2023 Compliance Assessment Report
Yoongarillup Mineral Sands Project

Ministerial Statement 1030

6th September 2023

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APPENDICES

1. INTRODUCTION

The Doral Mineral Sands Yoongarillup Project was approved by the former Office of the EPA (OEPA) (now Department of Water and Environmental Regulation, DWER) on the 7 June 2016 with the issuing of Ministerial Statement 1030 (MS:1030).

Subsequent approval as required by MS:1030 Condition 4-1 was granted by OEPA on 04/11/16 for the submitted Compliance Assessment Plan, and as per MS 1030 Condition 4-6 Doral hereby presents the seventh Compliance Assessment Report (CAR) for the annual period to 7 June 2023.

In accordance with the approved Compliance Assessment Plan (CAP), all compliance assessments shall;

(1) be endorsed by the proponent's Chief Executive Officer or a person delegated to sign on the Chief Executive Officer's behalf;

(2) include a statement as to whether the proponent has complied with the conditions;

(3) identify all potential non-compliances and describe corrective and preventative actions taken;

(4) be made publicly available in accordance with the approved Compliance Assessment Plan; and

(5) indicate any proposed changes to the Compliance Assessment Plan required by condition 4-1.

This CAR provides details of the implementation status of the proposal for the reporting period 8th June 2022 until the 7th June 2023, a statement of compliance and details of declared compliance status for each implementation condition of MS 1030. The CAR has been prepared in accordance with *Post Assessment Guideline for Preparing a Compliance Assessment Report*, Post Assessment Guideline No. 3 (OEPA, 2012).

2. SUMMARY OF OPERATIONS

The Yoongarillup Mine officially ceased operations on 2nd November 2020. Rehabilitation of the site was progessive during the operational phase. The final 1.02 hectares of rehabilitation was completed in June 2022.

2.1 AREA A REHABILITATION

The fourth monitoring report within the 5-year monitoring plan summarises four monitoring events conducted within 2022 (See Appendix 6 for full report). The data summarised within this report provides data to establish future trends against the fulfillment of closure criteria. Assessment of the Yoongarillup Area A rehabilitation will become more robust with each successive year of reporting but will still hold limitations as detailed in Section 3.3. A summary of the report can be found below:

The general trend of the rehabilitation within Area A is positive with most metrics trending towards closure criteria. Monitoring photos in Figures 4 to 7 are taken from the northwest corner of Quadrat 1 and give a visual understanding of the change typically seen across the site each year. It was previously discussed that the south/southeast area of the site was shown to out-perform the west/northwest area in all metrics, likely due to the west/northwest corner being the low point and experiencing inundation and erosion in higher rainfall months. Although some areas have had a better establishment period than others, this trend has become less obvious, with the vegetation becoming more diverse in species and consistent in growth and health as it matures.

Seed germination from direct seeding is still ongoing, with some additional species establishing via natural recruitment and the returned topsoil, however as expected germination has significantly reduced since the first two years of rehabilitation. Development of a soil seed bank is becoming evident where in the past two years, certain species installed during revegetation works have matured and set seed, and germination is being observed (Figure 8). The most significant new species identified on site was Daviesia elongata subsp. elongata (listed as threatened flora) (Figure 9), with two individuals showing positive signs of growth and development of immature seed pod in November 2022. The initial direct seeding of Area A produced a stem count that was higher than any static natural germination events and therefore natural succession reducing the number of stems was expected. This is observed in the density metrics where stems per hectare of all native species have reduced by 12% between 2020 and 2021, and further reduced by 20% between 2021 and 2022. Currently the total average density count across site is 56120 stems per hectare.

Vegetation health and survival has been positive in 2022, likely due to the extended cool and stable climate throughout Spring and continuing resilience of the revegetation as it establishes. In 2021 the effects of exposure were commonly observed where tips of both established and unestablished understorey species across the site were found to be burnt or very dry (wilting/curling). These effects have been significantly less evident this year. Currently the closure criteria of understorey species health are scored at the maximum metric of >81 % of original canopy present. The closure criteria of overstorey species health are also scored at the maximum metric of 91–100% healthy tree canopy, with leaf die-off/yellowing scarce, new tip growth scarce and epicormic growth not visible.

The removal of bunds between each cell and track in Autumn this year has been a key difference in the structure of site this year, as the movement of water throughout site drains much more evenly over the high rainfall period in Winter. Inundation is minimal and erosion has been reduced, stabilising washouts and topsoil across the site.

Vegetative cover of native species has increased in % cover consistently and is still recorded at the closure criteria's maximum target of >70 %. Considering the very high number of stems per hectare and continued growth for both understory and overstory, the vegetation cover criteria is expected to maintain target.

Species richness measured within 10 x 10m quadrats has remained similar this year. A decrease by 1.35 % for understorey species richness, -10.35 % overstorey species richness and an increase of 4 % keystone species richness. Natural losses are likely due to several minor factors in these early stages of revegetation rather than any significant events, the rate of recruitment has likely plateaued

as expected, and is evident in the stems per hectare metrics recorded over time. Both mean native species richness performance metrics are expected to meet closure criteria, within 10 x 10 m quadrats well above targets. The > 50 % understorey target is currently recorded at 94.07 %, and the > 85 % overstorey target is currently recorded at 158%.

The mean keystone native species richness across 5 x 5-metre sub quadrats is 22.33 species, which is 50.75 % of the total possible species and up from 21.47 species or 48.8%. As detailed in the Appendices 1 and 2 of 'Area A Management Plan 2017' this metric is just above of the minimum performance score of >50% to be on track towards closure criteria of >70%. Last year being under the 50% threshold, the data recorded triggered a response to correct the trajectory towards target. Propagating additional keystone species has been anticipated and further infill planting in 2023 and 2024 will act as a contingency response to this result.

The mean stems per hectare count of overstory species that can provide habitat of conservation significant BlackCockatoos is based upon three major tree species - Corymbia calophylla, Corymbia haematoxylon and Eucalyptus marginata. The Spring monitoring event observed 773 stems/ha of these three species and when extrapolated estimates show the current number of potential habitat trees across the site is 6523 stems. While the number of trees expected to become habitat (i.e. achieve Diameter at Breast Height (DBH) >50cm) or breeding trees (containing large hollows) is uncertain, the current numbers represent a positive trend towards achieving the pre-clearing density of 110 Black-Cockatoo habitat trees, 10 suitable breeding hollows and 1 night roosting site.

The Whicher Scarp is a floristically diverse area with 156 species recorded within and surrounding the site (Ecoedge, 2014). Achieving the criteria of 60% site species richness, > 50% mean species richness in quadrats (and > 85% for overstory species) and 70% mean keystone species richness in quadrats will continue to be key metrics to focus upon.

3. STATEMENT OF COMPLIANCE

3.1 PROPOSAL AND PROPONENT DETAILS

Proposal Title	*Yoongarillup Mineral Sands Project*
Statement Number	*MS: 1030*
Proponent Name	*Doral Mineral Sands Pty Ltd*
Proponent's ACN	096 342 451

3.2 STATEMENT OF COMPLIANCE DETAILS

Reporting Period	*8/06/22* to *7/06/23*

Implementation phase(s) during reporting period (please tick ✓ relevant phase(s))							
Pre-construction		Construction		Operation		Decommissioning	✓

Audit Table for Statement addressed in this Statement of Compliance is provided at **Section 4**:	
An audit table for the Statement addressed in this Statement of Compliance must be provided as Attachment 2 to this Statement of Compliance. The audit table must be prepared and maintained in accordance with the Office of the Environmental Protection Authority's (OEPA) *Post Assessment Guideline for Preparing an Audit Table*, as amended from time to time. The 'Status Column' of the audit table must accurately describe the compliance status of each implementation condition and/or procedure for the reporting period of this Statement of Compliance. The terms that may be used by the proponent in the 'Status Column' of the audit table are limited to the Compliance Status Terms listed and defined in Table 1 of Attachment 1.	

Were all implementation conditions and/or procedures of the Statement complied with within the reporting period? (please tick ✓ the appropriate box)			
No (please proceed to Section 3)		Yes (please proceed to Section 4)	✓

3.3 DETAILS OF NON-COMPLIANCE(S) AND/OR POTENTIAL NON-COMPLIANCE(S)

No non-compliances or potential non-compliances were recorded during the reporting period.

3.4 PROPONENT DECLARATION

I, **Josh Brown, General Manager (Acting)**, declare that I am authorised on behalf of Doral Mineral Sands Pty Ltd (being the person responsible for the proposal) to submit this form and that the information contained in this form is true and not misleading.

Signature:..... Date: 06/09/2023

Please note that:

- It is an offence under section 112 of the *Environmental Protection Act 1986* for a person to give or cause to be given information that to his knowledge is false or misleading in a material particular; and
- The General Manager of the OEPA has powers under section 47(2) of the *Environmental Protection Act 1986* to require reports and information about implementation of the proposal to which the statement relates and compliance with the implementation conditions.

4. DETAILS OF DECLARED COMPLIANCE STATUS

Audit Code	Subject	Phase	Requirement		Evidence	Status
1030:M1.1	Proposal Implementation	Overall	When implementing the proposal, the proponent shall not exceed the authorised extent of the proposal as defined in Table 2 in Schedule 1, unless amendments to the proposal and the authorised extent of the proposal have been approved under the EP Act.		Schedule 1 of MS 1030 of the proposal is being implemented in accordance with Table 2 of Schedule 1 (see below)	C
			Element	**Authorised extent**		
			Mine Pits and additional disturbance (indicative)	Within 152 ha Development Envelope: • Clearing of no more than 8.9ha of native vegetation within Area A; and • An additional disturbance of no more than 88ha.	Within 152 ha Development Envelope: • Area A was clearly delineated and fenced and no more than 8.9ha of native vegetation was cleared during the reporting period. • A total of 77.02ha of 'additional' disturbance was recorded for the project. Aerial imagery showing disturbance areas is provided in Appendix 1.	C
			Area A	Within 152 ha Development Envelope: • Clearing of no more than 8.9ha.	Within 152 ha Development Envelope: • No more than 8.9ha of native vegetation was cleared during the reporting period.	C

			Life of Mine	Three years	A s45c application is due for submission in Sept 2019 requesting an extension of mine life by a further 12 months, making it a 4 year mine life. The mine was officially closed on 2nd November 2020 (See Appendix 8)	C
			Groundwater abstraction	Abstraction of up to 1.6GL per annum of groundwater for: • Dewatering purposes (from superficial aquifer); and • Mine water supply (from the Yarragadee aquifer).	• No dewatering was undertaken during the reporting period. • 19,160 kL was abstracted Aug 22-Jul 2023.	C
1030:M2.1	Contact Details	Overall	The proponent shall notify the CEO of any change of its name, physical address or postal address for the serving of notices or other correspondence within twenty eight (28) days of such change. Where the proponent is a corporation or an association of persons, whether incorporated or not, the postal address is that of the principal place of business or of the principal office in the State.		Name and address of Doral Mineral Sands Pty Ltd remains unchanged during the reporting period.	C
1030:M3.1	Time Limit for Proposal Implementation	Overall	The proponent shall not commence implementation of the proposal after five (5) years from the date on this Statement, and any commencement, prior to this date, must be substantial.		The proposal was implemented on 3 January 2017, which is within 5 years from the date of issue of MS 1030.	C
1030:M3.2	Time Limit for Proposal Implementation	Overall	Any commencement of implementation of the proposal, on or before five (5) years from the date of this Statement, must be demonstrated as substantial by providing the CEO with written evidence, on or before the expiration of five (5) years from the date of this Statement.		Doral notified the CEO in writing on the 23 January 2017 that the proposal had commenced implementation on 3 January 2017 (OEPA REF: 2017-1485505479972).	C

