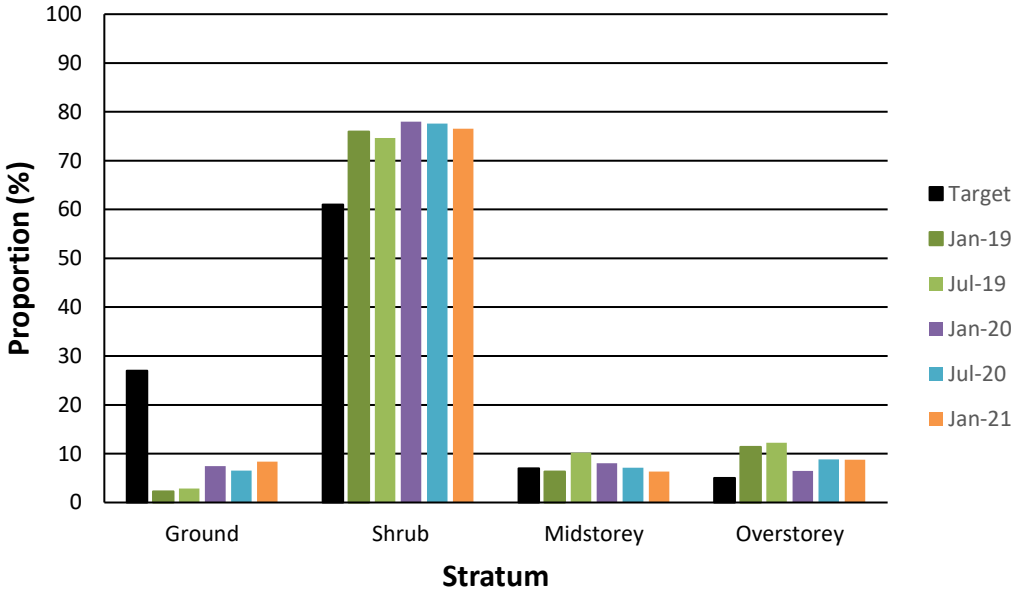


Chart 8: **The overall averages for stratum proportions for Block Q4 for the initial biannual survey and comparison to rehabilitation targets**

3.4.2 Target Species

The planting campaign that has undertaken has been very successful on this block. The overstorey species are now well over target and may require thinning in the future if they prove

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to be too dense. Each of the other target species is either present, or one of the additional species has filled that niche to an extent.

Table 11: Total estimated numbers of target species and additional species and comparison to targets for Block Q4. Note – additional species have not been calculated for previous surveys.

Species	Target Number	Est No. Jan-19	Est No. Jul-19	Est No. Jan-20	Est No. Jul-20	Est No. Jan-21	Target Achieved this Survey (%)
Banksia aemula/serrata	4576	1467	3461	2411	2557	2081	45.48
Corymbia gummifera	141	1877	1291	1567	1903	832	591.22
Eucalyptus piperita	528	645	939	844	238	1070	202.70
Leptospermum polygalifolium	2112	0	293	844	951	832	39.41
Leptospermum trinervium	2394	0	469	0	357	1368	57.13
Melaleuca nodosa	4928	469	880	1326	1724	1903	45.48
Xanthorrhoea glauca	No target	528	293	362	476	416	-
Eucalyptus robusta	No target	-	-	904	714	2141	-
Angophora costata	No target	-	-	0	0	0	-
Eucalyptus spp.	No target	-	-	0	0	0	-

3.5 BLOCK Q5

3.5.1 Growth Parameters

Block Q5 has been surveyed for the fifth time with results shown in

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Table 12, **Chart 9** and **Chart 10**. Since the previous survey, this block has had extensive weed control work conducted including a controlled burn August 2020.

Average cover and height have increased from the previous surveys. Average plant density has decreased to 40 plants per 4m^2 as a result of the weed control efforts although *Eragrostis curvula* (African Lovegrass) is still the dominant ground cover, while *Acacia longifolia* has become the dominant shrub. The initial species richness of 12.88 species/4m^2 has decreased to 5.95 species/4m^2. Fire Resistant Species has remained largely unchanged and very much above target. Stratum proportions are skewed by the combined effects of a high proportion of ground stratum species – usually weeds, and the low average species. Native shrub species are much reduced in this block – only 26.10% - when compared to other rehabilitation areas. Recent planting efforts have increased the relative proportions of the midstorey and overstory strata to 21.08% and 8.72% respectively.

Table 12: Results of the January 2021 rehabilitation monitoring for Block Q5

Parameter	Target	Rehab status Jan 2019	Rehab status Jul 2019	Rehab status Jan 2020	Rehab status Jul 2020	Rehab status Jan 2021	Percent Target Achieved (Jan 20)
Average Cover (%)	**80**	42.20	58.98	31.60	44.51	71.09	88.87
Average height (cm)	**230**	28.64	51.56	32.93	61.81	89.88	39.08
Ave. No. of plants (plants/4 m^2)	**40**	39.10	21.48	40.56	18.26	21.97	54.94
Ave. No. Fire resistant species (plants/4 m^2)	**1**	4.85	4.36	3.56	3.78	3.87	387.80
Ave. Species Richness (species/4 m^2)	**12**	12.88	8.73	8.60	6.00	5.95	49.59
Ave. Ground stratum proportion (%)	**27**	46.13	35.72	53.93	50.01	41.66	154.29
Ave. Shrub stratum proportion (%)	**61**	38.56	44.96	22.66	22.94	26.10	42.79
Ave. Midstorey stratum proportion (%)	**7**	12.17	15.37	22.71	19.75	21.08	301.20
Ave. Overstorey stratum proportion (%)	**5**	3.14	3.95	0.70	4.87	8.72	174.36

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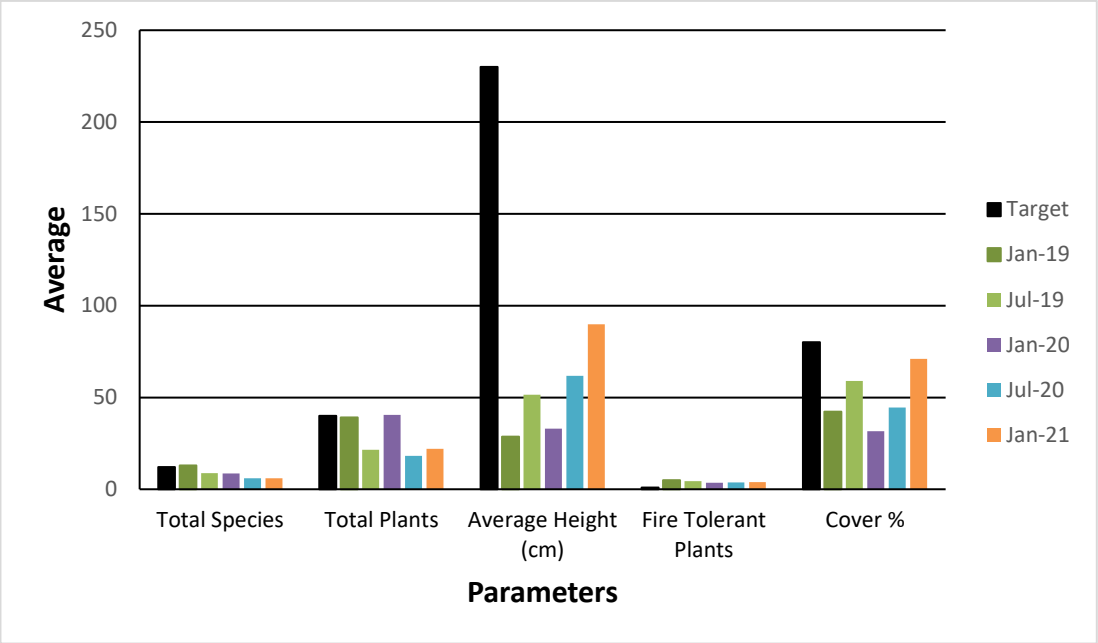


Chart 9: **The average key rehabilitation parameters over the course of the surveys for Block Q5 and comparison to rehabilitation targets**

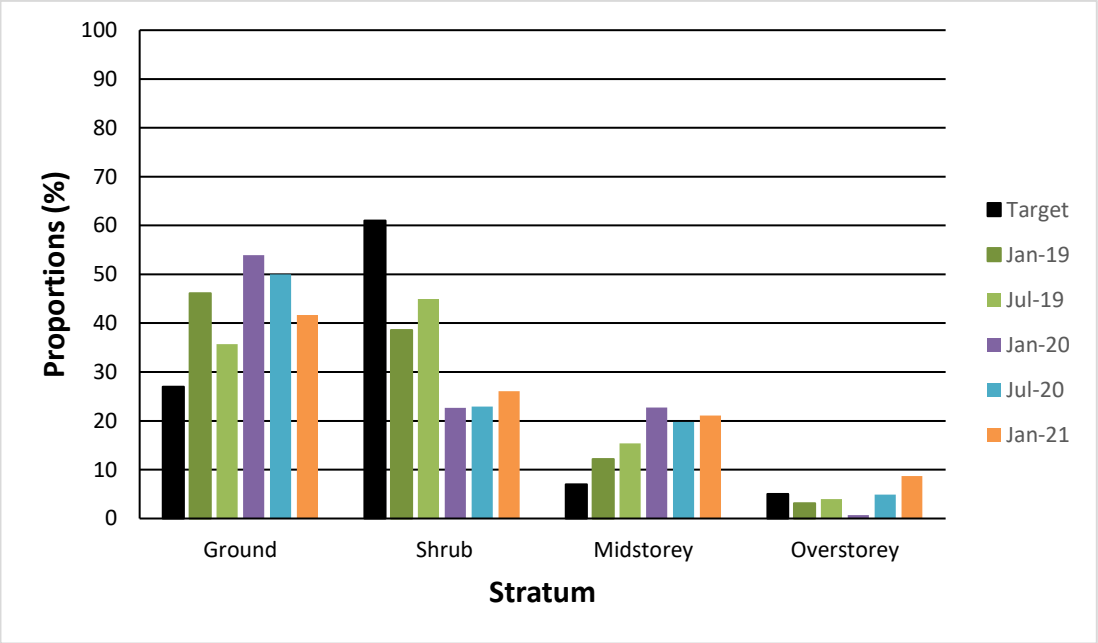


Chart 10: **The average proportion of species that will occupy each stratum for Block Q5 and comparison to rehabilitation targets over the course of the biannual surveys**

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3.5.2 Target Species

Block Q5 has had further planting undertaken with overstorey and midstorey species installed (**Table 13**). This was reflected in survey numbers increasing for several species, e.g. *B. aemula* and *B. serrata, L. trinervium, M. nodosa* and *E. robusta*. The increased numbers were not recorded for *L. polygalifolium.* All key species were recorded for this block, but only *C. gummifera* is above target densities.

Table 13: **Total estimated numbers of target species and additional species and comparison to targets for Block Q5. Note – additional species a have not been calculated for previous surveys.**

Species	Target Number	Estimated No. Jan-19	Estimated No. Jul-19	Estimated No. Jan-20	Estimated No. Jul-20	Estimated No. Jan-21	Target Achieved this Survey (%)
Banksia aemula/serrata	2366	666	610	222	333	444	18.76
Corymbia gummifera	73	610	333	0	222	222	304.88
Eucalyptus piperita	273	0	0	0	0	55	20.33
Leptospermum polygalifolium	1092	666	555	0	555	111	10.16
Leptospermum trinervium	1238	0	55	388	0	333	26.90
Melaleuca nodosa	2548	444	499	277	499	610	23.95
Xanthorrhoea glauca	No target	999	2330	388	444	999	No Target
Eucalyptus robusta	No target	-	-	0	111	388	No target
Angophora costata	No target	-	-	0	0	-	No target
Eucalyptus spp.	No target	-	-	0	0	-	No target

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3.6 BLOCK Q6

3.6.1 Growth Parameters

This was the third survey undertaken on Block Q6. As **Table 14** shows average cover, height, plant density and fire tolerant plants all increased substantially over the previous surveys, and while most of these parameters are still below target, trajectories are indicating that targets will be met at this stage. The stratum proportions were as expected for this age rehabilitation with the shrub stratum dominating and increasing with the increased number of species recorded.

Table 14: Results of the January 2020 rehabilitation monitoring for Block Q6

Parameter	Target	Rehab status Jan 2020	Rehab status Jul 2020	Rehab status Jan 2021	Percent Target Achieved (Jan 21)
Average Cover (%)	**80**	6.11	18.90	40.88	51.11
Average height (cm)	**230**	14.65	19.81	30.27	13.16
Ave. No. of plants (plants/4 m^2)	**40**	19.14	21.29	28.18	70.45
Ave. No. Fire resistant species (plants/4 m^2)	**1**	2.14	1.70	2.32	232.79
Ave. Species Richness (species/4 m^2)	**12**	6.93	7.32	13.32	111.07
Ave. Ground stratum proportion (%)	**27**	7.49	4.31	3.82	14.14
Ave. Shrub stratum proportion (%)	**61**	60.22	68.07	74.31	121.85
Ave. Midstorey stratum proportion (%)	**7**	12.59	15.28	12.73	181.92
Ave. Overstorey stratum proportion (%)	**5**	19.69	12.35	9.14	182.84

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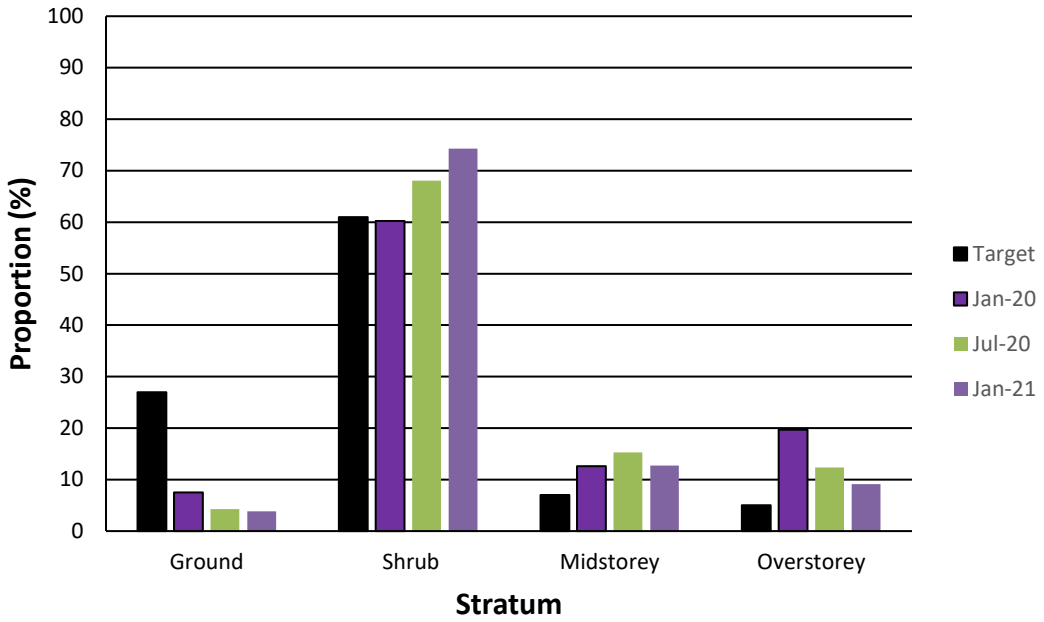