1030:M4.1	Compliance Reporting	Pre-construction	The proponent shall prepare, submit and maintain a Compliance Assessment Plan to the CEO at least six (6) months prior to the first Compliance Assessment Report required by condition 4-6, or prior to implementation, whichever is sooner.	Doral prepared and submitted a Compliance Assessment Plan (CAP) to the CEO in accordance with the OEPA guidelines on 27 October 2016 (at least 6 months prior to the first CAR). The OEPA approved the CAP as documented in correspondence dated 31 October 2017 (REF: 16-036203) (Appendix 2b).	C
1030:M4.2	Compliance Reporting	Pre-construction	The Compliance Assessment Plan shall indicate: (1) the frequency of compliance reporting; (2) the approach and timing of compliance assessments; (3) the retention of compliance assessments; (4) the method of reporting of potential non-compliances and corrective actions taken; (5) the table of contents of Compliance Assessment Reports; and (6) public availability of Compliance Assessment Reports.	Doral prepared and submitted a Compliance Assessment Plan (CAP) to the CEO in accordance with the OEPA guidelines on 27 October 2016 (at least 6 months prior to the first CAR). The OEPA approved the CAP as documented in correspondence dated 31 October 2017 (REF: 16-036203) (Appendix 2b).	C
1030:M4.3	Compliance Reporting	Overall	After receiving notice in writing from the CEO that the Compliance Assessment Plan satisfies the requirements of condition 4-2 the proponent shall assess compliance with conditions in accordance with the Compliance Assessment Plan required by condition 4-1.	The first Compliance Assessment Report (CAR) was submitted to DWER on 7th Sept 2017 and followed up by an Addendum on 8th December 2017 following the native veg clearing of Area A. subsequent CAR's have been submitted prior to 7th September annually. This CAR is the seventh annual report to be submitted to DWER	C

1030:M4.4	Compliance Reporting	Overall	The proponent shall retain reports of all compliance assessments described in the Compliance Assessment Plan required by condition 4-1 and shall make those reports available when requested by the CEO.	Reports of all compliance assessments will be maintained in accordance with Doral's management system and shall be made available to the CEO when requested.	C
1030:M4.5	Compliance Reporting	Overall	The proponent shall advise the CEO of any potential non-compliance within seven (7) days of that non-compliance being known.	No non-compliances were identified during the reporting period as documented in this CAR.	C
1030:M4.6	Compliance Reporting	Overall	The proponent shall submit to the CEO the first Compliance Assessment Report fifteen (15) months from the date of issue of this Statement addressing the twelve (12) month period from the date of issue of this Statement and then annually from the date of submission of the first Compliance Assessment Report, or as otherwise agreed in writing by the CEO. The Compliance Assessment Report shall: (1) be endorsed by the proponent's Chief Executive Officer or a person delegated to sign on the Chief Executive Officer's behalf; (2) include a statement as to whether the proponent has complied with the conditions; (3) identify all potential non-compliances and describe corrective and preventative actions taken; (4) be made publicly available in accordance with the approved Compliance Assessment Plan; and (5) indicate any proposed changes to the Compliance Assessment Plan required by condition 4-1.	The first CAR for MS 1030 was submitted to the CEO within 15 months of the issue of MS 1030, the second 7th September 2018, and this document is the seventh annual installment. The CAR has been endorsed by Doral's CEO (or delegate, General Manager), includes a statement of compliance, identifies any potential non-compliances, and will be made available to the public via Doral's website within 28 days of submission to the CEO (before 5 October 2022). No changes to the CAP have been made during the reporting period.	C
1030:M5.1	Public Availability of Data and Plans	Overall	Subject to condition 5-2, within a reasonable time period approved by the CEO of the issue of this Statement and for the remainder of the life of the proposal the proponent shall make publicly available, in a manner approved by the CEO, all validated environmental data and plans (including sampling design, sampling methodologies, empirical data and derived information products (e.g. maps))	All validated environmental data and plans relevant to the proposal have been made available to the public via Doral's website within 28 days of its submission to the CEO.	C

			relevant to the assessment of this proposal and implementation of this Statement.		
1030:M5.2	Public Availability of Data and Plans	Overall	If any data or parts of plans referred to in condition 5-1 contains particulars of: (1) a secret formula or process; or (2) confidential commercially sensitive information; the proponent may submit a request for approval from the CEO to not make these data or parts of plans publicly available. In making such a request the proponent shall provide the CEO with an explanation and reasons why the data or parts of plans should not be made publicly available.	During the submission of the Land Acquisition Management Plan (1030: M8.1), Doral requested that Appendix 2 of the Plan not be made publicly available as it contains commercially sensitive information. In response, the OEPA noted that Appendix 2 does not need to be made publicly available.	C
1030:M6.1	Flora and Vegetation	Overall	The proponent shall ensure that the proposal does not result in any loss of native vegetation beyond the boundary of Area A as shown in Figure 3 and delineated by the co-ordinates specified in Table 5 of Schedule 2.	No direct loss of vegetation beyond the boundary of Area A has occurred during the reporting period as discussed in Section 3.3. An area of disturbance is shown in Appendix 1.	C
1030:M6.2	Flora and Vegetation	Pre-construction	Prior to ground disturbing activities the proponent shall prepare a Flora and Vegetation Monitoring Plan in consultation with the Department of Parks and Wildlife and the Department of Water and submit the plan to the CEO. The Flora and Vegetation Monitoring Plan shall: (1) when implemented, substantiate and ensure that condition 6-1 is being met; (2) identify and spatially define reference sites including the scientific rationale for the proposed locations; (3) include baseline vegetation health and abundance parameters; (4) detail the proposed vegetation health (including impact from changes in groundwater level) monitoring methodology; (5) detail the proposed frequency and timing of monitoring; (6) specify criteria (trigger criteria) that will trigger the implementation of management and/or contingency actions to prevent loss of vegetation outside Area A; and (7) specify management and/or contingency actions to	Doral prepared and submitted a Flora and Vegetation Monitoring Plan in consultation with DPaW and DoW to the CEO on 6 October 2016. The OEPA approved the Plan as documented in correspondence dated 14 December 2016 (Appendix 2d). The Flora and vegetation Monitoring Plan was revised after 12 months and submitted on 16th October 2017 to remove the trial of the Projective Foliar Coverage measurements (using an iPhone app) and was approved by DWER on 30th April 2018.	C

			be implemented in the event that the trigger criteria required by condition 6-2(6) have been reached.	The Flora and Vegetation Monitoring Plan was revised and submitted on the 18/20/20 to reduce/remove monitoring requirements due to completion of rehabilitation of Area A. The plan was approved by DWER 17th December 2020. (Appendix 2d) Prior to the revised plan approval Doral were granted permission to cease Water Potential monitoring for October and November 2020 due to the monitoring location proximity to Dieback infestation. (Appendix 2c)	
1030:M6.3	Flora and Vegetation	Overall	After receiving notice in writing from the CEO, that the Flora and Vegetation Monitoring Plan satisfies the requirements of condition 6-2, the proponent shall: (1) monitor in accordance with the requirements of the Flora and Vegetation Monitoring Plan; and (2) continue to monitor in accordance with the requirements of the Flora and Vegetation Monitoring Plan until the CEO has confirmed, on the advice of the Department of Parks and Wildlife and the Department of Water, by notice in writing that it has been demonstrated that the outcome in condition 6-1 is being and will continue to be met and therefore monitoring is no longer required.	The baseline flora and vegetation monitoring commenced on 12th September 2016 as per the proposed Flora and Vegetation Monitoring Plan submitted to OEPA. Upon approval of the plan, it was formally implemented on the 14th December 2016 and continues to be implemented as per the revised monitoring plan V8. No direct loss of vegetation was observed, and monitoring ceased 24 months post rehabilitation of Area A, as per the approved Flora and Veg Management Plan (V8).	C

1030:M6.4	Flora and Vegetation	Overall	In the event that the monitoring indicates that the trigger criteria specified in the Flora and Vegetation Monitoring Plan have been reached the proponent shall: (1) immediately implement the management and/or contingency actions specified in the Flora and Vegetation Monitoring Plan on advice from the Department of Parks and Wildlife and the Department of Water and continue implementation of those actions until the trigger criteria are being met, or until the CEO has confirmed by notice in writing that it has been demonstrated that the outcome in condition 6-1 is being, and will continue to be met, and implementation of the management and/or contingency actions is no longer required; (2) investigate to determine the likely cause of the trigger criteria being reached, and to identify any additional contingency actions required to prevent the trigger criteria being reached in the future; and (3) provide a report to the CEO within 7 days of an event referred to in condition 6-4 occurring. The report shall include: (a) details of management and/or contingency actions implemented; and (b) the findings of the investigation required by condition 6-4(2).	No trigger criteria specified in the Flora and Vegetation Monitoring Plan were reached during the operational phase. Monitoring ceased 24 months post rehabilitation of Area A, as per the approved Flora and Veg Management Plan (V8) A formal request was also submitted to DWER 26th August 2021 as there was no observed loss of vegetation beyond Area A (Appendix 2e)	C
1030:M6.5	Flora and Vegetation	Overall	The proponent may review and revise the Flora and Vegetation Monitoring Plan, in consultation with the Department of Parks and Wildlife and the Department of Water.	No changes were requested during the reporting period	C
1030:M6.6	Flora and Vegetation	Overall	The proponent shall review and revise the Flora and Vegetation Monitoring Plan as and when directed by the CEO.	No request by the CEO to revise the Flora and Vegetation Monitoring Plan occurred during the reporting period.	C
1030:M6.7	Flora and Vegetation	Overall	The proponent shall implement the latest revision of the Flora and Vegetation Monitoring Plan in consultation with the Department of Parks and Wildlife and the Department of Water, which the CEO	The latest (revised) version of the Flora and Vegetation Monitoring Plan (V8) continues to be implemented.	C

			has confirmed, by notice in writing, satisfies the requirements of condition 6-2.		
1030:M7.1	State Forest – Area A	Overall	The proponent shall ensure that Area A, as shown in Figure 3 and delineated by the co-ordinates specified in Table 5 of Schedule 2, is decommissioned and rehabilitated to support functional landforms, soil profile, ground and surface water systems and ecological communities, that are suitable for continued use of this area as State forest.	Area A was delineated, decommissioned, and rehabilitated as per approved State Forest Area A Management Plan	C
1030:M7.2	State Forest – Area A	Pre-construction	Prior to ground disturbing activities the proponent shall prepare a State Forest – Area A Management Plan in consultation with the Department of Parks and Wildlife, and submit this plan to the CEO. The Management Plan shall: (1) ensure that clearing and mining of the Area A is undertaken in stages to ensure progressive rehabilitation; (2) ensure that if clearing is to be undertaken, the proponent shall thoroughly inspect the area for Black Cockatoo breeding activity, in particular nesting, and if the area is found to be in use, clearing in the area shall be postponed until such time as determined suitable, on the advice of the Department of Parks and Wildlife; (3) ensure that if clearing is to be undertaken, a qualified terrestrial native fauna spotter shall thoroughly inspect the area for the presence of conservation significant fauna, and implement suitable mitigation (4) ensure that the topsoil removed from Area A is stored only within Area A, and is stored for a maximum of 18 months; (5) specify the fencing and access requirements to Area A; (6) specify the method of clearing vegetation, including the retention of any vegetative material for rehabilitation within Area A; (7) specify the topsoil removal, storage (location and time), and respreading procedures within Area A; (8) specify the timing of mining, and return of soil profile and landforms; (9) specify measures, including the timing of operations, to prevent weeds and	Doral prepared and submitted a State Forest – Area A Management Plan in consultation with DPaW and DoW to the CEO on 6 October 2016. The Plan was approved on 17 November 2016.	C

			dieback from establishing in Area A; (10) specify the placement of mining infrastructure to ensure that progressive rehabilitation can occur; (11) specify measurable, achievable, realistic and timing specific completion criteria, to ensure the management objective in condition 7-1 is achieved; (12) specify the monitoring program to report on completion criteria progress; (13) specify any other management actions that will be implemented to ensure the management objective in condition 7-1 is achieved; and (14) be consistent with the Department of Mines and Petroleum and EPA Guidelines for Preparing Mine Closure Plans.		
1030:M7.3	State Forest – Area A	Overall	After receiving notice in writing from the CEO that the State Forest – Area A Management Plan satisfies the requirements of condition 7-2, the proponent shall:(1) implement the management actions and monitor in accordance with the requirements of the State Forest – Area A Management Plan; and (2) continue to implement the State Forest – Area A Management Plan until the CEO has confirmed by notice in writing that it has been demonstrated that the objective in condition 7-1 has been met and therefore the implementation of the management actions and monitoring is no longer required.	Doral continues to implement the approved Stae Forest Area A Management Plan. A table of compliance with the approved Area A Management Plan is shown in Section 5.	C
1030:M7.4	State Forest – Area A	Overall	The proponent may review and revise the State Forest – Area A Management Plan, in consultation with the Department of Parks and Wildlife.	No revision to the State Forest-Area A Management Plan occurred during the reporting period by Doral.	C
1030:M7.5	State Forest – Area A	Overall	The proponent shall review and revise the State Forest – Area A Management Plan as and when directed by the CEO.	No request by the CEO to revise the State Forest-Area A Management Plan occurred during the reporting period.	C
1030:M7.6	State Forest – Area A	Overall	The proponent shall implement the latest revision of the State Forest – Area A Management Plan, in consultation with the	Native vegetation clearing was conducted in October 2017 in accordance with the	C

			Department of Parks and Wildlife, which the CEO has confirmed by notice in writing, satisfies the requirements of condition 7-2.	Approved State Forest-Area A Management Plan (refer Section 5). Re-establishment of native vegetation was conducted as per the Approved State Forest Area A Management Plan in June/July 2019.	
1030:M8.1	Offsets	Pre-construction	The proponent shall undertake an offset, as outlined in conditions 8-2 to 8-3, with the objective of counterbalancing the significant residual impact to 8.9 hectares of Whicher Scarp Forest Ecosystem, including impacts to foraging and breeding habitat for Calyptorhynchus banksii naso (Forest Red-tailed Black-Cockatoo), Calyptorhynchus baudinii (Baudin's Black-Cockatoo) and Calyptorhynchus latirostris (Carnaby's Black-Cockatoo), the Declared Rare Flora Davesia elongata subsp. elongata, Whicher Scarp Floristic Community Type C1 (FCT C1) Priority Ecological Community (PEC) and the high diversity community of the Whicher Scarp Forest Ecosystem as a result of implementation of the proposal.	Doral prepared and submitted a Land Acquisition and Management Plan on 30 November 2016. The OEPA approved the Plan on 6 December 2016. (Appendix 2a)	C
1030:M8.2	Offsets	Pre-construction	Prior to ground disturbing activities, the proponent shall prepare a Land Acquisition and Management Plan, in consultation with the Department of Parks and Wildlife, and submit the plan to the CEO. The Land Acquisition and Management Plan shall: (1) identify an area of at least 19 hectares to be protected and managed for conservation; (2) identify the environmental attributes of the area(s) to be acquired which must: a) contain known foraging and breeding habitat for Calyptorhynchus banksii naso (Forest Red-tailed Black-Cockatoo), Calyptorhynchus baudinii (Baudin's Black-Cockatoo) and Calyptorhynchus latirostris (Carnaby's Black-Cockatoo). b) have native forest ecosystem values (including condition attributes)	Doral prepared and submitted a Land Acquisition and Management Plan on 30 November 2016. The OEPA approved the Plan on 6 December 2016. (Appendix 2a)	C

			similar to those being impacted by the proposal; c) include no more than 3 hectares of cleared land for revegetation; and d) be located on the Whicher Scarp Native Forest Ecosystem, unless otherwise agreed by the CEO. (3) if any of the vegetation in the area(s) identified is in a degraded condition, or if any area is cleared and identified for revegetation: a) outline the objectives and targets to be achieved, including completion criteria and timeframes for completion; b) identify improvement actions and a timeframe for the actions to be undertaken to improve the condition of native vegetation, in that area; c) detail the on-ground activities that will be undertaken, with associated completion criteria; d) detail the funding arrangements and timing of funding for activities; and e) detail the monitoring requirements for offset activities. (4) identify the role of the proponent and detail any agreements with third parties; and (5) identify the mechanism by which the land will be provided for management under the Conservation and Land Management Act 1984, and timeframes for this to occur.		
1030:M8.3	Offsets	Overall	After receiving notice in writing, on the advice of the Department of Parks and Wildlife, from the CEO that the Land Acquisition and Management Plan satisfies the requirements of condition 8-2, the proponent shall: (1) implement the actions in accordance with the requirements of the approved Land Acquisition and Management Plan; and (2) continue to implement the approved Land Acquisition and Management Plan until the CEO has confirmed, on the advice of the Department of Parks and Wildlife, by notice in writing that it has been demonstrated that the completion criteria in the Land Acquisition and Management Plan have been met, and therefore the implementation of the actions is no longer required.	Significant work was undertaken with assistance by DBCA to acquire a direct offset to the satisfaction of the CEO. The purchase agreement and funding arrangement for the Offset was approved by the CEO (Director General DWER) on 27th September 2017. Offsets lands were officially purchased and transferred to DBCA on 16th November 2017 and fencing completed, under the supervision of DBCA officers, in May 2018.	C

1030:M8.4	Offsets	Overall	The proponent may review and revise the Land Acquisition and Management Plan, in consultation with the Department of Parks and Wildlife.	No revision to the Land Acquisition and Management Plan occurred during the reporting period by Doral.	C
1030:M8.5	Offsets	Overall	The proponent shall review and revise the Land Acquisition and Management Plan as and when directed by the CEO.	No request by the CEO to revise the Land Acquisition and Management Plan occurred during the reporting period.	C
1030:M8.6	Offsets	Overall	The proponent shall implement the latest revision of the Land Acquisition and Management Plan, which the CEO has confirmed by notice in writing, satisfies the requirements of condition 8-2.	The latest version of the Land Acquisition and Management Plan has been implemented. Offsets lands were officially purchased and transferred to DBCA on 16th November 2017 and fencing completed, under the supervision of DBCA officers, in May 2018. The Offset site was inspected by DWER compliance officers on 26/06/18.	C
1030:M8.7	Offsets	Overall	The Land Acquisition and Management Plan required by condition 8-2 shall be made publicly available once approved by the CEO.	The Land Acquisition and Management Plan has been made publically available on Doral's website. As noted in correspondence by OEPA, Appendix 2 of the Plan is not required to be made publicly available.	C

5. STATE FOREST AREA A MANAGEMENT PLAN COMMITMENT STATUS

State Forest Area A Management Plan		
Section of MP	**List of Commitments**	**Status**
Section 2 Context, Scope and Rationale	Comprehensive species list for Area A, including collection of detailed information on introduced and native species cover and abundance will be undertaken in spring of 2016	Complete
	Pre-clearing assessment of Black Cockatoo habitat tree density in Area A will be undertaken in spring of 2017	Completed in late September prior to clearing in October 2017
	Surface soils survey to assess soil physical, chemical and biological characteristics will be undertaken in January 2017	Complete
	Topographic survey to determine pre-mining ground surface levels will be undertaken in January 2017	Complete
	Leaf water potential assessment at minesite and reference monitoring sites to commence in September, 2016	Complete
	Soil moisture assessments; intended to commence in spring 2016	Commenced Jan 2017 due to DPaW Reg 4 permit delays
	Depth to groundwater assessments; intended to commence in spring 2016	Commenced Jan 2017 due to DPaW Reg 4 permit delays
Section 3 Fencing and Access	Vehicle access to Goulden Road within Area A is restricted in the first quarter of 2017	Road closure Complete in Q1 with signage and gates/fences. Access to SF33 from south tracks also removed by installation of gates and blocked by logs (prior dieback surveys conducted) in coordination with DBCA officers.
	The eastern, southern and western boundaries of Area A are fenced prior to entering the area for mining	Area A clearly delineated in Jan 2017 prior to clearing. Fauna resistant fence with

State Forest Area A Management Plan		
Section of MP	**List of Commitments**	**Status**
		shade cloth and egress gates erected concurrent with clearing in Oct 2017
	The northern boundary of Area A is fenced during decommissioning and rehabilitation, before rehabilitation of native vegetation	Completed May 2019
	For 5 years post-rehabilitation of native vegetation, herbivores are excluded from Area A and there is no evidence of grazing within Area A	Fencing was completed in May 2019. All herbivores are currently excluded from Area A
Section 4 Scheduling and placement of Mine Infrastructure	Table 1 Schedule of Mining and Rehabilitation	Compliant as discussed in this report
Section 5 Ground and Surface Water Management	Groundwater will recover to 90% of pre-mining levels within 3 years and 100% of pre-mining levels within 5 years	Groundwater levels shown in annual groundwater operating strategy monitoring reports to have been unaffected by mining operations as dewatering was not required.
	Groundwater levels in “potential impact area” monitored bores are stable within the range of variation of surrounding “reference” monitoring bores and show the same seasonal patterns as surrounding reference monitored bores	Compliant. Groundwater report submitted to DWER in March 2022
	Groundwater quality (pH, EC, Total Dissolved Salts, Total Acidity, Total Alkalinity, chloride, sulphate, Al, Fe and Mn) in “potential impact area” monitored bores is within the range monitored within the surrounding areas	Compliant. Groundwater report submitted to DWER in March 2022
	Groundwater levels in “potential impact area” monitored bores are stable within the range of variation of surrounding monitoring bores and show the same seasonal patterns as surrounding monitored bores	Compliant. Groundwater report submitted to DWER in March 2022
	Drainage lines flow in the same direction and to the same catchments as they did pre-mining	Compliant Rehabilitation was contoured to pre-mining contours

State Forest Area A Management Plan		
Section of MP	**List of Commitments**	**Status**
	Monthly monitoring of local (mine site and vicinity) bores and quarterly monitoring of regional bores to measure surface and groundwater quality utilising appropriate field meters and samples analysed at a (NATA) accredited laboratory.	Compliant. Groundwater report submitted to DWER in March 2022
	Monthly monitoring of soil-moisture levels in bores adjacent to Area A	Compliant as per Flora and Vegetation Management Plan V8
	Monthly monitoring of plant stress levels in vegetation adjacent to Area A using a pressure chamber in accordance with Management Plan.	Compliant as per Flora and Vegetation Management Plan V8
Section 6 Fauna Management	No trees containing hollows in current use by black cockatoos for nesting purposes felled/disturbed during clearing operations	Compliant. Pre-clearing fauna study conducted as required and reporting in CAR addendum Dec 2017
	All hollow trees inspected for occupancy by other fauna species with animals encountered being captured and relocated or allowed to vacate of their own accord	Compliant. Pre-clearing fauna study conducted as required and reporting in CAR addendum Dec 2017
	100% of animals encountered in hollows will be relocated or allowed to move on of their own accord prior to felling	Compliant. Pre-clearing fauna study conducted as required and reporting in CAR addendum Dec 2017
	100% of trapped/captured fauna that is alive and well will be relocated prior to clearing	Compliant. Pre-clearing fauna study conducted as required and reporting in CAR addendum Dec 2017
	Direct and indirect impacts on vertebrate fauna that are present during vegetation clearing will be minimised as much as reasonable and practicable	Compliant. Pre-clearing fauna study conducted as required and reporting in CAR addendum Dec 2017
Section 7 Weed management	No new weed species (environmental or declared) introduced into Area A	Compliant to present. Regular manual and spray weed control across site and including rehabilitated area of Area A