Chart 11: **The average proportion of species that will occupy each stratum for Block Q6 for the biannual surveys and comparison to rehabilitation targets**

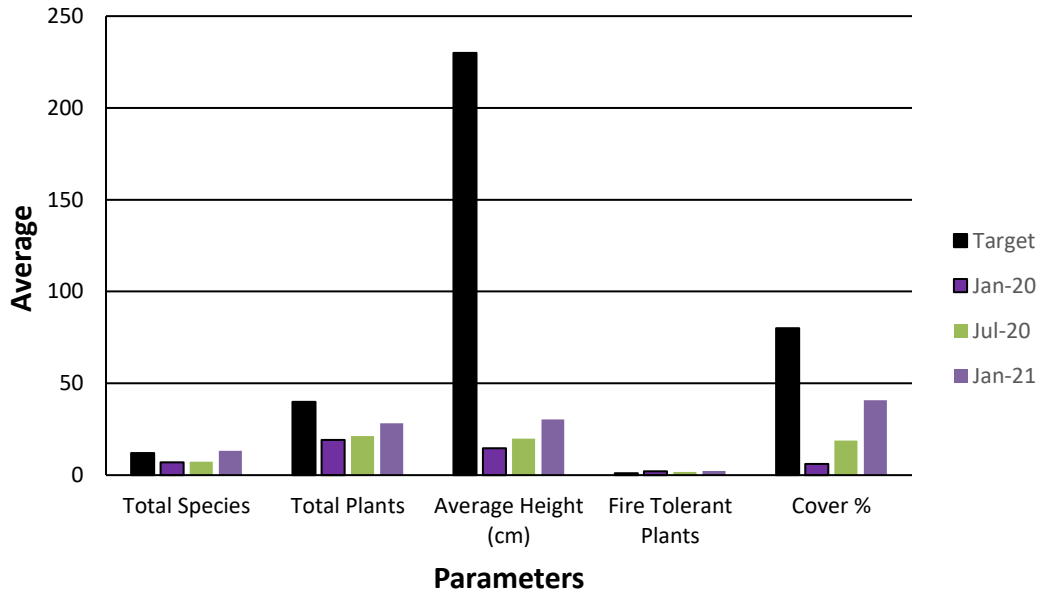


Chart 12: **The average key rehabilitation parameters for the biannual surveys for Block Q6 and comparison to rehabilitation targets**

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3.6.2 Target Species

Target species plantings for this block have taken place and this is reflected in the numbers with three of the target species over target, with *C. gummifera* considerably above target. *B. aemula* and *M nodosa* are below target at 64.63% and 43.91% respectively. *L. trinervium* numbers have increased markedly after good germination from the seed bank. At this relatively early stage of rehabilitation, the parameters and the target species are on track.

Table 15: Total estimated numbers of target species and additional species and comparison to targets for Block Q6.

Species	Target Number	Estimated No. Jan- 20	Estimated No. Jul- 20	Estimated No. Jan- 21	Target Achieved this Survey (%)
Banksia aemula/serrata	3562	1797	1853	2302	64.63
Corymbia gummifera	110	1291	1291	1797	1639.34
Eucalyptus piperita	411	449	730	730	177.60
Leptospermum polygalifolium	1644	2077	2190	2246	136.61
Leptospermum trinervium	1863	0	56	4716	253.13
Melaleuca nodosa	3836	2583	1460	1684	43.91
Xanthorrhoea glauca	No target	287	337	730	No Target
Eucalyptus robusta	No target	0	168	56	No Target
Leptospermum laevigatum	No target	0	0	0	No Target
Angophora costata	No target	0	0	0	No Target
Eucalyptus spp.	No target	0	0	0	No Target

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4. PLANTING – NORTH DUNES EXTENSION

Planting and seeding were undertaken on the North Dunes Extension from July 2020 to December 2020 and concentrated on the blocks highlighted in previous reports as deficient in particular species. As part of the re-planting works, Holcim also removed the topsoil and weed infestation of a large area of Q1 and Q5 back to the soil surface with the aim of removing a large component of the weeds and, as importantly, reduce the weed seed bank. The planting and seeding works are detailed in the table below.

Table 16: Details of species and numbers planted during 2020

Species	Number	Area	Month	Units	Method
Banksia aemula/serrata	**284**	Q1 & Q5	July - November	Forestry Tubes & seed	Hand Planted, direct seed
Corymbia gummifera	**135**	Q1 & Q5	August - September	Forestry Tubes	Hand Planted
Eucalyptus piperita	**315**	Q1 & Q5	August	Forestry Tubes	Hand Planted
Eucalyptus robusta	**101**	Q2 & Q5	August	Forestry Tubes	Hand Planted
Leptospermum polygalifolium	**495**	Q5	August & December	Forestry Tubes	Hand Planted
Leptospermum trinervium	**-**	Q1, Q2, Q5 & Q6	December	-	Brushmatting
Melaleuca nodosa	**1085**	Q2 & Q5	August	Forestry Tubes	Hand Planted

4.1 WEEDS

Weed control operations were undertaken by Sibelco staff in July through to December 2020. Works included the cool season burn undertaken in August on Blocks 1 and 5, and included herbicide application and hand weeding (hoeing) within the blocks and along the adjacent haul roads.

As has been reported previously (Kleinfelder, 2020) weeds are a major problem for the extension (Error! Reference source not found.). Weeds are starting to encroach into blocks Q3, Q4 and Q6 from the adjoining haul roads and weed infested areas. The northern section of block Q1, the whole of Q2 and Q5 are heavily weed infested. Each block will be discussed in turn. **Table 17** lists the major weeds identified from the survey – but is not a comprehensive

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list of weed species - and calculates their density. It should be noted that Holcim has undertaken several weed control measures in the period covered by this report including the previously mentioned scalping of portions of Block Q1 and Q5, burning of dense *E. curvula* on Block 5 as well as hand control and herbicide application in Blocks Q1, Q2 and along the adjacent haul road.

Table 17: Numbers of the major weed species across the North Dunes Extension by block. Please note these are calculated densities based on survey data undertaken in July 2020 (Block Q1) and late January 2021 for the remainder.

Scientific Name	Common Name	Block Density					
		Q1	Q2	Q3	Q4	Q5	Q6
Acanthospermum australe	-	0	53	0	0	222	56
Conyza spp.	Fleabane	216	0	0	0	0	0
Eragrostis curvula	African Lovegrass	3343	1973	0	476	6770	225
Leptospermum laevigatum	Coastal Tea Tree	1186	320	0	357	5327	56
Megathyrsus maximus	Guinea Grass	0	0	0	297	1443	0
Melinis repens	Red Natal Grass	4097	373	115	119	9266	56
Oenothera mollissima	-	0	0	0	0	444	0

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Block Q1 – this block has good revegetation along its eastern portion, but at its western end, near the turning circle, *E. curvula* has formed a dense infestation. This species is now starting to encroach into the adjoining Block Q4. The northern section of Q1, between the haul road and the northern boundary was densely weed infested, the major weed being *E. curvula*, but this is by no means the only weed species present with the weedy grasses *Megathyrsus maximus* (Guinea Grass), *Melinis repens* (Red Natal Grass), *Axonopus fissifolius* (Narrow-leafed Carpet Grass) and *Eleusine indica* (Crowsfoot Grass) also recorded. Holcim have undertaken a major revegetation of this section of the block, with topsoil scraping and replanting conducted.

Block Q2 – this is small block to the east of Q1 and presents the same issues as Q1 with a high density of weeds, including the listed weed species *Gloriosa superba* (Glory Lilly) and a lack of native species diversity (**Plate 2**). Just to the east of this block in the Offsets area, several other weed species have been identified and treated, but the major concern here is the *Phyllostachys aurea* (Fishpole Bamboo) that despite multiple treatments was still observed to be re-growing. Further ongoing and frequent treatment of this species is required. The recent weed control works undertaken for the North Dunes Extension Offsets has targeted these infestations.



Plate 2: **Plot 6 in Q2 showing bare soil and *E. curvula* in January 2021 showing the proliferation of *G. superba* (red flowers)**

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Block Q3 – The grass weed *Melinis repens* (Red Natal Grass) was recorded within the rehabilitation for the first time this survey, although the infestations are sparse, limited to single plants.

Block Q4 - has four weed species recorded within the rehabilitation. These are the grass weeds, *E. curvula*, *M. repens* and *Megathyrsus maximus* (Guinea Grass) encroaching from Block Q1 along its northern boundary. *L. laevigatum* has become established with the rehabilitation and individuals should be removed before seed set.

Block Q5 – sits to adjacent to The Knoll, between the haul road and the northern boundary of the site. It too is heavily weed infested but does have a greater species richness than the adjacent portions of Block Q1 and Block Q2. It suffers from recruitment of weed species from the buffer zone along Rutile Rd to the north as well as the previously mentioned dense *E. curvula.* This block has been the subject of on-going control works and replanting by Holcim field staff.

Block 6 – this is the latest block to be rehabilitated and as such has small, young plants and low coverage. Weeds are starting to encroach from Block Q5. In addition, during sand extraction it appears a short haul road was constructed using road base. This has not been removed prior to rehabilitation and is now a source of weeds with some minor *Acanthospermum australe* re-establishing after previous weed control and a substantial infestation of a weed identified as *Oenothera mollissima*. This infestation has been the subject of weed control efforts by Holcim field staff (**Plate 3**).

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Plate 3: **Plot 16 in Q6 showing *Oenothera mollissima* (centre) colonising bare soil of the road base.**

5. SUMMARY OF SPECIES RECORDED

Appendix 5 lists the plant species recorded during the January 2021 survey (note that this is NOT a cumulative list of every species ever recorded from all surveys), and the number of species and their stratum are summarised in **Table 18**. This survey shows a total of 99 species recorded of which 77 were native flora species 22 were exotic species, which a slight reduction from the previous survey results. As expected from this vegetation community and the stages of rehabilitation, shrub species were the dominant stratum. The ground stratum was relatively evenly divided between natives (18 species) and exotics (15 species), while the shrub stratum was predominantly composed of native species (49 natives and 3 exotics). The seven midstorey species recorded on site have been re-evaluated for the status. Three have now been classifies as ‘exotic”, but these are native Australian species, but are not listed as comprising a natural part of the target rehabilitated vegetation community. These species are *Acacia falcata, A. mearnsii* and *L. laevigatum.* An additional two native species *Acacia cardiophylla* (Wyalong Wattle) and *Acacia saligna* (Golden wreath Wattle) were observed on site in Bl Q1 and Q5 but did not appear in the plot data. Seven overstorey species were recorded this survey with *Pinus elliottii* the lone exotic overstorey species recorded in the plot

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data. Again, a native species not considered a component of the target vegetation community, *Casuarina cunninghamiana* (River Oak) was observed on site in Bl Q1.

Breakdown by block shows Bl Q1, Q4 and Q6 have about the same total number of species at around 50 each, but Bl Q1 has a greater number of exotic species with 12 recorded. Block Q2 has the fewest number of species and a high percentage of exotics, while Bl Q5 also has the highest number of exotic species at 13 species. Block Q3 did not record any weed species.

Table 18: Summary of numbers of flora species for the North Dunes Extension broken down by rehabilitation block, strata and native vs exotic

Stratum		Nth Dunes (All Blocks)	Bl Q1	Bl Q2	Bl Q3	Bl Q4	Bl Q5	Bl Q6
Total Species	**Totals**	**99**	**56**	**32**	**50**	**52**	**42**	**55**
	Natives	77	44	23	49	50	29	51
	Exotics	22	12	9	1	2	13	4
Ground	**Totals**	**33**	**14**	**12**	**8**	**8**	**15**	**8**
	Natives	18	6	6	7	7	5	4
	Exotics	15	8	6	1	1	10	4
Shrub	**Totals**	**52**	**31**	**12**	**35**	**35**	**18**	**39**
	Natives	49	30	10	35	35	17	39
	Exotics	3	1	2	0	0	1	0
Midstorey	**Totals**	**7**	**6**	**4**	**3**	**5**	**5**	**4**
	Natives	4	4	3	3	4	3	4
	Exotics	3	2	1	0	1	2	0
Overstorey	**Totals**	**7**	**5**	**4**	**4**	**4**	**4**	**4**
	Natives	6	4	4	4	4	4	4
	Exotics	1	1	0	0	0	0	0

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6. DISCUSSION AND MANAGEMENT ACTIONS

Each block will be discussed in turn, but a general comment can be made that with the improved rainfall, vegetation condition has improved. This is evident both from the data collected during the survey and the monitoring photos provided in **Appendix 1**. Rehabilitation blocks that had previously recorded good diversity such as Blocks Q3 and Q4 are blocks where many of the shrub species may have set seed and with the excellent rainfall in since October, these species have re-germinated and progressed to very good rehabilitation. In those blocks where diversity is low (part of Bl Q1 and all of Bl Q2 and Q5), diversity could be increased with the return of organic screenings from the processing plant and treatment with smoke chemicals to mimic the effect of fire without the need for ecological or other burns (ecobiolgical, 2005). The effect of low diversity can be seen in the **Appendix 3** charts that compare the species proportions at the similar stages of rehabilitation. These charts show clearly the effect of the high proportion of ground species on Blocks Q1, Q2 and Q5 (**Chart 13**) and the corresponding reduction in the proportion of shrub species in the same blocks (**Chart 14**).

The planting program undertaken by Holcim of the key species will greatly assist with the improvement of the rehabilitation in those areas.

During the reporting period covered by this report, Holcim has undertaking weed control works on the North Dunes Extension with spot spraying and hand weeding of weeds along the haul road and a controlled burn to help reduce the density of *E. curvula.* Further weed control works are required to prevent the further spread of weeds, especially from Bl Q1 into Blocks Q3 and Q4 and from Q5 into Q6.

6.1.1 Block Q1

6.1.1.1 Developmental Parameters

Block Q1 was the first of the North Dunes Extension rehabilitation areas. It straddles the haul road with the better rehabilitation occurring as a thin strip of rehabilitation on either side. This section of the rehabilitation exhibits good canopy density and height, with many of the trees estimated to be up to 5m tall, although most are estimated to be between 1.5m and 2.5m in height (**Plate 11**). Shrub species have begun to die-back and there is a considerable amount of bare ground that is beginning to be colonised by the grassy weed species. Growth parameters have been negatively affected by the combination of drought and weed infestation

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in large sections of this block (**Plate 12**). Species diversity has decreased to its lowest point since monitoring commenced. Additional seeding of shrub species is required to increase the species diversity in those areas where *E. curvula* is densest and after treatment of the weeds.

6.1.1.2 Target Species Planting/Seeding

Of the target species, *L. trinervium* appears to have made a slight comeback after not being recorded in the previous survey, but has only been recorded in a small number of plots in this block (**Figure 7**). This species germinates from the seed bank or is brush-matted and as such the young seedlings can be more vulnerable to drought conditions when compared to planted tubestock. *M. nodosa* is also well below target and requires remedial action such as additional planting and/or seeding. *E. piperita* is also below target, but the high numbers of other canopy species compensate for this. The observation of flowers and seeds on some individual key species is a positive development.

6.1.1.3 Weed Control

E. curvula requires further urgent control action. The previously recommended action for controlled burns (Kleinfelder, 2020) has been undertaken and Holcim are to be commended for this and the scalping followed by additional planting, but continued and sustained follow up is required to capitalise on this good start. Other weeds require spot herbicide application to prevent spread into the rehabilitated areas from along the haul road. *Pinus elliottii* seedlings are still germinating from the soil or being distributed from trees in the offsets that have not yet been subject to control actions. These seedlings can be controlled by manual lopping as they do not resprout, obviating the need for herbicide application. Further remedial seeding and planting works should occur after the weed species have been controlled.

6.1.2 Block Q2

6.1.2.1 Developmental Parameters

Development parameters are only superficially good, with a very high weed content accounting for the average cover, average number of plants per quadrat, and the high proportion of ground stratum overall. The return to better conditions has led to a resurgence the weed species – mainly *E. curvula*, but also the listed weed noxious weed species *Gloriosa superba* (**Plate 17**).

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Additional seeding of native species, especially shrubs and ground covers is required to reach species diversity targets.

6.1.2.2 Target Species Planting

Target species numbers for this block are very low with two of the species – *E. piperita* and *L. trinervium* not recorded at all (**Figure 5** and **Figure 7**) although a small number of *E. robusta* have been planted and survive. The midstorey species *B. aemula* (**Figure 3**) and *L. polygalifolium* (**Figure 6**), are present but require additional planting and/or seeding to achieve targets.

6.1.2.3 Weed Control

Active weed control measures have been undertaken including the controlled burn and hand weeing/herbicide application. But as with all of the weed control measures recommended are required to be increased and consistent.

6.1.3 Block Q3

6.1.3.1 Developmental Parameters

The previous annual report (Kleinfelder, 2020) stated the drought has adversely affected this block with most growth parameters reduced from the previous (2019) survey. But as reported in the above sections, this block has rebounded well displaying a high of resilience. The monitoring photos for this block highlight this, with good growth evident (**Plate 22** and **Plate 27**).

6.1.3.2 Target species Planting

The planting program has resulted in above target numbers of canopy, even if the diversity is somewhat lacking. For instance, *C. gummifera* (**Figure 4**) numbers are well over target with the caveat that these are probably multiple *Eucalyptus* species that are too young to differentiate at this stage. *L. polygalifolium* (Figure 6 numbers appear to have collapsed with the previous drought conditions and require another round of planting to ensure targets are achieved, while *L. trinervium* numbers have come back somewhat, again displaying a degree of ecological resilience.

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6.1.3.3 Weed Control

Isolated grass weed species were recorded within the block itself, and with weeds present along the haul roads and Block Q1 adjacent to this block, further spread is probable. Holcim has undertaken control works in these areas, but efforts will need to be undertaken regularly until such time as the haul road is rehabilitated.

6.1.4 Block Q4

6.1.4.1 Development Parameters

This block has continued to progress and has improved its rehabilitation parameters since the previous surveys. **Plate 30** shows the good vegetative cover that has been achieved. This block on trajectory to achieve rehabilitation targets.

6.1.4.2 Target Species

Target species as mentioned in the results section are generally over or near target densities. **Appendix 2** figures show good distribution of the target specie across this block, with all key species present.

6.1.4.3 Weed Control

Weeds were observed within the central portions of this block for the first time this survey. Previous surveys have noted grassy weed species such as *Megathyrsus maximus* (Guinea Grass) and *E. curvula* colonising the edges of this block, especially where it adjoins Block Q1 (**Plate 35**). Two examples of *Melinis repens* (Red Natal Grass) were recorded in the plots, with further individuals observed.

6.1.5 Block Q5

6.1.5.1 Developmental Parameters

This block is very similar to Blocks Q1 (north section) and Q2 in that it is older rehabilitation with a high level of grassy weeds (mainly *E. curvula* but also *M. maximus*) and other woody weeds. The distribution of native vegetation is uneven across the block with some areas

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dominated by the grassy weeds. *A. longifolia* is the dominant native shrub species with many of the individual plants now getting quite large (**Plate 41**), but even this species is not present in all areas of the block. Where it is present, it tends to dominate as this species has an average height of 180cm (ranging up to 300cm) on this block at the time of survey. It can achieve heights of 800cm, suggesting that it will pose severe competition to smaller species.

6.1.5.2 Target species Planting

Holcim has undertaken additional planting of key species from August through to December of 2020, including 950 *M. nodosa,* 280 *Banksias,* 495 *L. polygalifolium.* No doubt many of these were planted into the newly re-prepared areas of the block. These will take time to mature and to be able to counter the weeds.

6.1.5.3 Weed Control

As stated above, Holcim have undertaken extensive control efforts including controlled burns and scalping of weed infested topsoils, excellent control measures. Further consistent weed control is required to further reduce the weed levels on this block, and to prevent spread into adjacent rehabilitation blocks such as Block Q6 and The Knoll when that area is rehabilitated. The amenities screen located between this block and Rutile Rd is acting as a source for several weed species including *L. laevigatum* (recorded in large numbers with this species germinating from the seedbank) and *Lantana camara*. Consideration should be made to extend weed control efforts into this area.

6.1.6 Block Q6

6.1.6.1 Developmental Parameters

Including the biannual survey undertaken in June 2020, this was the third survey of this block. Rehabilitation parameters are progressing satisfactorily. Comparison of monitoring photos (**Plate 42** and **Plate 43** with **Plate 44** and **Plate 45** respectively) shows that revegetation is well underway with increasing cover, species diversity and plant numbers, although the proportion of ground stratum species is very low. Further monitoring will be required to determine if numbers improve.

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6.1.6.2 Target Species

Target species have been planted into his block and most of the species are at or above target, and no further planting is required at this stage. **Appendix 2** figures show excellent distribution of target species across this block.

6.1.6.3 Weed Control

As very young rehabilitation this block can be susceptible to colonisation by weed species. This is the case with weeds encroaching from Block Q5. Hand weeding has been conducted by Holcim staff to remove an infestation of *Oenothera mollissima* (**Plate 3**). Spot spraying is required to prevent further spread of weeds into this block.

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7. REFERENCES

ecobiological (2005), *Vegetation rehabilitation monitoring of Block A, June 2005.* A report prepared by ecobiological now Kleinfelder Australia) on behalf of Unimin Australia (now Sibelco Australia)

Kleinfelder (2013), *Landscape Management Plan – Tanilba Northern Dune Extension*. A report prepared for Sibelco Australia by Kleinfelder Australia

Kleinfelder (2019), *Annual Report for North Dunes and North Extension – 2019* A report prepared by Kleinfelder Australia for Sibelco Australia.

Kleinfelder (2020), *Weed Control Recommendations for the Sibelco Sand Extraction Operations at Salt Ash and surrounds.* A report prepared by Kleinfelder Australia for Sibelco Australia.

Kleinfelder (2020), *Annual Report for North Dunes and North Extension – 2020* A report prepared by Kleinfelder Australia for Sibelco Australia.

Kleinfelder (2020), *Recommended management actions for the North Dunes Extension Area following the July 2020 biannual rehabilitation monitoring*. A short report prepared by Kleinfelder Australia for Holcim Australia.

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APPENDIX 1: PHOTOGRAPHIC MONITORING RECORD

Block Q1

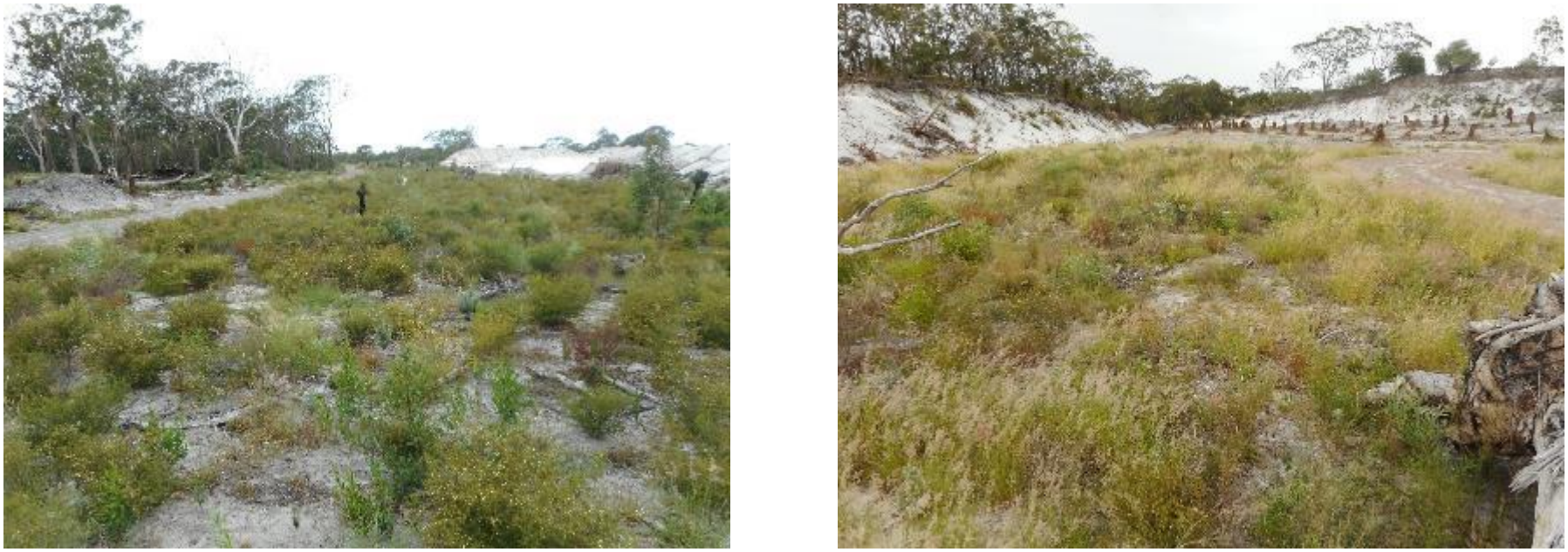


Plate 4: **View of Block Q1 from PP1 looking East (left) and West (right) January 2018**

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Plate 5: **Block Q1 PP2 January 2018**



Plate 6: **Block Q1 PP2 July 2018**

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Plate 7: **Block Q1 PP1 looking from east to west January 2019**

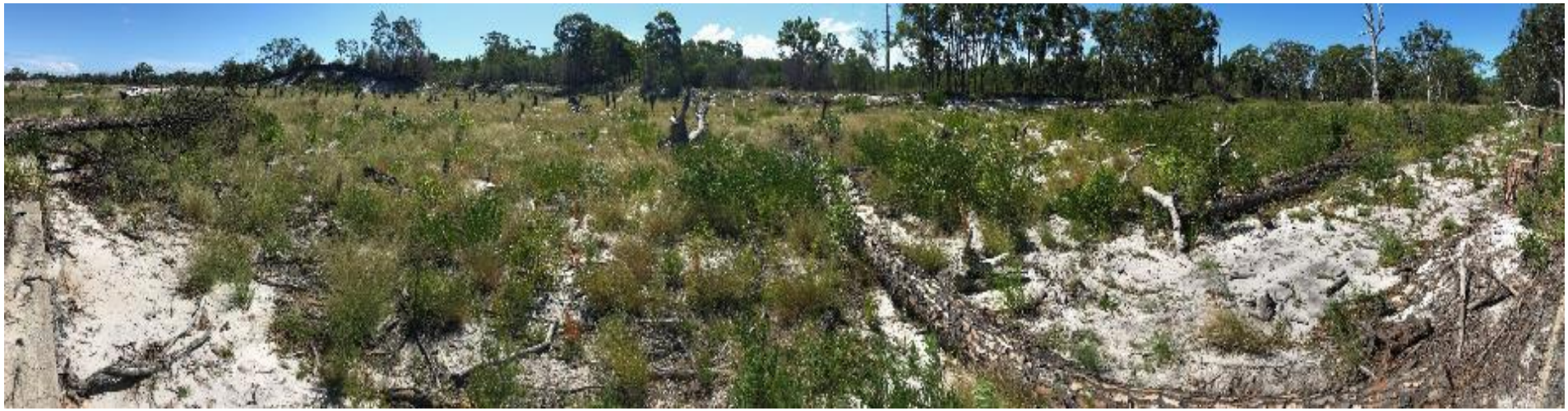


Plate 8: **Block Q1 PP2 looking west January 2019**

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Plate 9: **View of Block Q1 from PP1 looking East (left) and West (right) July 2019**



Plate 10: **Block Q1 PP2 looking west July 2019**

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Plate 11: **View of Block Q1 from PP1 looking East (left) and West (right) January 2020. Notice the dieback of shrub species and the height of the Eucalypt (left) and the prevalence of *Eragrostis curvula* (right)**



Plate 12: **Block Q1 PP2 looking west January 2020**

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Block Q2



Plate 13: Block Q2 looking east January 2019



Plate 14: Block Q2 looking east July 2019

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Plate 15: Block Q2 looking east January 2020. Note the die back of *Acacia longifolia* around the perimeter of the block



Plate 16: Block Q2 looking east July 2020.