State Forest Area A Management Plan		
Section of MP	**List of Commitments**	**Status**
	Within 5 years of rehabilitation, mean weed cover in 25 m2 monitoring sub-quadrats is no greater than 150% of baseline levels	Unable to verify compliance presently however is planned to occur
	Monitoring of weed and native species cover and abundance will be undertaken in autumn and spring 2017 using stratified random sampling of 5 x 5 m quadrats placed along four transects 160 m to 280 m long, passing north-south from the edge of the private property and extending least 120 m into SF33 (**Figure 8**). The quadrat size of 25 m2 has been chosen to facilitate more accurate estimation of herbaceous species cover/abundance.	Weed survey conducted as part of the Area A vegetation monitoring and reported in this CAR. (Appendix 6)
	Prior to the period of mine operation (pre-rehabilitation), the section of the transects within Area A will form part of the Area A Management Plan	Rehabilitaiton complete
	Following rehabilitation of Area A, fifteen permanent 100 m2 floristic monitoring quadrats will be set up in Area A as part of the Area A Management Plan. Within each of these, a 5m x 5m sub-quadrat will be used to more closely monitor the cover and abundance of herbaceous species (both native and exotic).	Rehabilitation is complete. Set up of quadrats occurred in Spring 2019
	Within the monitoring program, weed cover and abundance will be assessed biannually, in spring and autumn	Weed cover and abundance assessment conducted throughout 2021 and reported in the 2021 Area A monitoring report. (Appendix 6).
	Monitoring data will be collected and analysed to determine weed species present and the average mean weed cover and abundance within each quadrat.	Fourth year reporting from quarterly monitoring events 2022 report low weed species present. Weeds are treated or manually removed (Appendix 6)
Section 8 Phytophthora dieback management	Assessed 5 years after rehabilitation of native vegetation, the area of *Phytophthora* Dieback mapped within Area A is no larger that was mapped in 2016	Unable to verify compliance presently however is planned to occur 2024
	It is proposed that overburden from one of the mining blocks east of Sues Road that has a similar clay content to that in Area A will be used in the soil profile reconstruction within Area A. Prior to use in rehabilitation, soil samples from these blocks will be sent to Murdoch University's Centre for *Phytophthora* Science and Management for testing to determine their *Phytophthora* status.	Overburden sampled at several locations and at a series of depths. All samples returned negative for phytophthora

State Forest Area A Management Plan		
Section of MP	**List of Commitments**	**Status**
	A *Phytophthora* Dieback Management Plan will be developed in October 2016 to reflect the results of the August and October 2016 surveys. The following management actions have been identified as a minimum to manage the dieback infestations within Area A	Plan was developed and complied with. DBCA officer on site regularly prior to and following clearing
	No equipment or plant will enter State Forest 33 beyond the boundary of Area A.	Compliant
	Immediately upon taking access of the site, all infestations will be clearly demarcated onsite with flagging tape and/or bunting and signage around their perimeters. This demarcation will remain in place until clearing occurs. The demarcated area will be checked monthly to ensure flagging tape remains in place	Compliant. 'Blazing', orange flagging and identification pickets used successfully
	Goulden Road, which is known to be infested in the western portion, will be blocked as soonas possible, currently likely to be in the first quarter of 2017.	Goulden Rd closed in January 2017
	Clearing of vegetation and stripping of topsoil and subsoil/overburden from Area A will be undertaken in dry conditions in summer	Salvage 27/9/17, Clearing Oct 2017, stripping over summer of 2017/18
	Respreading of topsoil and subsoil/overburden will occur in autumn, under dry conditions	Topsoil and Subsoil was spread in April/May 2019
	All vegetation, topsoil and root matter from infested areas potentially excluding some which, if DPaW agree, would be retained to undertake treatment trials will be removed and deep-buried in one of the mine pits in the paddock area west of Sues Road, outside of Area A.	All mapped infested topsoil and vegetation removed from Area A. Vegetation burnt and topsoil was buried at base of mine void outside Area A
	To reduce the threat of *Phytophthora* dieback whilst maximising the topsoil resource available for use in rehabilitation, it is proposed that topsoil from undetermined 'Disease Risk Roads', including parts of Goulden Road, plus a 10 m buffer either side, will be removed and stockpiled on sterile, weed free sand tails on either Block 15 or Block 17, and stored there for potential reuse.	Topsoil from disease risk roads were removed from Area A and buried
	All Doral field staff and earthmoving contractors and will be educated during site induction and weekly meetings regarding the presence of dieback, access and movement restrictions, signage recognition and necessary hygiene measures to minimise the risk of contaminating the dieback free areas.	Greencard training was held on site for all relevant Doral and Contracting supervisors and personnel

State Forest Area A Management Plan		
Section of MP	**List of Commitments**	**Status**
	Surface water movements, such as around topsoil stockpiles, will be controlled to prevent flow to un-infested areas.	Rehabilitation now complete
	Vehicle movements between infested and un-infested areas will be restricted, and all vehicles will be cleaned before entering uninfested areas. Where possible, clean machinery will be kept inside Area A once it is inside, i.e. reducing all vehicle movements in and out of the protected area as much as possible.	Clean on entry station created and maintained throughout all clearing and operational phases. Cleaned machines stayed inside clean zone until relevant campaign complete
	Prior to clearing, the demarcated 'Infested' areas will be checked monthly to ensure flagging tape/bunting remains in place.	Dieback signage and controls have been maintained. When cleared, identification marker pegs remained
	In rehabilitated vegetation, monitoring for *Phytophthora* Dieback would be carried out using visual assessment of susceptible species within the floristic monitoring quadrats and opportunistically, plus sampling followed by laboratory testing of any recent deaths of susceptible species.	Unable to verify compliance presently however is planned to occur
Section 9 Rehabilitation	No less than 26 kg of local provenance seed mixed from the species listed, treated to maximise the likelihood germination, is available for use in direct seeding	26.4kg of locally collected seed was treated and direct seeded to Area A in June 2019 following surface treatment scarifying and organic microbe and fungi infused surface spray of topsoil
	The mix of species within Area A rehabilitation is comprised of species recruited from topsoil and species introduced through direct seeding and species introduced as tubestock grown from seed, cuttings or whole plants salvaged from Area A	Species mix comprised of seed, tubestock grown from seed, cuttings and whole plants salvaged from Area A.
9.2 Soil profiles	Final landform is suitable for continued use of the area as State Forest	Final profile reestablished to pre mining contours
	The land surface is returned to a level and slope as close as possible to the premining state and is integrated into the surrounding undisturbed landscape	Level and slope are consistent with surrounding topography. Contour banks installed for erosion control

State Forest Area A Management Plan		
Section of MP	**List of Commitments**	**Status**
	Soils and landforms exhibit topsoil erosion levels that are consistent with surrounding areas and do not compromise the intended rehabilitated native vegetation land use	Contour banks and access tracks have now been removed as vegetation is established reducing erosion. Roads and contour banks will be revegetated during the 2022/2023 planting seasons.
	Overburden returned to the Area A mine pit will have a similar clay content to the pre-mining soil substrate	Selected overburden returned to Area A profile was selected based on clay content and was deep ripped into profile with added gypsum
	At a minimum, the top 50 mm and generally the top 70 mm of the recreated soil profile will consist of replaced Area A topsoil	Dieback uninfested Area A Topsoil stockpiled and respread into topsoil profile at a depth of at least 50mm
	The slope of the re-created landform is within acceptable limits (+/- 1.0o of pre-disturbance levels)	Compliant
	The re-created landform is able to support native vegetation	Rehabilitation is complete. Germination of seed evident. Spring survey completed spring 2021 to determine survival rate. Follow up survey conducted in spring 2022 indicates native vegetation supported.
	No erosion or subsidence maintenance is required after 4 years (assessed based on monitoring and maintenance logs)	Unable to verify compliance presently however is planned to occur.
	Survey of slope after rehabilitation of landform, and again at 12 months and further as required to assess variance with pre-mining levels.	Survey complete.
	Subsidence and erosion monitoring, utilising both GPS surveyed ground surface markers and visual inspection, will be undertaken bi-annually for at least three and up to four years to identify and enable the remedy any affected areas.	Ground markers installed August 2019. Visual assessment considered more reliable as ground marks can be dislodged.

State Forest Area A Management Plan		
Section of MP	**List of Commitments**	**Status**
	A detailed soil survey similar to the pre-mining survey will be carried out 6 to 12 months after rehabilitation has been completed to assess the soil characteristics against KPI levels	Soil survey completed June 2020
9.3 Topsoil management	Topsoil stripped using a clean-on-entry GPS dozer with a spotter to minimise disturbance and mixing of topsoil with subsoil	Compliant
	Topsoil stripped to a maximum depth of 100 mm to conserve seed bank density	Compliant
	Subsoil/overburden stripped where present (i.e. where ore is not at surface) using a clean GPS dozer with a spotter	Compliant
	Topsoil stripped in the summer months of 2017/2018	Compliant
	Subsoil/overburden stripped in the summer months of 2017/2018	Compliant
	Topsoil windrowed and relocated to stockpiles by excavator and dump truck (if carry-graders/scrapers are not used) Subsoil/overburden would be stripped using an excavator and dump truck	Compliant
	Topsoil and subsoil/overburden salvaged from Area A will not be used for any other purpose than stockpiling or direct placement for rehabilitation of Area A	Compliant
	Topsoil from Area A will be stored within Area A	Compliant
	No topsoil or other material of any kind from outside of Area A will be stored within Area A	Complaint
	Records of topsoil and subsoil removal and storage locations kept and maintained	Compliant
	All stockpiles clearly labelled in the field and mapped using GPS	Compliant
	Direct placement of topsoil and subsoil/overburden implemented where possible	Was not possible during mining due to limited footprint. Rehabilitation now complete.

State Forest Area A Management Plan		
Section of MP	**List of Commitments**	**Status**
	Topsoil stored for between 12 and 18 months (maximum) as required to enable respreading during autumn	Clearing October 2017 and soil profile reinstated April 2019
	Stockpiles a maximum height of 2 m	Heights 2-3m due to restricted available footprint. Rehabilitation now complete
	Other than as is necessary to provide access to mining stages, stockpiles not accessed or trafficked during storage, and will not be mixed with other materials (e.g. drain spoil);	Compliant
	Stockpiles capped with hydromulch or spray seal material if required to minimise drying, erosion and weed establishment	Mulch material was inoculated with organic microbe biology spray in July 2018. Topsoil, subsoil and mulch stockpiles sealed with biodegradeable Glue on PVA dust suppressant when stockpiled at east end adjacent to Sues Rd Rehabiltiation now complete
	Dust suppression measures employed as necessary using clean, non-processed Yarragadee water, such as if the drying of the surface of the stockpiles occurs	Compliant
	Weed control undertaken on stockpiles as required	Regular inspection and manual weed pulling as required. Rehabilitation now complete.
	Drainage controls (e.g. shallow drains designed to shed and not retain water constructed around the base of stockpiles) established to prevent the potential for *Phytophthora* dieback infestation from up-gradient surface water flow	Earth bunds around stockpiles Rehabilitation now complete
	To enable the stockpiling and mining within Area A, some relocation of stockpiles within Area A may be required. This shall be conducted only as deemed reasonably necessary and shall not be done twice with the same stockpile	Minimal stockpile interaction as is possible. Secondary movement of stockpiles was

State Forest Area A Management Plan		
Section of MP	**List of Commitments**	**Status**
		required due to condition to retain all materials within Area A footprint Rehabilitation now complete
	Topsoil respread onto rehabilitation areas in autumn to maximise germination of the native soil seed bank. Ideally, to make best use of the applied seed without jeopardising the establishment of species from the topsoil, pits should be ripped and sown by April	Returned profile ripped and topsoil spread in May. Seeding took place after the installation of Xanthorea and Dasypogan species in early June 2019.
	Topsoil respread using a combination of dump truck and GPS D6 bulldozer, both clean on entry	Topsoil was respread using GPS carry grader, clean on entry
	Topsoil respread to nominal thickness of 70 mm however ensuring a minimum of no less than 50 mm (calculated taking into consideration the loss of sacrificed topsoil from areas at risk from and known to be infested with *Phytophthora d*ieback)	Topsoil was respread at a minimum thickness of 50mm
	Area A subsoil/overburden replaced to a nominal average thickness of 150-200 mm across all of Area A using a combination of dump truck and GPS D6 bulldozer	Area A subsoil/overburden replaced to a nominal average thickness of 150-200 mm
	Area A subsoil/overburden replaced directly after replacement of overburden. This stage may be achieved several months in advance of topsoil replacement	Area A subsoil/overburden was replaced directly after placement of overburden which was deep and cross ripped into underlying sand tails co-disposal
	Water spraying (with clean, unprocessed Yarragadee water) and/or other appropriate measures used for dust control during the placement of topsoil and subsoil as required	Water from the Yarragadee bore was used for dust control during placement of topsoil and subsoil.
	Under high wind conditions, topsoil and subsoil placement will cease.	Cessation of Topsoil placement was not required due to avoidance of high wind periods

State Forest Area A Management Plan		
Section of MP	**List of Commitments**	**Status**
	Rehabilitation area re-contoured prior to the respreading of topsoil and as close as possible to the pre-mining surface design	Rehabilitation area was recontoured prior to topsoil respreading
	Following topsoil and subsoil replacement, Area A ripped to a maximum depth of 300 mm	The rehabilitation area was ripped numerous times and the topsoil/subsoil was scarified to 200mm depth prior to the application of direct seeding
	No vehicle traffic shall be permitted onsite once topsoil has been replaced	Dieback control point was established and vehicle access restricted to Area A via fencing and wash down protocols.
9.4 Re-establishment of native veg	Within 5 years:	
	Vegetation composition on the rehabilitated area is representative of the premining state of Area A in species diversity and (potential8) vegetation structure • Mean cover of native species in all 10 m X 10 m monitoring quadrats reaches no less than 70% • Mean weed cover in 25 m2 monitoring sub-quadrats is no greater than 150% of baseline levels • Mean stems/ha count of species that comprise Black Cockatoo habitat shall be +/- 10% of pre-clearing density • Mean species richness within 10 x 10 m monitoring quadrats is greater than 50% (and greater than 85% for overstorey species) of the mean value recorded in all 10 m X 10 m reference plots in comparable unmined areas • Mean species richness of identified keystone species, in all 10 m X 10 m monitoring quadrats is no less than 70% of the total possible • 60% of all species present within Area A prior to mining are present within 5 years post-mining • Average annual health scores of overstorey and understorey plants within 10 x 10 m monitoring quadrats is no less than 3 out of a maximum possible score of 5 • Measured on an annual basis, plants show consistent growth (height or area covered) • Within 3 years, overstorey species average a minimum of 3 m in height or are likely to attain that height in the short-term future without the need for remedial action • All plant material used in rehabilitation sourced from within 10 km of the rehabilitation area	Unable to verify compliance presently however is planned to occur

State Forest Area A Management Plan		
Section of MP	**List of Commitments**	**Status**
	• Within 15 years of completion of rehabilitation, rehabilitated areas have the potential to regenerate after fire • Vegetation structural complexity is restored 12 years post-mining • Fire is excluded from Area A rehabilitation for a minimum of 15 years to allow sufficient establishment and resilience of vegetation to fire	
	Direct seeding at a rate of 3 kg/ha of native seed collected from within Area A and similar vegetation within 10 km radius of Area A	Direct seeding of native seed collected within Area A or from similar vegetation within a 10km radius of Area A was undertaken at a rate of 3kg/ha.
	Planting of 600 stems/ha of tree species grown from seed collected within 10 km radius of Area A including *Banksia grandis, Corymbia calophylla, Corymbia haematoxylon, Eucalyptus marginata, Xylomelum occidentale*	Compliant 600 stems/ha of tree species grown from seed collected within a 10km radius of Area A were planted.
	Propagation (via cuttings or division) and planting out of species with a low likelihood of establishment through topsoil recruitment or direct seeding, especially 'Keystone' species, where possible	Keystone species were propagated from cutting and grown at an independent nursery prior to planting.
9.5 Fauna recolonising	Fauna monitoring forms part of the rehabilitation program and the proposed survey methods detailed here will aim to provide evidence of compliance with the fauna recruitment rehabilitation completion criteria, which are: • Native fauna is utilising the rehabilitation area • Evidence, based on monitoring data, that increased numbers of fauna are utilising the area	A Wood Duck and numerous wasp nests observed within State Forest - Area A.

6. FLORA AND VEGETATION MANAGEMENT PLAN

The Flora and Vegetation Management Plan (FVMP) was approved by OEPA on 14 December 2016 however due to the importance of obtaining spring data, baseline monitoring commenced in anticipation of the approval of the methodology of the FVMP on 12th September 2016.

The FVMP was then revised after 12 months (16/10/17) to request the removal of the trial Projective Foliar Coverage measurements (using an iPhone app) following the realization that the data provided by the foliar coverage measurements did not provide consistent or reliable results. Following DWER consultation at the time of submission of the revised document, delays due to staff changes saw the revised FVMP approved by DWER on 30/04/18.

Due to the presence of Phytophthora Dieback and a duration of 12 months post mining, an amendment was submitted to DWER 18th September 2020, to request a reduction on monitoring. The Version 8 of the FVMP was approved on the 17th December 2020. (Appendix 7)

Final Monitoring results as per the approved plan are as follows;

6.1 WATER POTENTIAL (STRESS) MONITORING

Rehabilitation of Area A was completed in May/June 2019. As per V8 of the FVMP, water potential monintoring has now ceased due to the duration of 24 months post rehabilitation.

With reference to the final Annual Report of Water Potential monitoring at Yoongarillup (Ecoedge, 2021) reported in the 2021 CAR and also shown in Appendix 3, the concluding comments for the reporting period are as follows;

There was a trend of plants at Mine Area sites having substantially lower PWP than Reference sites during the monitoring period. In the case of P. drouynianus, this difference was statistically significant in January and May 2021. This indicates that the effect of increased wind speed and insolation at the edge of the mined area (Area A) is still causing an increased drying out of the soil and probably increasing transpiration in the monitored plants in comparison to the Reference sites.

Nevertheless, as the data for water potential shows plant health (including canopy density) has generally improved at all sites and there are no signs that the lower PWP at Mine Area sites has deleteriously affected the trees and shrubs being monitored, or any other plants at these sites.

6.2 NATIVE VEGETATION VISUAL HEALTH MONITORING

Rehabilitation of Area A was completed in May/June 2019. As per V8 of the FVMP, native vegetation visual health monitoring has now ceased due to the duration of 24 months post rehabilitation.

With reference to the final Annual Report of Visual Health Monitoring (Ecoedge, 2021) reported in the 2021 CAR and as shown in Appendix 4, the concluding comments for the reporting period are as follows;

Yoongarillup recorded much greater rainfall in 2020 compared to 2019. This was apparent in the fall in canopy yellowing scores for all species at all sites. For E. marginata, by May 2020, canopy yellowing scores were similar at both Mine Area and Reference sites.

After declining over summer 2019/2020, visual health scores for K. rostrata remained steady through to May 2021. No further deaths were recorded for K. rostrata.

Visual health scores for P. drouynianus remained steady throughout, and there was a similar range of scores at Mine Area and Reference sites.

In conclusion, there was a general improvement in the visual health of the trees over the monitoring period from November 2019. Visual health scores have stabilized in K. rostrata and have remained constant throughout for P. drouynianus.

6.3 MONITORING OF NATIVE AND INTRODUCED SPECIES (WEEDS)

After the completion of State Forest – Area A rehabilitation, fifteen 5m x 5m sub quadrats were established to closely monitor the cover and abundance of both exotic and native herbaceous species. To date low numbers of exotic species are observed and are treated via herbicide or manual removal.

6.4 SOIL MOISTURE MONITORING

Rehabilitation of Area A was completed in May/June 2019. As per V8 of the FVMP, soil moisture monitoring has now ceased due to the duration of 24 months post rehabilitation.

With reference to the final Soil Moisture summary report in Appendix 5 and reported in the 2021 CAR, soil moisture and perched water monitoring commenced in January 2017 in accordance with the FVMP following the installation of the 6 operational and 3 reference soil moisture bores and 3 (SF33) dip wells.

Results of monthly monitoring is discussed and the direct relationship of rainfall and monitored soil moisture is evident in the graphically presented soil profiles. Throughout the period soil moisture profiles show a reduction in all moisture bores during late summer, early autumn period due to a lack of significant rainfall being received.

Within this report the results of monthly/quarterly soil moistures are discussed, and a clear relationship is shown between rainfall and effects within the moisture profile at depth. The graphical representations displayed using baseline data, provides a good basis to enable the identification of a significant reduction in soil moisture relative to seasonal fluctuations. Remediation in the form of artificial irrigation ceased in April 2019. Soil Moistures adjacent to ‘Area A’ do not appear to have been affected by cessation of irrigation in State Forrest 33 post rehabilitation of ‘Area A’.

APPENDIX 1

AERIAL IMAGE OF DISTURBANCE AREA FOR 2023 REPORTING PERIOD

353000 m 353500 m 354000 m 354500 m

6263500 m

6263000 m

6262500 m

LEGEND

- Proposed Orebody
- Overburden Mined
- Ore Mined
- Cadastral Boundaries
- Disturbance Envelope
- Infrastructure and Plant
- Bitumen Roads (HV standard)
- Bitumen Roads (LV standard)
- Gravel Roads / Carparks
- Over Head Power Line
- Over Head Power Pole
- Security Fence
- Armco Railing
- Solar Evap Ponds
- Topsoil Stockpiles
- Premine Ore Stockpile

N

Lot 1872 Haddon

Lot 1873 Haddon

Lot 1870 Haddon

Lot 1874 Haddon

GOULDEN RD

SSD 05

SSD 04

SSD 03

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27

STATE FOREST

M 7000459
DORAL MINERAL SANDS PTY LTD

M 7000458
DORAL MINERAL SANDS PTY LTD

0 400 m

353000 m 353500 m 354000 m 354500 m

Doral

OVERBURDEN AND ORE MINED TO OCTOBER 2020

YOONGARILLUP MINERAL SANDS PROJECT

Scale : 1:5000 @ A3	MGA94 Zone50	Figure : 1
Drawn By: A.R.M.	File name : siteplan.map	Date: 29/10/2020

APPENDIX 2 – OEPA CORRESPONDENCE

2a – DG Approval of LAMP Purchase Agreement

2b - Statement 1030 - DWER Notice of Compliance Audit and Audit Report

2c - Statement 1030 - Compliance Audit closeout - 17 July 2018

2d - Letter approving pause in monitoring due to Phytophthera Dieback

2e - Letter to Doral re. Flora and Veg Management Plan Approval

2f – Letter requesting the cessation of Vegetation Health Monitoring

Government of Western Australia
Department of Water and Environmental Regulation

Mr Andrew Templeman
General Manager
Doral Mineral Sands Pty Ltd
PO Box 9155
PICTON WA 6229

Your Ref:
Our Ref: *CEO2652/17 DWERA-000067*
Enquiries: *Paul Zahra, 6364 7005*
Email: *paul.zahra@dwer.wa.gov.au*

Attention: Mr Craig Bovell, OSH&E Superintendent

Dear Mr Templeman

MINISTERIAL STATEMENT 1030 – ENVIRONMENTAL OFFSETS

Thank you for your letter dated 22 September 2017 regarding the Yoongarillup Mineral Sands Project to satisfy environmental offset requirements.