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Plate 17: **Block Q2 looking east January 2021.**

Block Q3



Plate 18: **Block Q3 east (looking west) January 2019**

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Plate 19: **Block Q3 east (looking west) July 2019**



Plate 20: **Block Q3 east (looking west) January 2020**

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Plate 21: Block Q3 east (looking west) July 2020

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Plate 22: Block Q3 east (looking west) January 2021



Plate 23: Block Q3 south (looking east along haul road) January 2019

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Plate 24 **Block Q3 south (looking east along haul road) July 2019**



Plate 25: **Block Q3 south (looking east along the haul road) January 2020**

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Plate 26: **Block Q3 south (looking east along haul road) July 2020**



Plate 27: **Block Q3 south (looking east along haul road) January 2021**

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Block Q4



Plate 28: **Block Q4 east (looking west) January 2019**



Plate 29: **Block Q4 east (looking west) July 2019**

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Plate 30: **Block Q4 east (looking west) January 2020**



Plate 31: **Block Q4 east (looking west) July 2020**

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Plate 32: Block Q4 east (looking west) January 2021

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Plate 33: **Block Q4 west (looking east) January 2019**



Plate 34: **Block Q4 west (looking east) July 2019**

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Plate 35: **Block Q4 west (looking east) January 2020. Note the grassy weeds adjacent to this block (far left and right of photo)**



Plate 36: **Block Q4 west (looking east) January 2020.**

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Plate 37: **Block Q4 west (looking east) January 2021. Note the dense weedy grass infestation in Block Q1 (left of photo) and the encroachment into this block.**

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Block Q5



Plate 38: **Block Q5 looking east January 2019**



Plate 39: **Block Q5 looking east July 2019**

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Plate 40: **Block Q5 looking east January 2020**



Plate 41: **Block Q5 north (looking south) January 2021. Growth of vegetation necessitated the relocation of the photo point for this block. Note the dominance of grasses (brown) and *Acacia longifolia* (large green shrubs)**

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Block Q6



Plate 42: **Block Q6 north east (looking south and west) July 2020.**



Plate 43: **Block Q6 south east (looking south west to north east) July 2020.**

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Plate 44: **Block Q6 north east (looking south and west) January 2021. Note the grassy weeds encroaching from Block Q1 at right of photo**



Plate 45: **Block Q6 south east (looking south west to north east) January 2021.**

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APPENDIX 2: TARGET SPECIES LOCATIONS RECORDED DURING JANUARY/FEBRUARY 2021 SURVEYS

This set of figures show the plot locations where individuals of the target species were recorded and are included to aid in any replanting efforts. Please note that often the plots do not record all individuals that have survived on site and observations by personnel undertaking replating operations should be made to ascertain the absolute necessity of replanting.



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Legend

2021 Monitoring Blocks

Banksia aemula

Present

Absent

Metres

0 10 20 40 60 80 100

N

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DATE DRAWN: 2021/03/20 00:57 Version 1

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DATA SOURCE:
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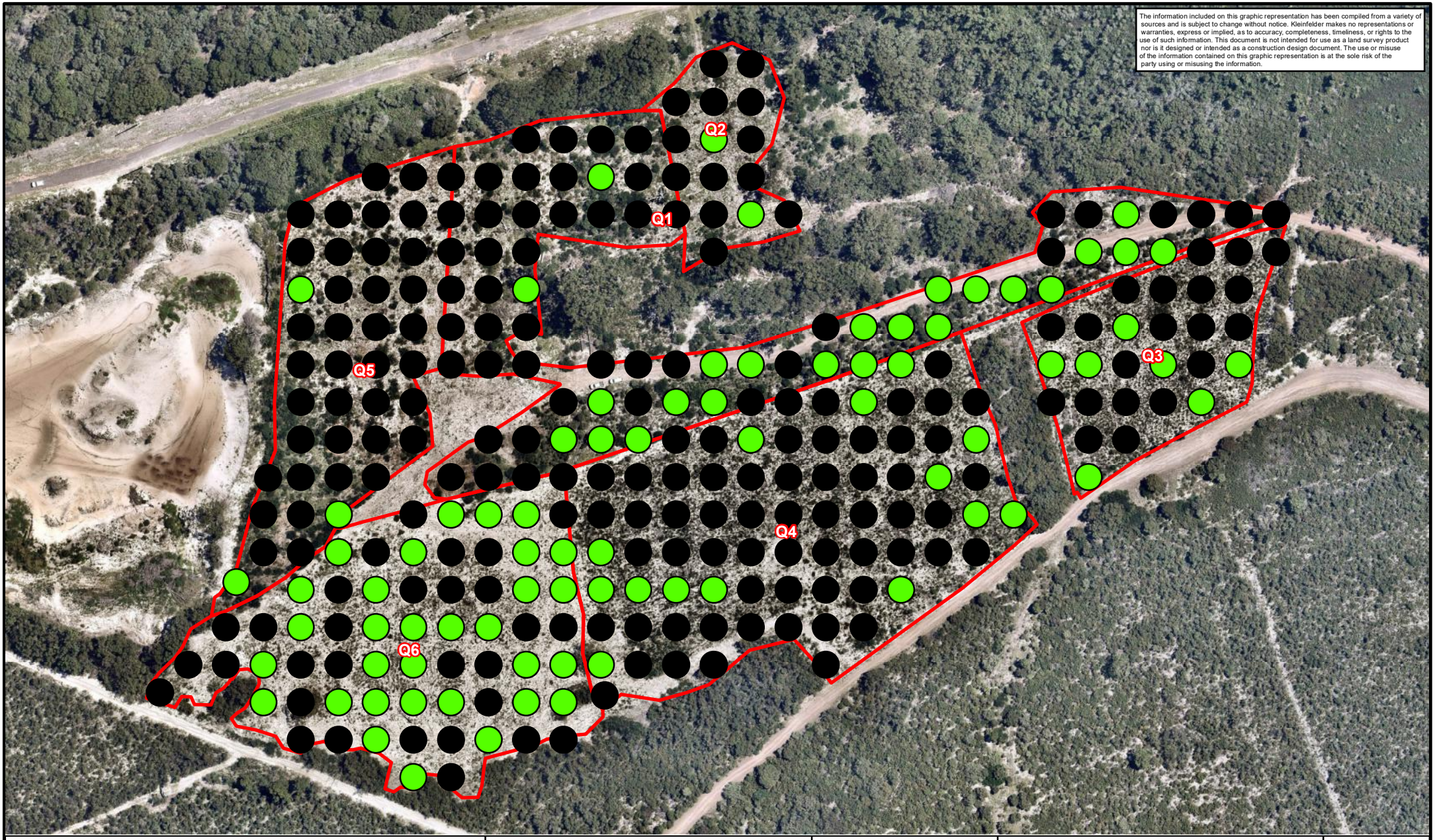
Presence/Absence of *Banksia aemula*

Sibelco Australia
2021 Annual Vegetation Rehabilitation Monitoring Report
North Dune Extension Sand Mining Extraction Operation
Oyster Cove Rd, Tanilba Bay

FIGURE:

3

L:\GIS FOLDER\00 CLIENT FILES\131942_Holcim\AnnualMonitoring\20211342_NorthDunesExt_Biannual_Jan2021\Mapping\20211342_Fig03_Banksia aemula.mxd



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Legend

2021 Monitoring Blocks

Corymbia gummifera

Present

Absent

Metres

0 10 20 40 60 80 100

N

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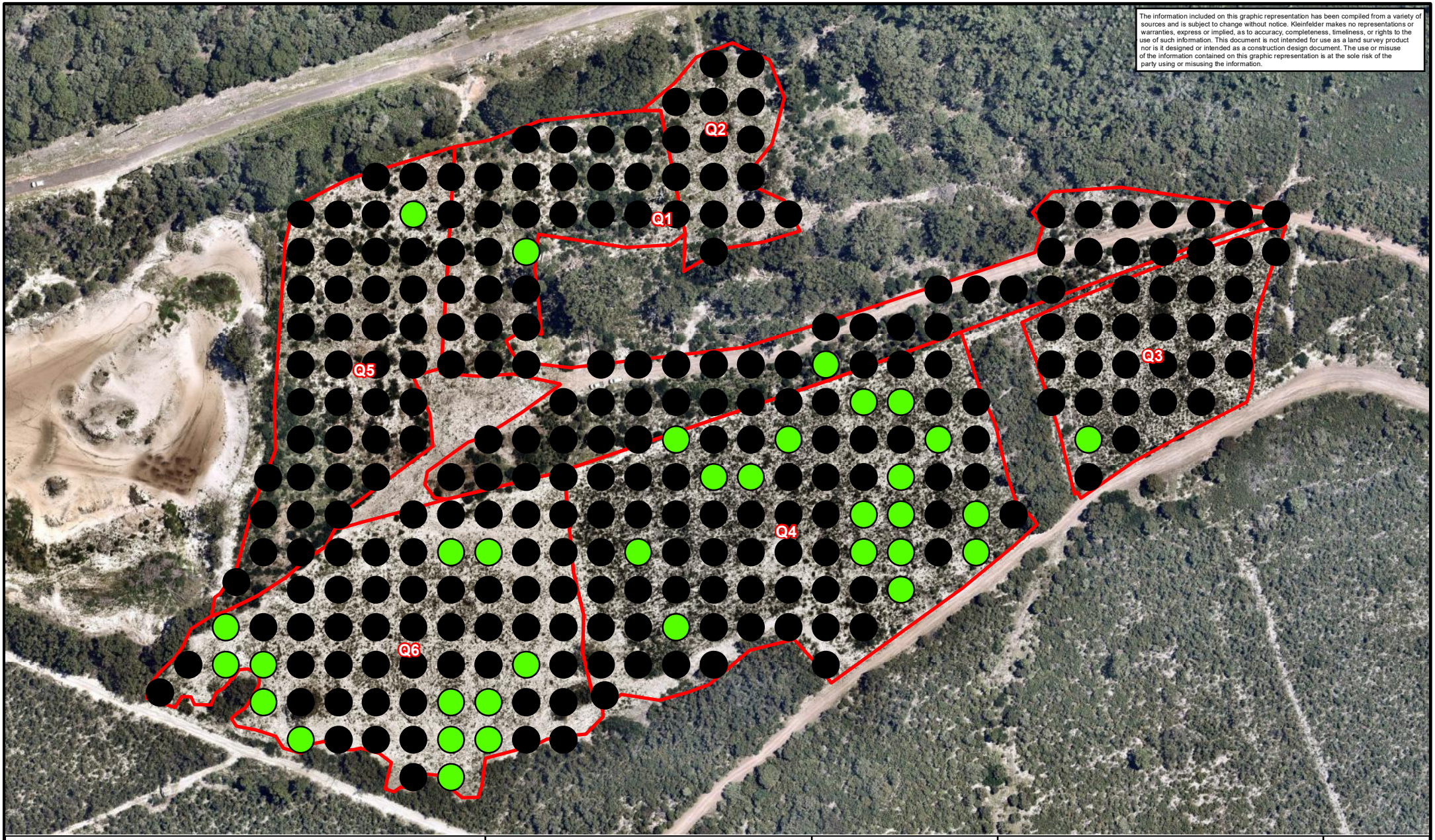
Presence/Absence of *Corymbia gummifera*

Sibelco Australia
2021 Annual Vegetation Rehabilitation Monitoring Report
North Dune Extension Sand Mining Extraction Operation
Oyster Cove Rd, Tanilba Bay

FIGURE:

4

L:\GIS FOLDER\00 CLIENT FILES\131942_Holcim\AnnualMonitoring\20211342_NorthDunesExt_Biannual_Jan2021\Mapping\20211342_Fig04_Corymbia gummifera.mxd



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Legend

2021 Monitoring Blocks

Eucalyptus piperita

Present

Absent

Metres

0 10 20 40 60 80 100

N

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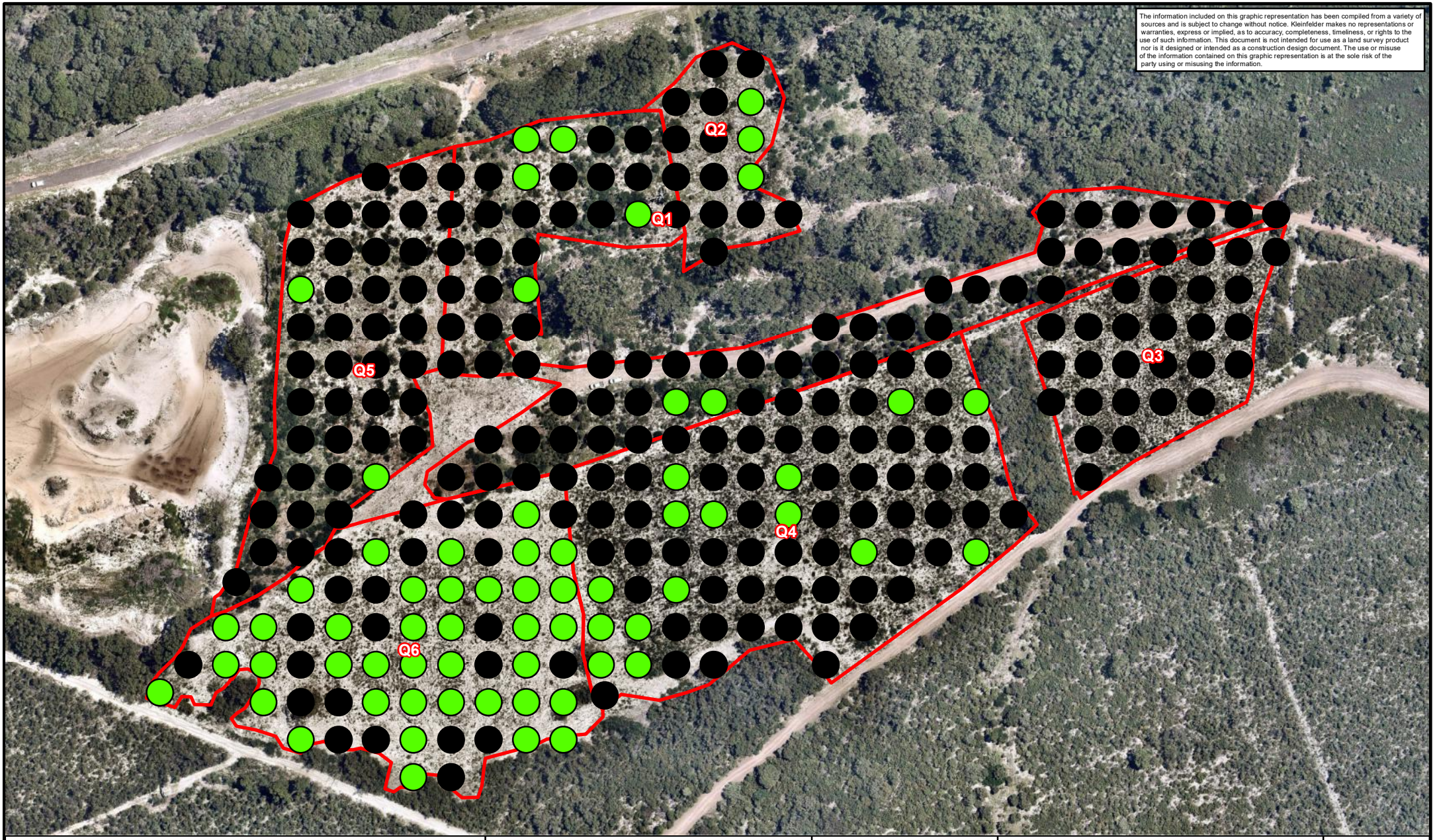
Presence/Absence of *Eucalyptus piperita*

Sibelco Australia
2021 Annual Vegetation Rehabilitation Monitoring Report
North Dune Extension Sand Mining Extraction Operation
Oyster Cove Rd, Tanilba Bay

FIGURE:

5

L:\GIS FOLDER\00 CLIENT FILES\131942_Holcim\AnnualMonitoring\20211342_NorthDunesExt_Biannual_Jan2021\Mapping\20211342_Fig05_Eucalyptus piperita.mxd