The Department of Water and Environmental Regulation (DWER) accepts that the purchase agreement and funding arrangements documented are satisfactory evidence that key components of the *Land Acquisition and Management Plan (November 2016, Rev 2)* have been implemented.

It is noted that you will continue to work with the Department of Biodiversity, Conservation and Attractions to complete the remaining components of the plan, such as fencing and confirmation of land purchase.

If you have any questions regarding this matter, please contact Paul Zahra on 6364 7005

Yours sincerely

Mike Rowe
DIRECTOR GENERAL
DEPARTMENT OF WATER AND ENVIRONMENTAL REGULATION

27 September 2017

168 St Georges Terrace Western Australia 6000
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www.dwer.wa.gov.au

Government of **Western Australia**
Office of the **Environmental Protection Authority**

Mr Andrew Templeman
General Manager
Doral Mineral Sands Pty Ltd
PO Box 9155
PICTON WA 6229

RECEIVED
4 NOV 2016
BY:

Our Ref: *16-036203*
Enquiries: *Hugh Lance, 6145 0846*
Email: *hugh.lance@epa.wa.gov.au*

Attention: Mr Craig Bovell, OSH&E Superintendent

Dear Mr Templeman

COMPLIANCE ASSESSMENT PLAN APPROVED – STATEMENT 1030 – YOONGARILLUP MINERAL SANDS PROJECT

Thank you for your email dated 27 October 2016 submitting the Yoongarillup Mineral Sands Project Compliance Assessment Plan (27 October 2016)(CAP) to the Office of the Environmental Protection Authority (OEPA) as required under Condition 4-1 of Statement 1030.

The OEPA has reviewed the CAP and determined that it meets the requirements of Conditions 4-1 and 4-2 of Statement 1030. As required under Condition 4-6 please submit the first Compliance Assessment Report to the OEPA by **7 September 2017**.

If you have any questions about this matter please contact Hugh Lance on 6145 0846 or at hugh.lance@epa.wa.gov.au.

Yours sincerely

Mr Kim Taylor
GENERAL MANAGER

31 October 2016

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Government of Western Australia
Department of Water and Environmental Regulation

Our ref: DWERA-000067
Enquiries: Rowan Inglis, Ph 6364 6472

Ms Julie Edwards
Environmental Advisor
Doral Mineral Sands Pty Ltd
25 Harris Road
Picton WA 6229

Dear Ms Edwards

MINISTERIAL STATEMENT 1030 YOONGARILLUP MINERAL SANDS PROJECT

I refer to your email dated 12 October 2020, in which Doral Mineral Sands Pty Ltd (Doral) requested that monthly monitoring for water potential not be carried out at monitoring locations YM3-1, YM3-2, YM4-1, YM4-2, YM4-3 in accordance with the Flora and Vegetation Management Plan (FVMP) approved by the Department of Water and Environmental Regulation (the department) on 30 April 2018 under Condition 6-2 of Ministerial Statement 1030. This request is based on the potential outbreak of *Phytophthora cinnamoni* in the monitoring area.

It is noted that an updated FVMP has been submitted which is currently under assessment by the department. This revision removes the requirement to conduct water potential monitoring at these sites.

The department considers it appropriate for Doral to pause monitoring for the months of October and November 2020. Should it be determined through the assessment of the revised FVMP that water potential monitoring at these sites is to continue, Doral will be required to resume monitoring in December 2020.

Please contact Rowan Inglis on 6364 6472 or rowan.inglis@dwer.wa.gov.au if you require any additional information regarding this matter.

Yours sincerely

Peter Dawson
A/Senior Manager
Compliance and Enforcement
22 / 10 / 2020

Prime House, 8 Davidson Terrace Joondalup Western Australia 6027
Locked Bag 10 Joondalup DC WA 6919
Telephone: 08 6364 7000 Facsimile: 08 6364 7001
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Government of Western Australia
Department of Water and Environmental Regulation

Your ref: DMS-YG-EMP-6.2, September 2020_V8
Our ref: DWERT5747
Enquiries: Hugh Lance, Ph 6364 6484
Email: hugh.lance@dwer.wa.gov.au

Mr Craig Bovell
OHS&E Superintendent
Doral Mineral Sands Pty Ltd
Email: craig.bovell@doral.com.au and julie.edwards@doral.com.au

ATTENTION: Julie Edwards

Dear Mr Bovell

YOONGARILLUP MINERAL SANDS PROJECT– MINISTERIAL STATEMENT 1030 – FLORA AND VEGETATION MONITORING PLAN– APPROVED

Thank you for your letter of 18 September 2020 submitting the *Yoongarillup Mineral Sands Project Flora and Vegetation Monitoring Plan* (DMS-YG-EMP-6.2, September 2020_V8) (the plan) to the Department of Water and Environmental Regulation (DWER) for review.

I note the plan has been prepared to satisfy condition 6-1 and 6-2 of Ministerial Statement 1030 which states:

6-1 The proponent shall ensure that the proposal does not result in any loss of native vegetation beyond the boundary of Area A as shown in Figure 3 and delineated by the co-ordinates specified in Table 5 of Schedule 2.

6-2 Prior to ground disturbing activities the proponent shall prepare a Flora and Vegetation Monitoring Plan in consultation with the Department of Parks and Wildlife and the Department of Water, and submit the plan to the CEO. The Flora and Vegetation Monitoring Plan shall:

(1) when implemented, substantiate and ensure that condition 6-1 is being met;

(2) identify and spatially define reference sites including the scientific rationale for the proposed locations;

(3) include baseline vegetation health and abundance parameters;

(4) detail the proposed vegetation health (including impact from changes in groundwater level) monitoring methodology;

(5) detail the proposed frequency and timing of monitoring;

(6) specify criteria (trigger criteria) that will trigger the implementation of management and/or contingency actions to prevent loss of vegetation outside Area A; and

(7) specify management and/or contingency actions to be implemented in the event that the trigger criteria required by condition 6-2(6) have been reached.

I am satisfied that the *Yoongarillup Mineral Sands Project Flora and Vegetation Monitoring Plan* (DMS-YG-EMP-6.2, September 2020_V8) meets the requirements of condition 6-2 of Ministerial Statement 1030, and that the proponent must now implement the provisions of the Management Plan as required by condition 6-7.

Yours sincerely

Anthony Sutton
EXECUTIVE DIRECTOR
EPA SERVICES

for the Chief Executive Officer under Notice of Delegation dated 3 July 2017

17 December 2020

Doral

26th August 2021

Attn: Mike Rowe

CEO
Department of Water and Environmental Regulation
Locked Bag 10,
EAST PERTH WA 6892

Dear Mike,

DORAL – REQUEST TO CEASE VEGETATION HEALTH, WATER POTENTIAL AND SOIL MOISTURE MONITORING AS PER APPROVED FLORA AND VEGETATION MANAGEMENT PLAN V8– YOONGARILLUP MINE

Doral Mineral Sands (Doral) established a vegetation health monitoring program in 2016 in accordance with the requirements of Condition 6-2 of Ministerial Statement 1030, to enable the detection of any change in the health of vegetation within State Forest 33 (SF33), that may have occurred as a result of mining activity.

Vegetation Health Monitoring commenced in 2017 and has continued as per the approved Flora and Vegetation Management Plan V7 (MP) and more recently approved version V8 to satisfy condition 6-7 of Ministerial Statement 1030. The MP quotes a 24 month monitoring duration post rehabilitation of Area A.

State Forest – Area A rehabilitation was completed in June 2019 and the Yoongarillup Mine ceased to operate in early November 2020. As per the MP, Doral have now completed 24 months post rehabilitation monitoring.

The most recent Vegetation Health Report published in 2021 concludes that there was a general improvement in visual health of the trees over the 2019/2020 monitoring period and there has been no detrimental effect on vegetation due to mining activities. Monitoring reports demonstrate that the requirements of condition 6-1 of Ministerial Statement 1030 have been met and there has been no loss of vegetation beyond the boundary of Area A.

Doral request that all Vegetation Health, Water Potential and Soil Moisture monitoring be ceased. Weed and rehabilitation monitoring will continue as part of the approved State Forest - Area A Management Plan.

Please do not hesitate to contact Julie Edwards on 0427 198 143 julie.edwards@doral.com.au should you have any queries.

Yours sincerely

Craig Bovell
OHS&E Superintendent
Doral Mineral Sands

Doral

26th August 2021

Attn: Mike Rowe

CEO
Department of Water and Environmental Regulation
Locked Bag 10,
EAST PERTH WA 6892

Dear Mike,

DORAL – REQUEST TO CEASE VEGETATION HEALTH, WATER POTENTIAL AND SOIL MOISTURE MONITORING AS PER APPROVED FLORA AND VEGETATION MANAGEMENT PLAN V8– YOONGARILLUP MINE

Doral Mineral Sands (Doral) established a vegetation health monitoring program in 2016 in accordance with the requirements of Condition 6-2 of Ministerial Statement 1030, to enable the detection of any change in the health of vegetation within State Forest 33 (SF33), that may have occurred as a result of mining activity.

Vegetation Health Monitoring commenced in 2017 and has continued as per the approved Flora and Vegetation Management Plan V7 (MP) and more recently approved version V8 to satisfy condition 6-7 of Ministerial Statement 1030. The MP quotes a 24 month monitoring duration post rehabilitation of Area A.

State Forest – Area A rehabilitation was completed in June 2019 and the Yoongarillup Mine ceased to operate in early November 2020. As per the MP, Doral have now completed 24 months post rehabilitation monitoring.

The most recent Vegetation Health Report published in 2021 concludes that there was a general improvement in visual health of the trees over the 2019/2020 monitoring period and there has been no detrimental effect on vegetation due to mining activities. Monitoring reports demonstrate that the requirements of condition 6-1 of Ministerial Statement 1030 have been met and there has been no loss of vegetation beyond the boundary of Area A.

Doral request that all Vegetation Health, Water Potential and Soil Moisture monitoring be ceased. Weed and rehabilitation monitoring will continue as part of the approved State Forest - Area A Management Plan.

Please do not hesitate to contact Julie Edwards on 0427 198 143 julie.edwards@doral.com.au should you have any queries.

Yours sincerely

Craig Bovell
OHS&E Superintendent
Doral Mineral Sands

APPENDIX 3

Annual Report on Water Potential Monitoring at Yoongarillup Mine

Report 2016-2020 - Yoongarillup

Water Potential Monitoring

Prepared for Doral Mineral Sands
June 2020

Ecoedge

PO Box 9179, Picton WA 6229

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Executive Summary

This report provides the results and conclusions of the water potential (water stress) monitoring component of the FVMP of the Yoongarillup Mineral Sands Project for the period from commencement of the monitoring in September 2016 to May 2020.

There was a trend of declining mean WP in the three tree species and two shrub species over the period September 2016 to May 2020. This trend was reinforced by the very low WP recorded in autumn 2020 following the very dry 2019 wet season.

In the 2018-2019 monitoring year there was some evidence that either clearing, or mining activities were having an effect on WP. Monitored species adjacent to the Mine Area A with higher stress (lower values) were generally recorded adjacent to the mine than at reference sites.

This is was particularly the case for four of the five monitored species: *C. calophylla*, *C haematoxylon*, *K. rostrata* and *P. drouynianus* (Ecoedge, 2019). However, none of the differences between Mine Area (YM) and Reference sites (YR) were statistically significant.

This situation appears to have stabilized in the 2019-2020 monitoring year and following the revegetation of the Mine Area in autumn-winter 2019 any edge effects along the boundary between the Mine Area and State forest should continue to dissipate.

Contents

Table of Figures

1 Background

On 7 June 2016 Doral Mineral Sands Pty Ltd (Doral) obtained environmental approvals under the *Environmental Protection Act 1986* to undertake the Yoongarillup Mineral Sands Project subject to a compliance with range of Ministerial conditions. These included preparation and implementation of a Flora and and Vegetation Monitoring Plan (FVMP) to ensure that the proposal did not result in any loss of native vegetation within State Forest No. 33 (SF No.33) beyond the boundary of Area A (**Figure 1** & **Figure 2**).

The FVMP plan included monitoring of:

- Water stress of representative plant species (Water Potential (WP))
- Visual health (VH) of representative plant species
- Native and introduced plant species
- Watertable depth and quality
- Soil moisture.

Contingency measures are initiated in a two staged process based on the outcomes of the water potential monitoring. The level one contingency measures are initiated where statistical analysis shows a significant difference between monthly mine site (Yoongarillup Mine 'YM') and reference site (Yoongarillup Reference 'YR') data. The level two contingency measures are initiated where significant adverse vegetation health effects are observed in vegetation adjacent to the mine pit, but not at reference sites, which will lead to loss of vegetation without immediate action.

The FVMP monitoring program will continue until the CEO of the Environmental Protection Authority can confirm no loss of vegetation or potential ongoing loss of vegetation outside of Area A as a result of the proposal, based on the advice of the Department of Parks and Wildlife and the Department of Water and Environmental Regulation.

This report provides the results and conclusions of the water potential (water stress) monitoring component of the FVMP for the period from commencement in September 2016 to May 2020.

2 Methods

2.1 WP Measurement

The level of water stress in plants, in the form of stem, or leaf water potential, was measured in the field using a Scholander-type pressure chamber (Scholander *et al*., 1965). Water potential (WP) is most commonly expressed in kilopascals (kpa). Because water tension is measured, negative values are typically reported. In other words, water stress as measured by the pressure chamber is a "deficit:" the more the stress, the more the plant is experiencing a deficit of water.

A total of 21 sites were established for use in WP monitoring (**Figure 1**). Sixteen[1] of these are referred to as 'Mine Sites' (YM) sites as they are within the potential water drawdown zone, and are therefore potential impact sites (**Figure 2**). Five sites are 'Reference sites' (YR), located outside of the potential drawdown impact zone and therefore not likely to be affected by mining operations.

Water potential monitoring was carried out on nine occasions per year from 2016 to 2020. On each occasion monitoring extended over three days and each site was done in the same order (i.e. same time of day) at each monthly monitoring visit. This was done to maximise comparability between samples taken at the same site during the various visits – water potential readings typically decrease from just before dawn to reach their most negative in the early afternoon. Water potential measurements were made using two pressure chambers (PMS Instrument Co.).

Samples were taken from the plants[2] between 1100 hrs and 1245 hrs on each day of sampling using pruning clippers and then immediately placed in a sealable plastic bag and placed in a cooler box with a freezer pack to keep them cool. They were then taken back to the location where the measurement apparatus had been set up in the field. Generally, all samples were tested within 90 minutes of the sample being taken.

Sample collections from some species at several sites was temporarily suspended or ceased during the August 2019-May 2020 monitoring period, either because it was too difficult to collect specimens (too high above the ground) or because of concerns for the state of health of the trees or shrubs being monitored.

2.2 Date Entry and Statistical analysis

The WP data is entered in an Excel spreadsheet on a monthly basis and the data on a per species and per site basis. The resulting averages are studied to determine whether there are any anomalous readings or data that would indicate there is likely to be a significant difference between measurements with a species at a 'mine' site compared to a 'reference' site. Potentially significant differences are investigated using a t-test (two-tail), adjusted for unequal variances to test for significance at the $P<0.5$ level as was presented in Ecoedge (2018).

[1] YM8 is a Visual Health monitoring site and is not used for WP monitoring.

[2] The plants that were sampled were the trees *Eucalyptus marginata*, *Corymbia calophylla*, *C. haematoxylon*, and the shrubs *Kunzea rostrata* and *Podocarpus drouynianus*. At least one tree and one shrub was sampled at each site – three samples from each species and three of each species were sampled per site.

2.3 Irrigation adjacent to The Pit Area (Area A)

To reduce the risk of drought deaths supplementary watering has been carried out in vegetation adjacent to the mine at Yoongarillup. A flexible PVC irrigation pipe carrying bore water was installed around the edge of the Pit Area in 2017 and removed in April 2019. At approximately 20m intervals subsidiary hoses from the main pipe feed into a “spear” inserted into holes about a 50 -100 mm deep bored into the ground. Over the summer and autumn an amount equivalent to 10 mm of rain was applied once per week.

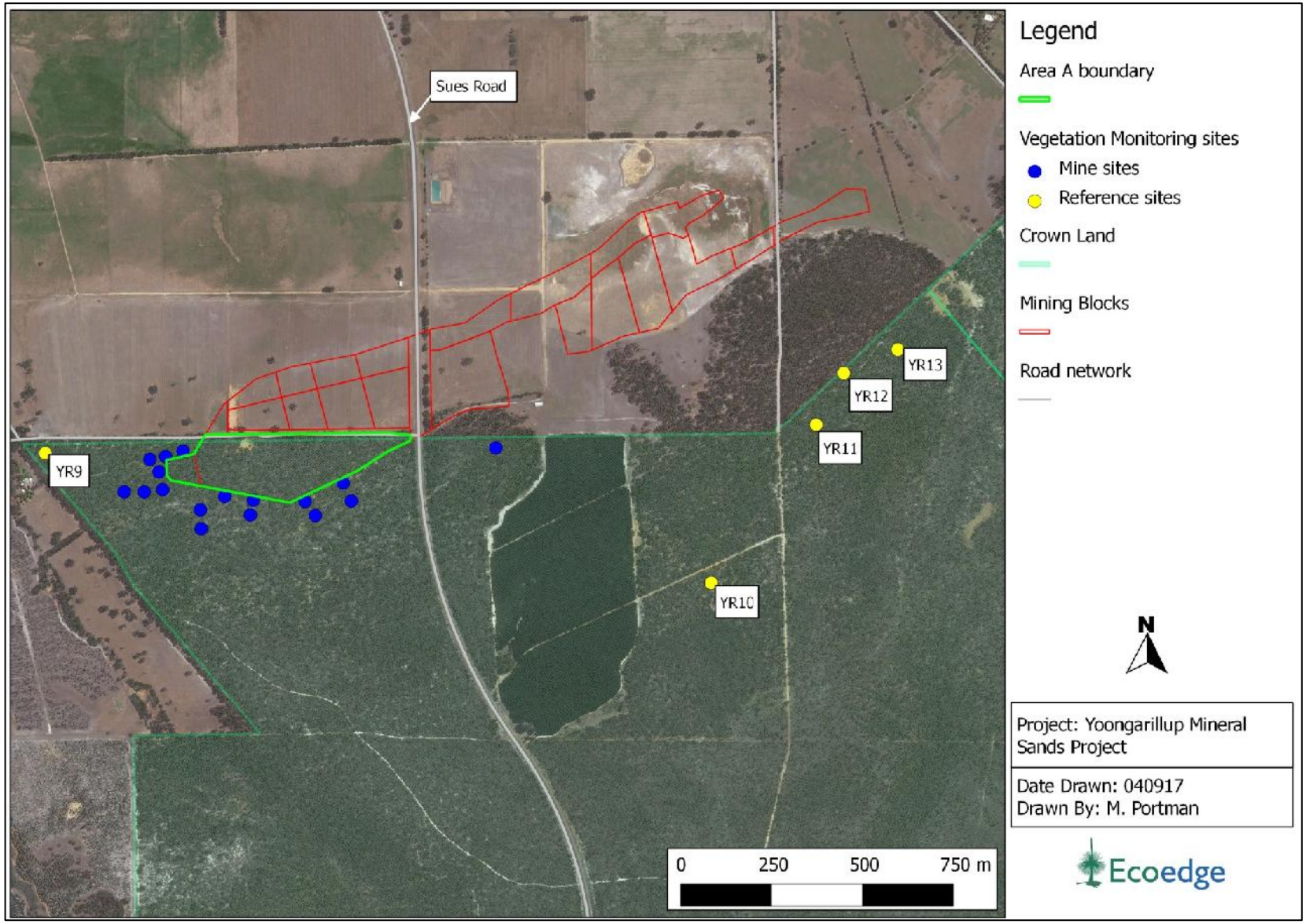

Figure 1. Location of vegetation monitoring sites at Yoongarillup.

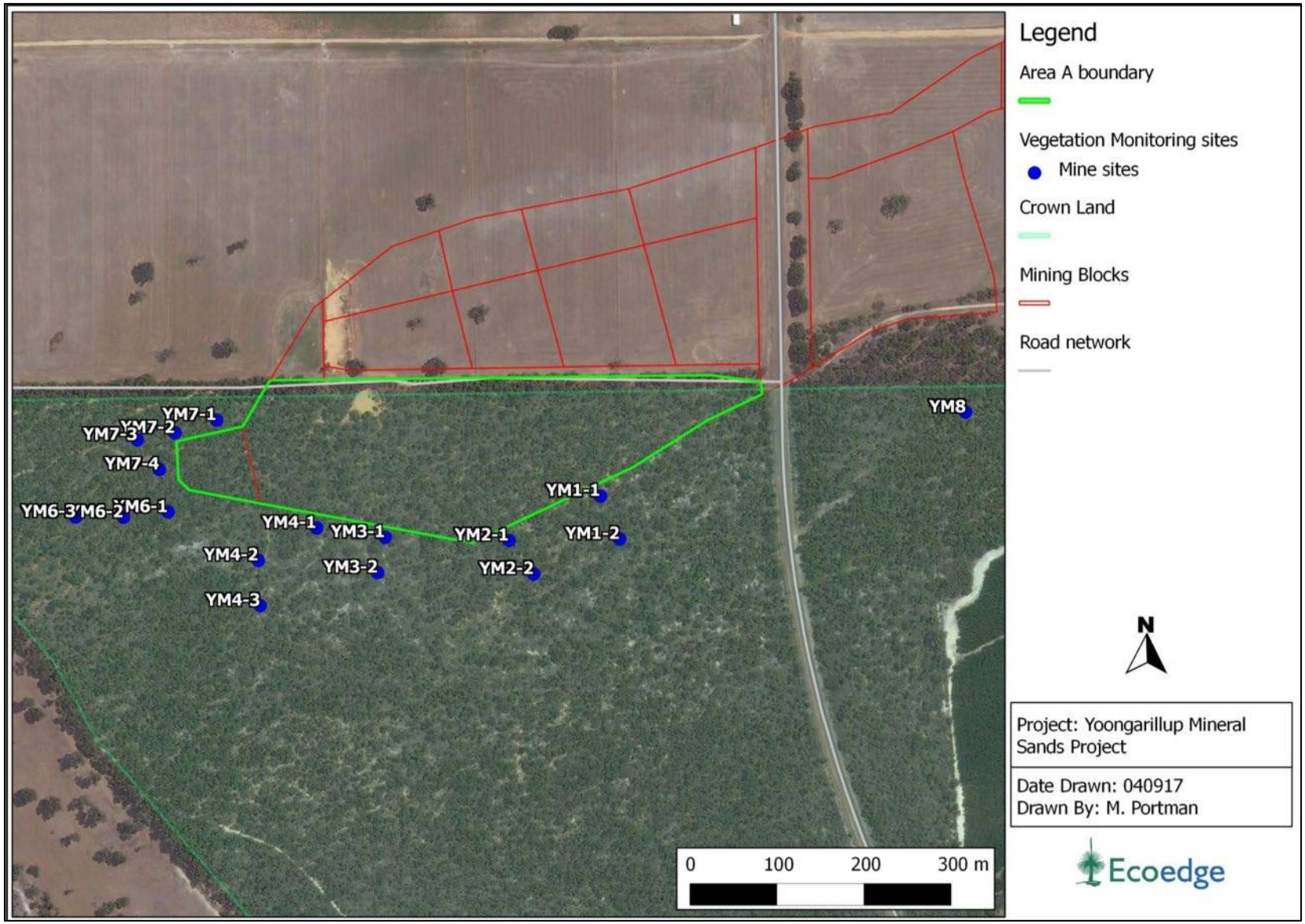

Figure 2. 'Mine Area' vegetation monitoring sites at Yoongarillup.