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Legend

2021 Monitoring Blocks

Leptospermum polygalifolium

Present

Absent

Metres

0 10 20 40 60 80 100

N

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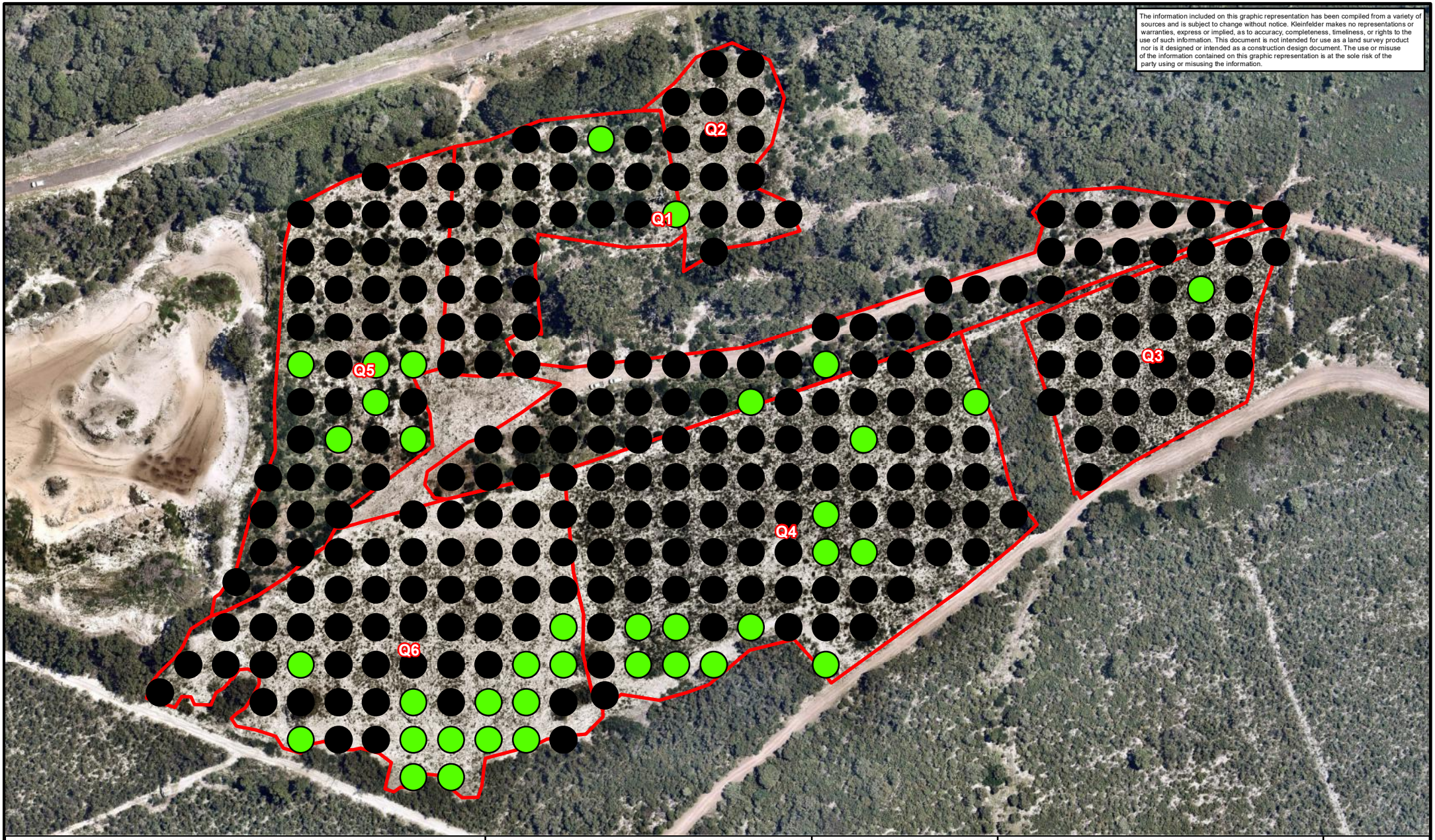
Presence/Absence of *Leptospermum polygalifolium*

Sibelco Australia
2021 Annual Vegetation Rehabilitation Monitoring Report
North Dune Extension Sand Mining Extraction Operation
Oyster Cove Rd, Tanilba Bay

FIGURE:

6

L:\GIS FOLDER\00 CLIENT FILES\131942_Holcim\AnnualMonitoring\20211342_NorthDunesExt_Biannual_Jan2021\Mapping\20211342_Fig06_Leptospermum polygalifolium.mxd



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Legend

2021 Monitoring Blocks

Leptospermum trinervium

Present

Absent

Metres

0 10 20 40 60 80 100

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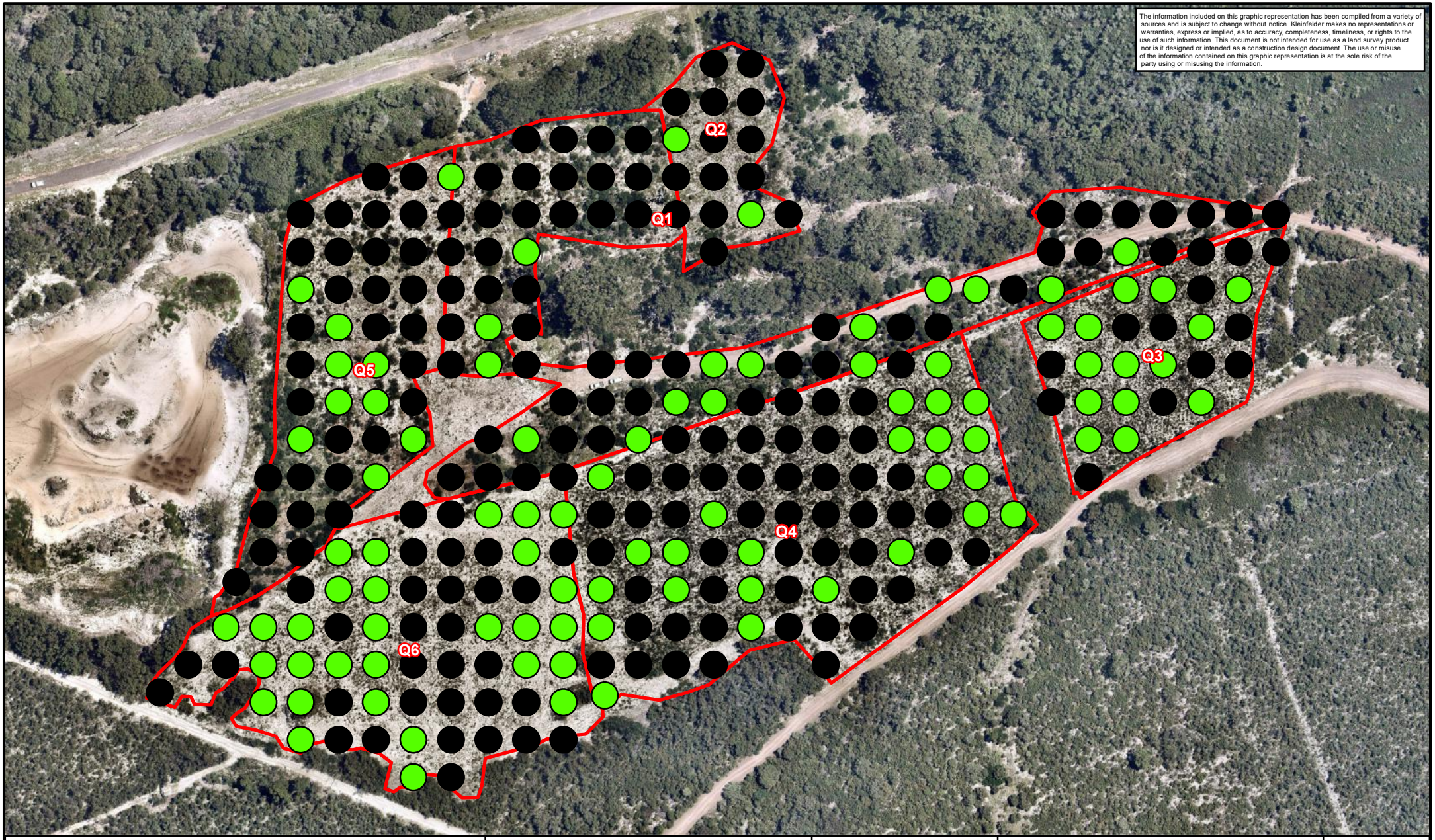
Presence/Absence of *Leptospermum trinervium*

Sibelco Australia
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Oyster Cove Rd, Tanilba Bay

FIGURE:

7

L:\GIS FOLDER\00 CLIENT FILES\131942_Holcim\AnnualMonitoring\20211342_NorthDunesExt_Biannual_Jan2021\Mapping\20211342_Fig07_Leptospermum trinervium.mxd



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Legend

2021 Monitoring Blocks

Melaleuca nodosa

Present

Absent

Metres

0 10 20 40 60 80 100

N

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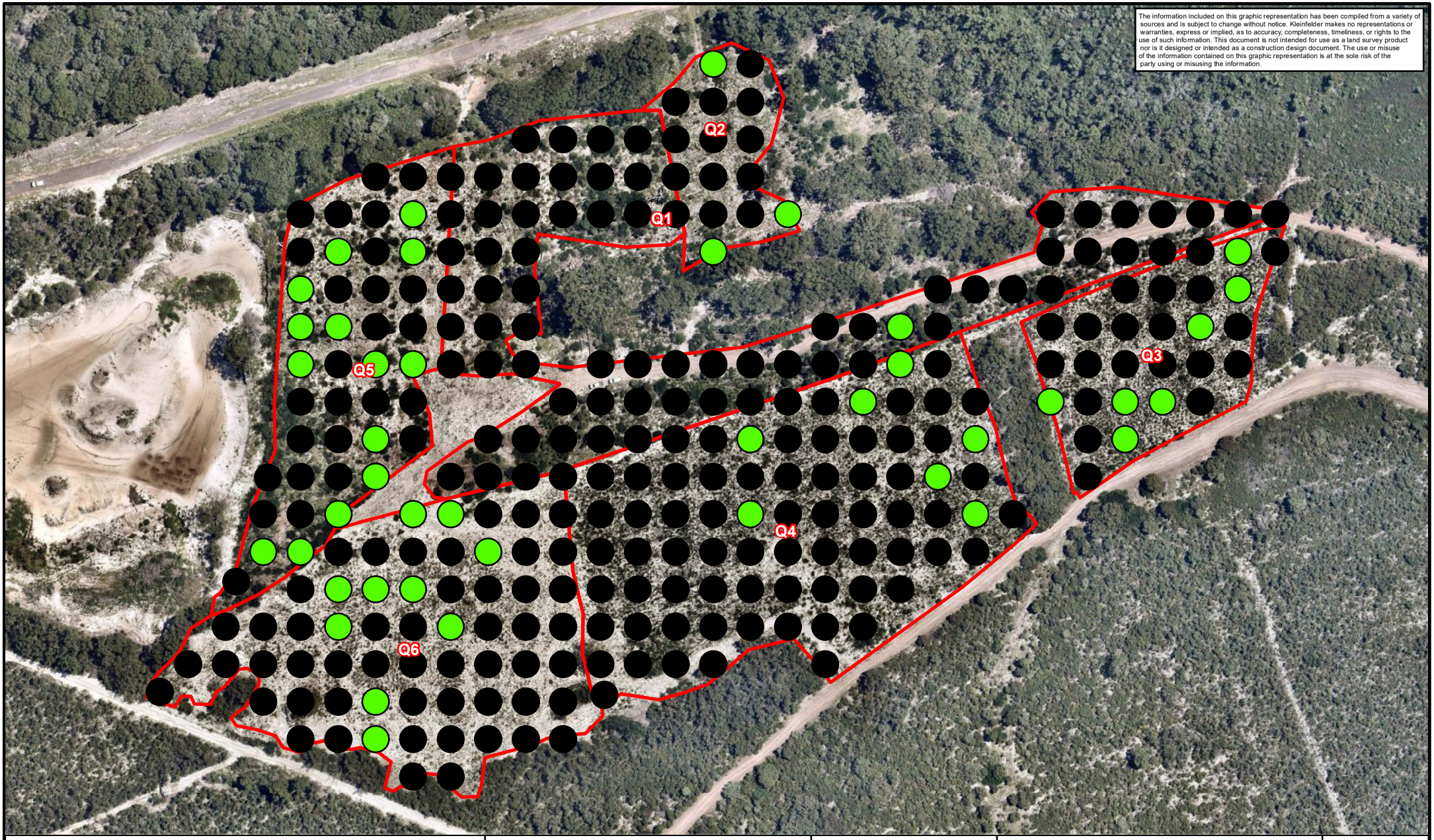
Presence/Absence of *Melaleuca nodosa*

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2021 Annual Vegetation Rehabilitation Monitoring Report
North Dune Extension Sand Mining Extraction Operation
Oyster Cove Rd, Tanilba Bay

FIGURE:

8

L:\GIS FOLDER\00 CLIENT FILES\131942_Holcim\AnnualMonitoring\20211342_NorthDunesExt_Biannual_Jan2021\Mapping\20211342_Fig08_Melaleuca nodosa.mxd



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Legend

2021 Monitoring Blocks

Xanthorrhoea glauca

Present

Absent

Metres

0 10 20 40 60 80 100

N

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DRAWN BY: GJoyce

DATA SOURCE:
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Nearmap - 2021

Presence/Absence of *Xanthorrhoea glauca*

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2021 Annual Vegetation Rehabilitation Monitoring Report
North Dune Extension Sand Mining Extraction Operation
Oyster Cove Rd, Tanilba Bay

FIGURE:

9

L:\GIS FOLDER\00 CLIENT FILES\131942_Holcim\AnnualMonitoring\20211342_NorthDunesExt_Biannual_Jan2021\Mapping\20211342_Fig09_Xanthorrhoea glauca.mxd

APPENDIX 3: NORTH DUNES EXTENSION BLOCKS Q1 TO Q6 COMPARSION CHARTS

The following charts compare the growth parameters for each blocks Q1 to Q6 at the same stages at each survey period (i.e. 6 months, 12 months) over the 3 years of monitoring. The proportion charts track the relative number of species by stratum for each block, with targets based on the original surveys of the Tanilba North Dune undertaken by ecobiological (now Kleinfelder Australia) in 2005.

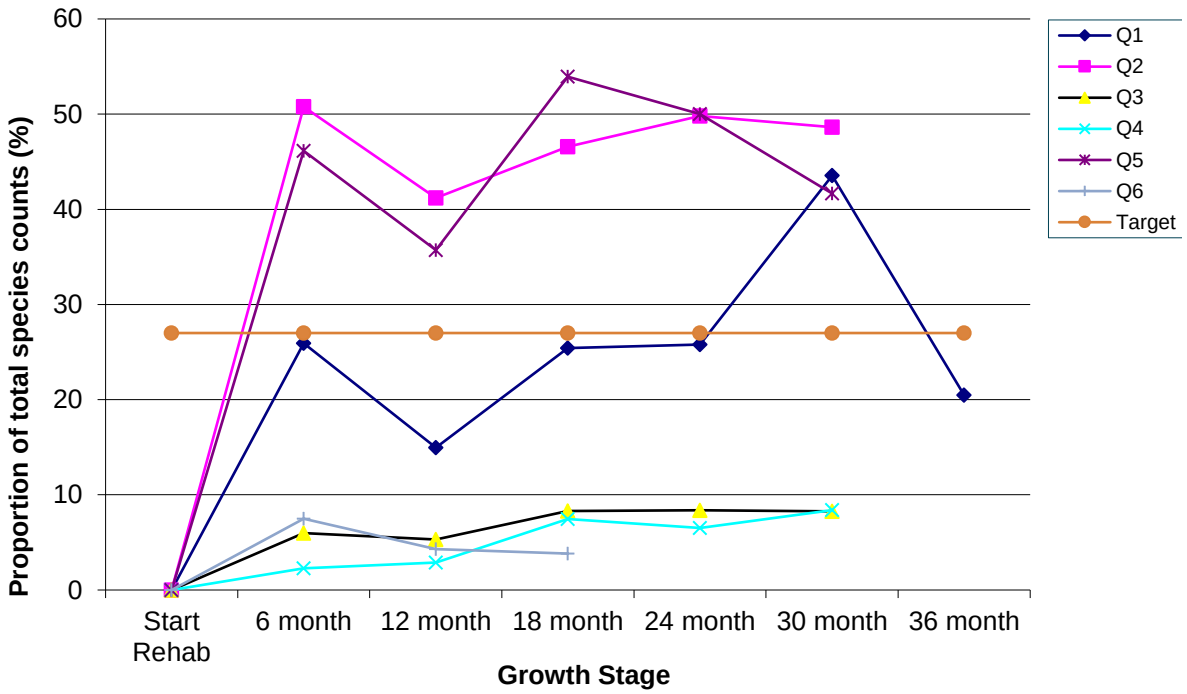


Chart 13: **The average proportion of ground species to all other stratum species at each stage of growth for the Northern Dune Extension rehabilitation areas Blocks Q1 to Q6.**

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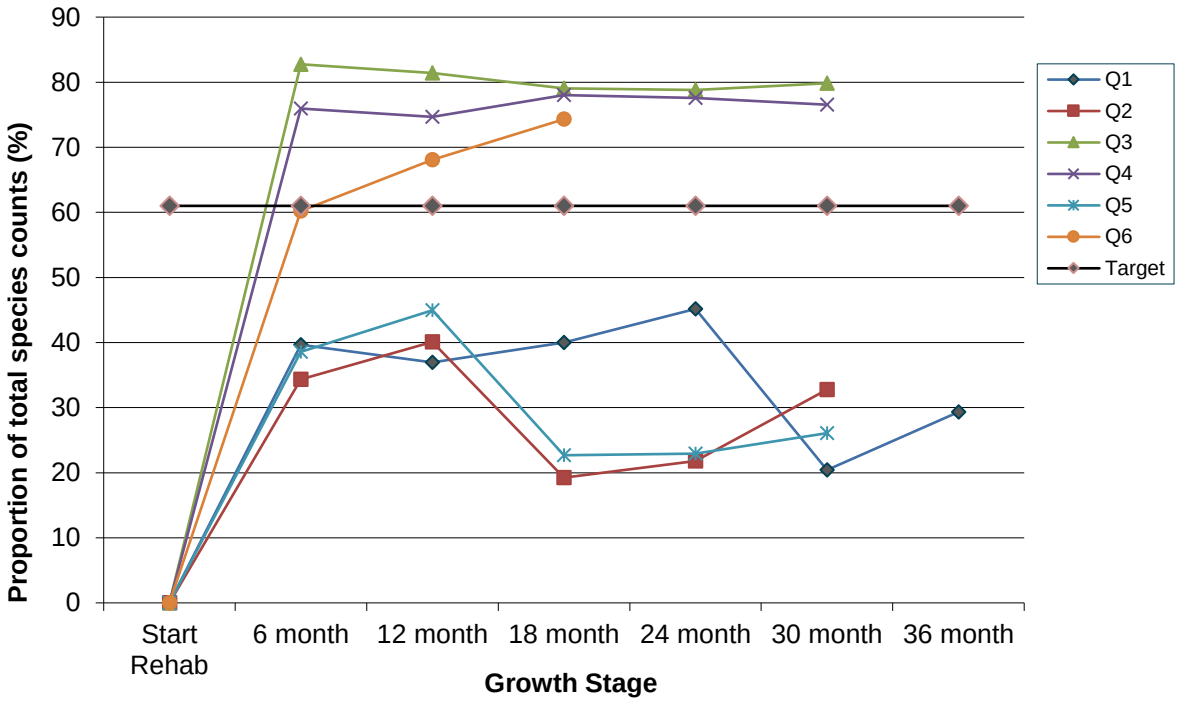


Chart 14: **The average proportion of shrub species to all other stratum species at each stage of growth for the Northern Dune Extension rehabilitation areas Blocks Q1 to Q6.**

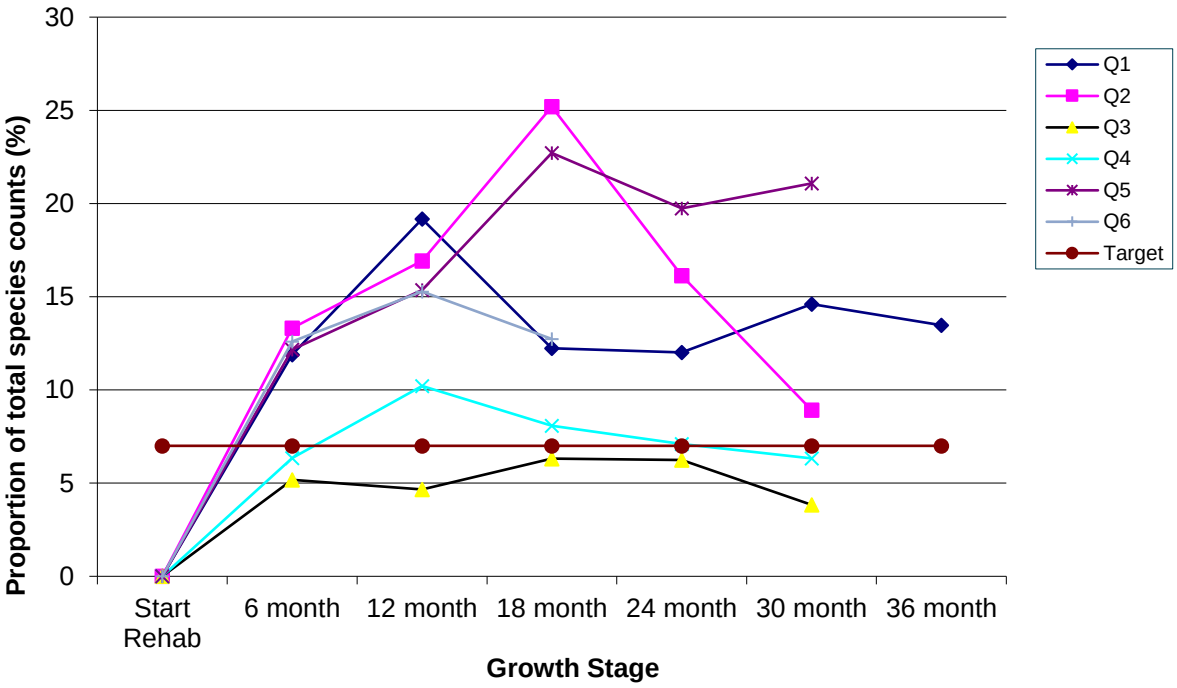


Chart 15: **The average proportion of midstorey species to all other stratum species at each stage of growth for the Northern Dune Extension rehabilitation areas Blocks Q1 to Q6.**

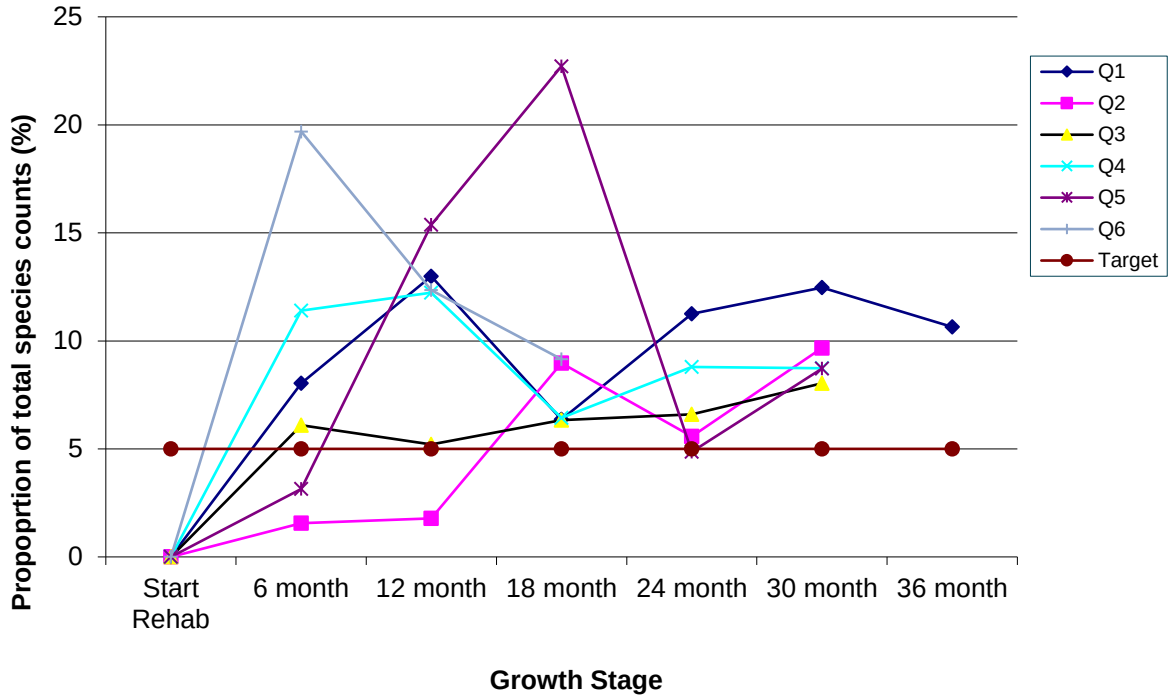


Chart 16: **The average proportion of canopy (overstorey) species to all other stratum species at each stage of growth for the Northern Dune Extension rehabilitation areas Blocks Q1 – Q6.**

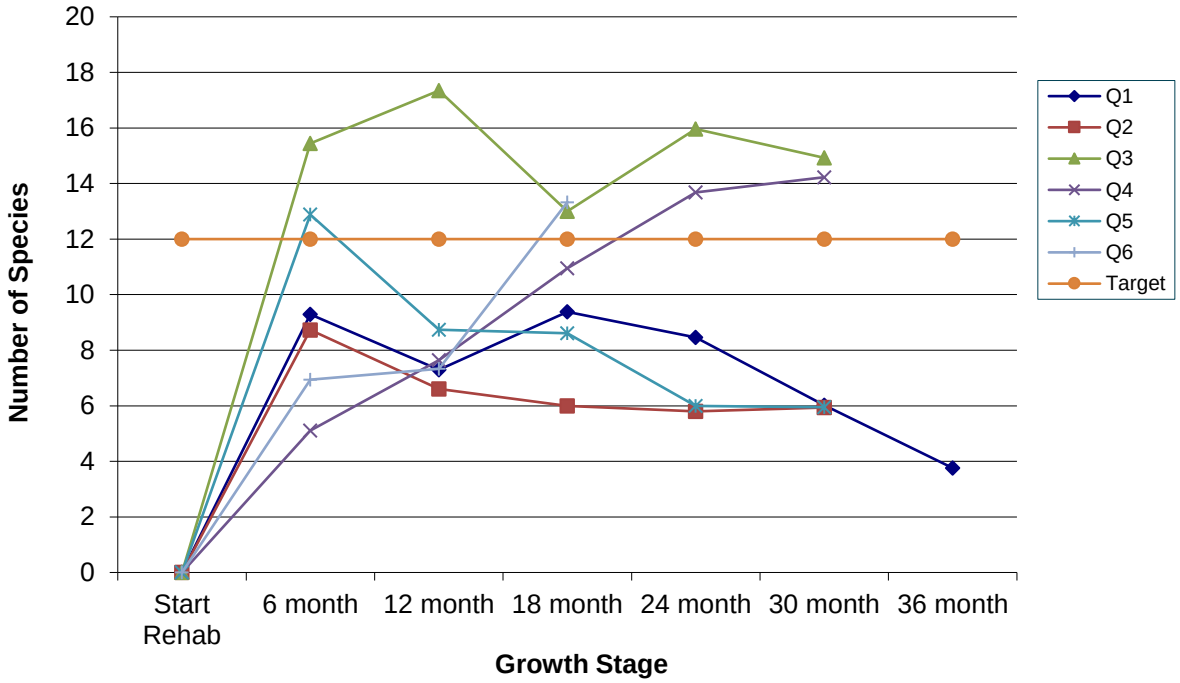


Chart 17: **The average total species per quadrat at each stage of growth for the Northern Dune Extension rehabilitation areas for Blocks Q1 to Q6**

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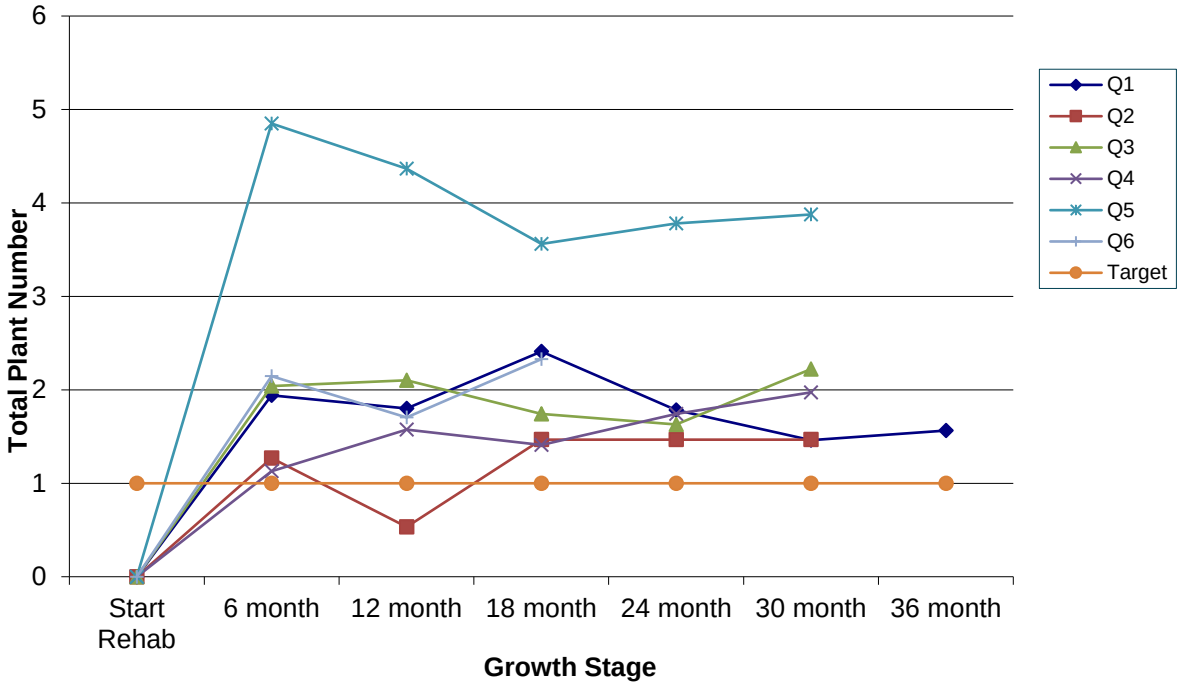


Chart 18: **The average total fire tolerant species per quadrat at each stage of growth for the Northern Dune Extension rehabilitation areas for Blocks Q1 – Q6.**

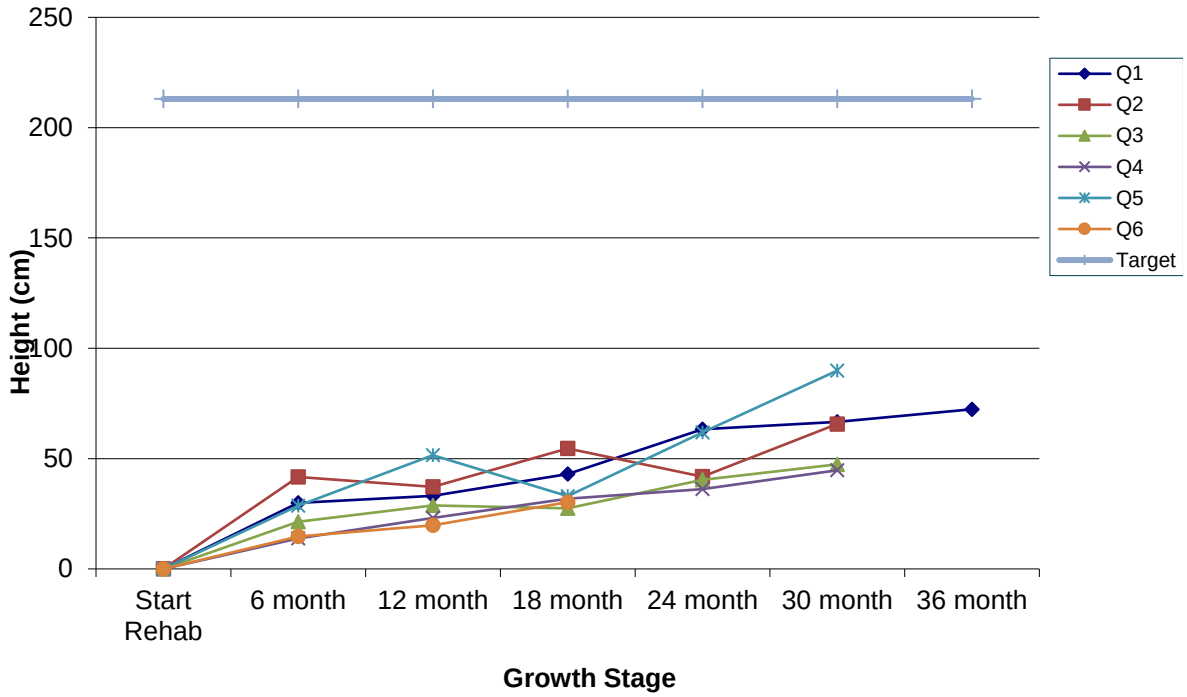


Chart 19: **The average plant height at each stage of growth for the Northern Dune Extension rehabilitation areas for Blocks Q1 – Q6. Note the target of 213 cm has not been shown to allow for clarity of the block data**

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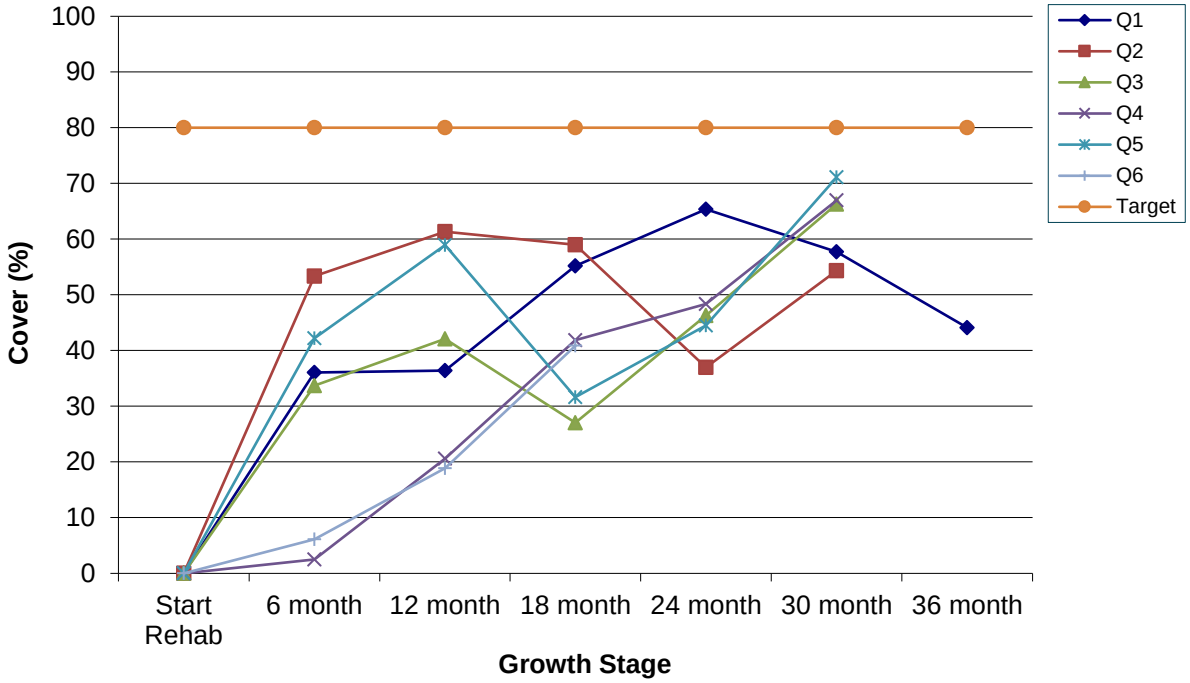


Chart 20: **The average foliage cover at each stage of growth for the Northern Dune Extension rehabilitation areas for Blocks Q1 to Q6.**

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APPENDIX 4: PREDICTIVE TRENDS

Available Data

Data is available for 36 months of rehabilitation for Block Q1. Blocks Q2 to Q5 have been surveyed for 30 months (five monitoring events) and Block Q6 has only been surveyed for the third time this survey i.e. 18 months or rehabilitation.

Changes to Predictive Modelling

Given the relatively short period of time that the Extension has been subject to monitoring, the predictive models will be subject to change with the collection of additional data. Feedback from the 2016 AEMR for the Tanilba North Dunes Monitoring was to include Post 3-year data in the predictive modelling where this data was available. The “Available Data” outlined above will include this data when it becomes available in the future.

Results

The results derived from **Chart 21** and **Chart 22** indicate a relatively common trend for all blocks in cover and height.

Cover

Based on just the surveyed data for between 18 and 36 months of growth, predicted foliage cover for rehabilitation blocks had been predicted to reach close to 80% after approximately 2 – 4 years, but this appears to have been extended to between 3 - 6 years (**Chart 21**). The rapid growth that occurs during this initial stage of rehabilitation appears to have been affected by the drought, with Blocks Q1, Q2 and Q5 in particular experiencing a period of regression in the average cover, thereby extending the period required to reach the target, with a decreased rate increase from this year onwards. The high proportion of grass species which die-back rapidly during drought, but then grow back equally as fast once conditions improve has contributed to the apparent volatility of the cover data. It is not apparent why Bl Q3 also displays the volatility, as it did not have a high proportion of weed species present. Nor is it apparent why Bl Q4 has not recorded the reduction in average cover that the other blocks have shown.

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Height

The effect of the drought was very pronounced for the time predicted to achieve target height with all blocks recording longer time periods post this survey (**Chart 22**). Blocks Q2 and Q5 have been adversely affected with target achievement not predicted for another 20 plus years. These times must be reflection of the lack of overstorey species on these blocks, and it is suggested that with additional planting these times will be greatly extended as these younger plants act to “reset” the development clock. Block Q6 is predicated to show a considerable change in the time to achieve target height as the planted overstorey species begin to mature.

A Cautionary Note

Development of plants and communities over time is not a linear process. Combinations of allometry and complex thinning laws have been shown to govern how individuals and communities develop. Furthermore, the overall development of the total respiratory surface (green area) at any given location has been shown to be a function of the evaporative thermodynamics at the locality (See the attached bibliography for a selection of relevant references). Nor do the predictive models take into account disturbances such as fire or drought which has affected all blocks during the course of the rehabilitation, or likewise the restorative effects of sustained rainfall once the drought has and obviously will break.

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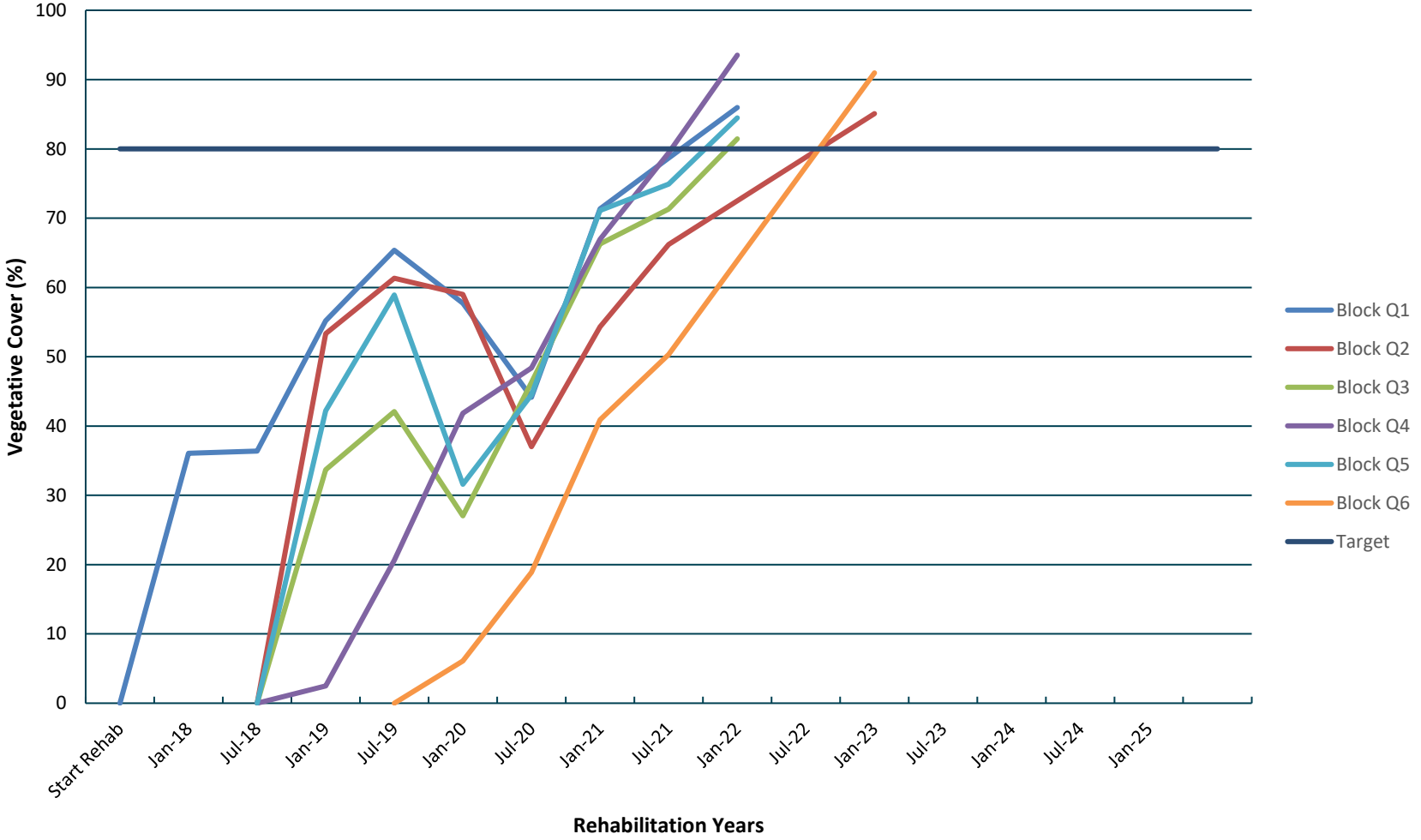


Chart 21: **The predicted dates since the commencement of rehabilitation for Blocks Q1 to Q6 to reach 80% foliage cover. Data for Block Q1 is based on six surveys, Blocks Q2 – Q5 based on five surveys, Block Q6 based on three surveys.**

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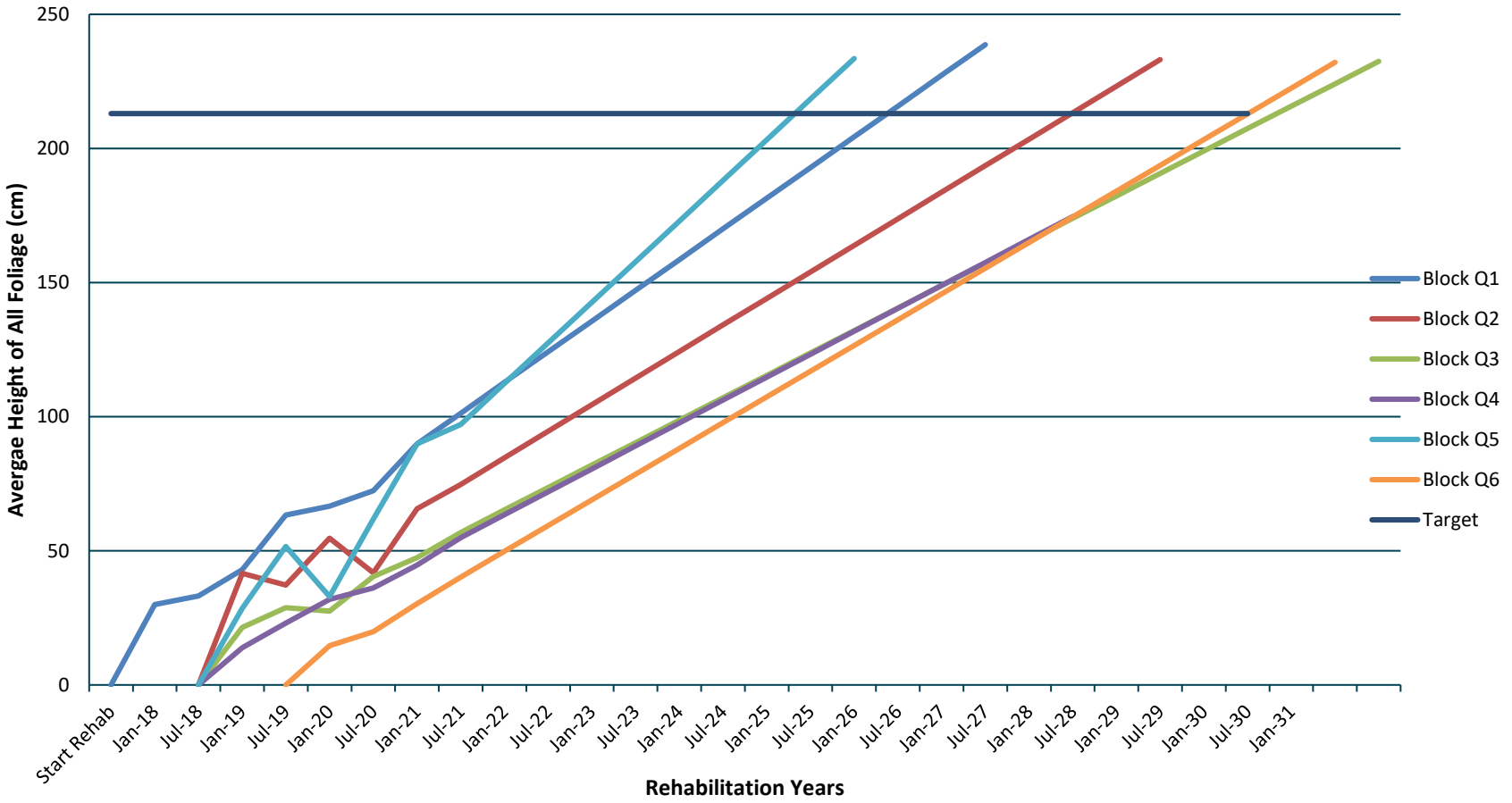


Chart 22: **The predicted dates since the commencement of rehabilitation for Blocks Q1 to Q6 to reach target average height (213 cm). Data for Block Q1 is based on five surveys, Blocks Q2 – Q5 based on three surveys, Block Q6 based on one survey.**

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APPENDIX 5: SPECIES LIST BY REHABILITATION BLOCK – JANUARY 2021

Table 19: Species list by rehabilitation block as surveyed from the 2m x 2m plot data. Presence/absence data as indicated by "1" = presence, "0" = absence

Family Name	Scientific Name	Stratum	Exotic	Bl 1	Bl 2	Bl 3	Bl 4	Bl 5	Bl 6
Anthericaceae	*Tricoryne elatior*	Ground		0	1	0	0	1	0
Apiaceae	*Actinotus helianthi*	Shrub		1	1	1	1	1	1
Apiaceae	*Platysace ericoides*	Shrub		0	1	1	1	1	1
Apiaceae	*Platysace linearifolia*	Shrub		0	0	0	1	0	1
Apiaceae	*Xanthosia pilosa*	Shrub		1	0	1	1	0	1
Asteraceae	*Acanthospermum australe*	Ground	*	0	1	0	0	1	1
Asteraceae	*Conyza bonariensis*	Ground	*	0	1	0	0	1	0
Asteraceae	*Conyza spp.*	Ground	*	1	0	0	0	0	0
Asteraceae	*Taraxacum officinal*	Ground	*	1	0	0	0	0	0
Casuarinaceae	*Casuarina cunninghamiana*	Overstorey	*	1	0	0	0	0	0
Colchicaceae	*Gloriosa superba*	Shrub	*	0	1	0	0	0	0
Commelinaceae	*Commelina cyanea*	Ground		0	1	0	0	0	0
Cyperaceae	*Caustis recurvata*	Shrub		1	0	1	1	1	1
Cyperaceae	*Chorizandra cymbaria*	Shrub		0	0	0	0	0	1
Cyperaceae	*Cyperus aggregatus*	Ground	*	0	1	0	0	1	1
Cyperaceae	*Cyperus spp.*	Ground		0	0	0	1	0	0
Cyperaceae	*Gahnia spp.*	Shrub		1	0	1	1	0	1
Cyperaceae	*Lepidosperma neesii*	Ground		0	0	0	1	0	0
Cyperaceae	*Schoenus ericetorum*	Ground		1	0	1	1	1	1

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Family Name	Scientific Name	Stratum	Exotic	BI 1	BI 2	BI 3	BI 4	BI 5	BI 6
Cyperaceae	*Schoenus turbinatus*	Ground		0	0	1	0	0	0
Dennstaedtiaceae	*Pteridium esculentum*	Shrub		1	1	1	0	0	0
Dilleniaceae	*Hibbertia acicularis*	Shrub		0	0	1	1	0	1
Dilleniaceae	*Hibbertia fasciculata*	Shrub		1	0	1	1	1	1
Dilleniaceae	*Hibbertia linearis*	Shrub		1	1	1	1	1	1
Elaeocarpaceae	*Tetratheca thymifolia*	Shrub		1	0	0	1	0	1
Ericaceae (Epacridoideae)	*Leucopogon deformis*	Shrub		0	0	0	1	0	0
Ericaceae (Epacridoideae)	*Leucopogon ericoides*	Shrub		1	0	1	1	1	1
Ericaceae (Epacridoideae)	*Leucopogon juniperinus*	Shrub		0	0	0	0	0	1
Ericaceae (Epacridoideae)	*Leucopogon virgatus*	Shrub		0	0	1	1	0	0
Ericaceae (Epacridoideae)	*Monotoca elliptica*	Midstorey		1	1	1	1	0	1
Ericaceae (Epacridoideae)	*Monotoca scoparia*	Shrub		1	0	1	1	0	1
Ericaceae (Epacridoideae)	*Woollsia pungens*	Shrub		1	0	1	1	0	1
Euphorbiaceae	*Amperea xiphoclada*	Shrub		1	0	0	0	0	1
Euphorbiaceae	*Euphorbia maculata*	Ground	*	1	0	0	0	0	0
Euphorbiaceae	*Ricinocarpos pinifolius*	Shrub		0	0	1	1	0	1
Fabaceae (Faboideae)	*Aotus ericoides*	Shrub		1	1	1	0	0	1
Fabaceae (Faboideae)	*Bossiaea ensata*	Shrub		1	0	1	1	0	1
Fabaceae (Faboideae)	*Bossiaea heterophylla*	Shrub		1	0	1	1	1	1
Fabaceae (Faboideae)	*Bossiaea rhombifolia*	Shrub		1	0	0	1	1	1

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Family Name	Scientific Name	Stratum	Exotic	BI 1	BI 2	BI 3	BI 4	BI 5	BI 6
Fabaceae (Faboideae)	*Desmodium rhytidophyllum*	Ground		0	0	0	0	1	0
Fabaceae (Faboideae)	*Dillwynia longifolia*	Shrub		0	0	0	0	1	0
Fabaceae (Faboideae)	*Dillwynia retorta*	Shrub		1	0	1	1	1	1
Fabaceae (Faboideae)	*Gompholobium glabratum*	Shrub		0	0	0	1	0	0
Fabaceae (Faboideae)	*Gompholobium virgatum*	Shrub		1	0	1	1	0	1
Fabaceae (Faboideae)	*Hardenbergia violacea*	Ground		1	1	0	0	1	1
Fabaceae (Mimosoideae)	*Acacia baueri*	Ground		0	0	0	1	0	1
Fabaceae (Mimosoideae)	*Acacia falcata*	Midstorey	*	0	0	0	0	1	0
Fabaceae (Mimosoideae)	*Acacia irrorata*	Shrub		0	0	1	0	0	0
Fabaceae (Mimosoideae)	*Acacia longifolia*	Shrub		1	1	1	1	1	1
Fabaceae (Mimosoideae)	*Acacia mearnsii*	Midstorey	*	1	0	0	0	0	0
Fabaceae (Mimosoideae)	*Acacia suaveolens*	Shrub		1	1	1	1	1	1
Fabaceae (Mimosoideae)	*Acacia terminalis*	Shrub		1	0	0	0	0	0
Fabaceae (Mimosoideae)	*Acacia ulicifolia*	Shrub		1	1	1	1	1	1
Goodeniaceae	*Goodenia sp.*	Shrub		0	1	0	0	0	0
Haloragaceae	*Gonocarpus teucrioides*	Ground		0	0	1	0	0	0
Lomandraceae	*Lomandra longifolia*	Ground		1	0	1	0	0	0
Malvaceae	*Sida rhombifolia*	Shrub	*	0	1	0	0	1	0
Myrtaceae	*Angophora costata*	Overstorey		0	1	0	0	0	0
Myrtaceae	*Corymbia gummifera*	Overstorey		1	1	1	1	1	1
Myrtaceae	*Eucalyptus piperita*	Overstorey		1	0	1	1	1	1
Myrtaceae	*Eucalyptus robusta*	Overstorey		0	1	1	1	1	1
Myrtaceae	*Euryomyrtus ramosissima*	Shrub		1	0	1	1	0	1
Myrtaceae	*Harmogia densifolia*	Shrub		0	0	1	1	0	1
Myrtaceae	*Leptospermum laevigatum*	Midstorey	*	1	1	0	1	1	0

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Family Name	Scientific Name	Stratum	Exotic	BI 1	BI 2	BI 3	BI 4	BI 5	BI 6
Myrtaceae	*Leptospermum polygalifolium*	Midstorey		1	1	0	1	1	1
Myrtaceae	*Leptospermum trinervium*	Midstorey		1	0	1	1	1	1
Myrtaceae	*Melaleuca nodosa*	Overstorey		1	1	1	1	1	1
Myrtaceae	*Melaleuca quinquenervia*	Overstorey		1	0	0	0	0	0
Olacaceae	*Olax stricta*	Shrub		0	0	1	1	0	1
Onagraceae	*Oenothera mollissima*	Ground	*	0	0	0	0	1	0
Orchidaceae	*Acianthus fornicatus*	Ground		0	0	0	1	0	0
Phormiaceae	*Dianella sp.*	Ground		1	1	0	0	0	0
Picrodendraceae	*Pseudanthus orientalis*	Shrub		1	0	1	1	0	1
Poaceae	*Axonopus fissifolius*	Ground	*	1	1	0	0	1	0
Poaceae	*Cynodon dactylon*	Ground		1	0	0	0	1	0
Poaceae	*Eleusine indica*	Ground	*	0	0	0	0	1	0
Poaceae	*Eragrostis brownii*	Ground		0	0	1	0	0	0
Poaceae	*Eragrostis curvula*	Ground	*	1	1	0	0	1	1
Poaceae	*Megathyrsus maximus*	Ground	*	0	0	0	0	1	0
Poaceae	*Melinis repens*	Ground	*	1	1	1	1	1	1
Poaceae	*Panicum spp.*	Ground		0	1	0	0	0	0
Poaceae	*Setaria parviflora*	Ground	*	0	0	0	0	1	0
Primulaceae	*Lysimachia arvensis*	Ground	*	1	0	0	0	0	0
Proteaceae	*Banksia aemula*	Midstorey		1	1	1	1	1	1
Proteaceae	*Conospermum taxifolium*	Shrub		1	0	1	0	0	1
Proteaceae	*Isopogon anemonifolius*	Shrub		0	0	1	0	0	0
Proteaceae	*Persoonia lanceolata*	Shrub		0	0	1	1	1	1
Proteaceae	*Petrophile pulchella*	Shrub		0	0	1	0	1	1

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Family Name	Scientific Name	Stratum	Exotic	Bl 1	Bl 2	Bl 3	Bl 4	Bl 5	Bl 6
Restionaceae	*Hypolaena fastigiata*	Ground		0	0	1	1	0	0
Rhamnaceae	*Pomax umbellata*	Ground		1	1	1	1	0	1
Rubiaceae	*Richardia humistrata*	Ground	*	1	0	0	0	0	0
Rutaceae	*Eriostemon australasius*	Shrub		0	0	0	0	0	1
Rutaceae	*Philotheca salsolifolia*	Shrub		1	0	1	1	0	1
Rutaceae	*Zieria laxiflora*	Shrub		1	0	0	1	0	0
Santalaceae	*Leptomeria acida*	Shrub		0	0	1	1	1	1
Sapindaceae	*Dodonaea triquetra*	Shrub		1	0	0	0	0	1
Thymelaeaceae	*Pimelea linifolia*	Shrub		1	0	1	1	0	1
Verbenaceae	*Lantana camara*	Shrub	*	1	0	0	0	0	0
Xanthorrhoeaceae	*Xanthorrhoea glauca*	Shrub		1	1	1	1	1	1

Totals		Nth Dunes (All Blocks)	Bl Q1	Bl Q2	Bl Q3	Bl Q4	Bl Q5	Bl Q6
Total Species	**Total**	**99**	**56**	**32**	**50**	**52**	**42**	**55**
	Native	77	44	23	49	50	29	51
	Exotic	22	12	9	1	2	13	4
Ground Species	**Total**	**33**	**14**	**12**	**8**	**8**	**15**	**8**
	Native	18	6	6	7	7	5	4
	Exotic	15	8	6	1	1	10	4
Shrub Species	**Total**	**52**	**31**	**12**	**35**	**35**	**18**	**39**
	Native	49	30	10	35	35	17	39
	Exotic	3	1	2	0	0	1	0
Midstorey Species	**Total**	**7**	**6**	**4**	**3**	**5**	**5**	**4**
	Native	4	4	3	3	4	3	4

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Totals		Nth Dunes (All Blocks)	Bl Q1	Bl Q2	Bl Q3	Bl Q4	Bl Q5	Bl Q6
	Exotic	3	2	1	0	1	2	0
Overstorey Species	**Total**	**7**	**5**	**4**	**4**	**4**	**4**	**4**
	Native	6	4	4	4	4	4	4
	Exotic	1	1	0	0	0	0	0

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APPENDIX 6: STAFF CONTRIBUTIONS

The following staff members were involved in the compilation of this report.

Name	Qualification	Title/Experience	Contribution
Nigel Fisher	BSc (Hons) PhD	Senior Restoration Ecologist	Field Work, Reporting, Project Management
Gayle Joyce	BSc Forestry (Hons 1)	GIS Specialist	GIS and Mapping

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