3 Results

3.1 Rainfall

Rainfall at Yoongarillup is shown below for 2016-2020 and the first five months of 2020 (**Figure 3**). Rainfall has declined over the four years. The mean rainfall at Yoongarillup over the 60 years of records is 847 mm, so 2017 (851 mm) was average and 2018 (785 mm) was 8% and 2019 (609 mm) was 28% below average, respectively. Rainfall for the first five months of 2020 is just above average. Rainfall decline has been going on for a long time in the Busselton area, with mean rainfall at Busselton, the nearest station with long-term rainfall records, declining from about 814 mm over the seven years from 1956-1963 to 580 mm in the seven years 2010-2016. Rainfall at Busselton shire weather station over the period 1956-2018 is presented in **Figure 4**.

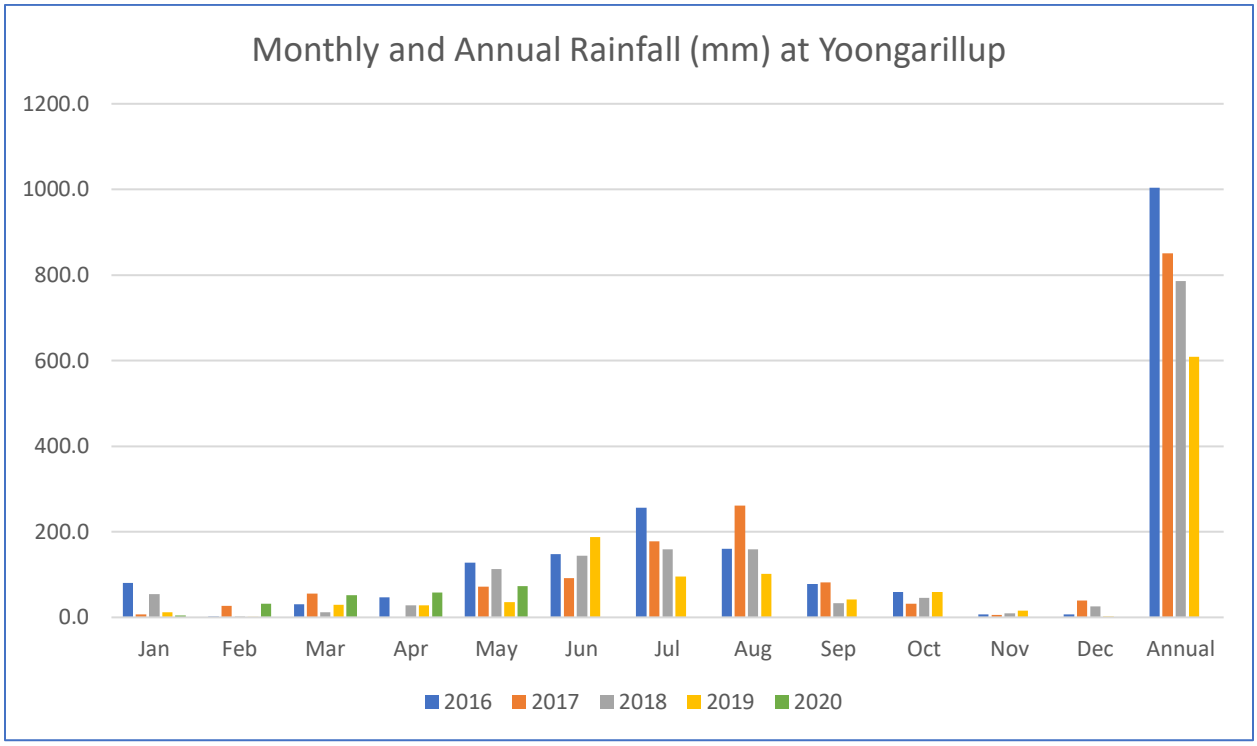

Figure 3. Rainfall at Yoongarillup (Station No. 9771) from Jan 2016 to May 2020.

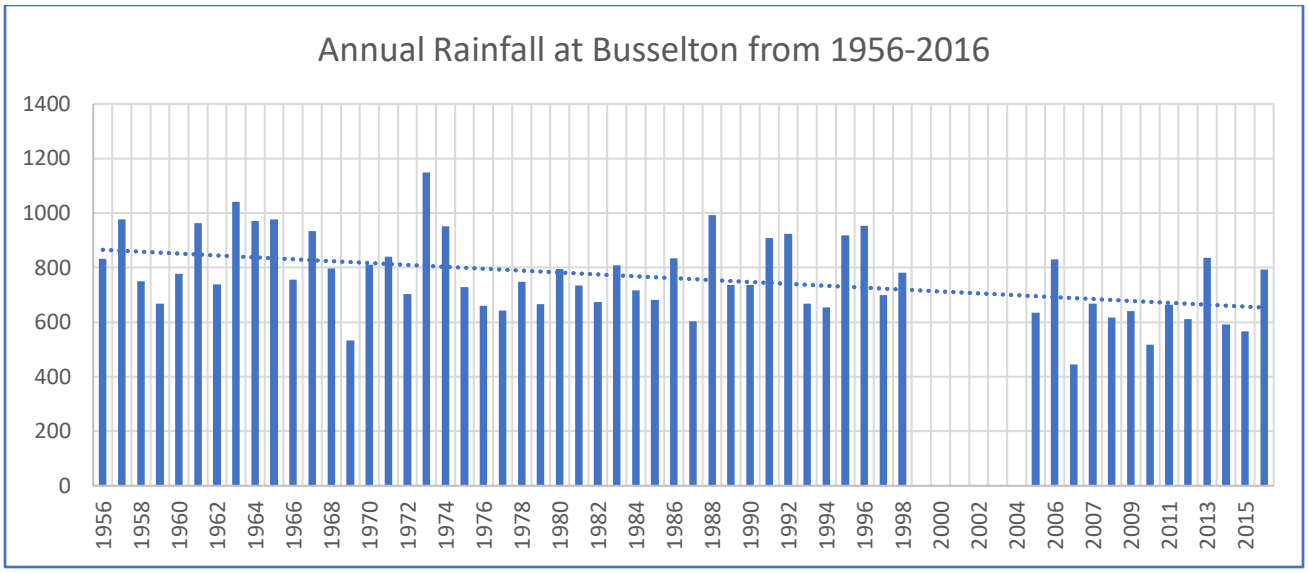

Figure 4. Annual Rainfall at Busselton shire Weather Station Since 1956. The graph also shows the linear trend line

3.2 Water Potential Monitoring

Water potential (WP) values (in kPa) are shown for the three tree species and two shrub species monitored between Sep 2016 and May 2020 in a series of graphs, below. For each site the values of three samples from each of three individual plants are used to arrive at a mean value for each species monitored at a particular site for each month of monitoring.

In general, water stress (i.e. indicated by negative water potential values) was greatest between December and March and lowest between September and November.

3.2.1 Corymbia calophylla

Monthly mean water potentials in *C. calophylla* from September 2016 to May 2020 are shown in **Figure 5**, below.[3] A trend-line based on the values at site YR10 is also shown. This trend-line slopes downward and reflects the gradual drying-out of the sites due mainly to declining annual rainfall. As an example of the drying out of the sites and consequently the general downward trend of water potentials the mean water potential at site YR10 in February was -1608 kPa in 2017 while it was -2450 kPa in 2020.

Across the four years of monitoring there is no clear evidence that there was a sustained or substantial difference in WP between YM and YR, although for a period (December 2018 to February 2019) it appeared that the WP at three sites near the mining boundary had been affected (made lower) by the adjacent clearing (Ecoedge, 2019).

[3] After May 2019 samples from *C. calophylla* at several sites were no longer taken as explained in subsection 2.1.

3.2.2 *Corymbia haematoxylon*

As the case with *C. calophylla*, mean WP declined in all months over the period from September 2016 to May 2020 in *C. haematoxylon* (**Figure 6**). The trend-line for one of the YR (YR11) declined from a mean of -1490 kPa in December 2016 to -1800 kPa in December 2019. WP values were generally lower in *C. haematoxylon* than in *C. calophylla* throughout the period – reflecting the fact that they are found further upslope in drier sites. As was the case with *C. calophylla*, there is no clear and consistent difference between mean WP at YM versus YR sites over the four-year monitoring period.

3.2.3 *Eucalyptus marginata*

WP in *Eucalyptus marginata* over the period September 2016 to May 2020 is shown below in **Figure 7** (YR) and **Figure 8** (YM). The trend-lines for the two groups of sites have a similar slope and illustrate a gradual drying-out of the soils over the period, due almost certainly to declining annual rainfall. The lowest mean WP levels over the 4½ year period were recorded in April 2020 at the YM sites YM4-3 (-2228 kPa), YM4-2 (-2330 kPa) and the three YR sites, YR09, YR11 and YR12 which all recorded levels below -2500 kPa.

The range on monthly mean WP levels was similar for both YM and YR sites and there is no discernible sustained difference between the two groups of sites.

3.2.4 *Kunzea rostrata*

The general trend declining in *K. rostrata* mean WP, a relatively shallow-rooted shrub, is similar to those in the three deep-rooted trees (**Figure 9**). Mean WP in *K. rostrata* over the three driest months (January-March) was -1887 kPa in 2017, -2087 in 2018, -1922 kPa in 2019 and -2554 kPa in 2020. Late summer and autumn 2020 were associated with a steep decrease in visual health scores in *K. rostrata* (Ecoedge, 2020), which corresponded with sharp falls in WP, particularly at site YM1-2 where mean WP of -4652 kPa were recorded.

A total of 10 deaths occurred among the monitored *K. rostrata* in the 4½ years from September 2016, which was a third of those being monitored. *Kunzea rostrata* appears to be a relatively short-lived shrub and also susceptible to the effects of drought. Its normal habitat is sandy wetlands with a clayey subsoil, so the occurrences at Yoongarillup, which are not in or near a swamp, are probably at the margins of habitat suitability.

3.2.5 *Podocarpus drouynianus*

Mean WP in the shrub *Podocarpus drouynianus* at YM sites (**Figure 10**) and YR (**Figure 11**) show a similar declining trend over the period September 2016 to May 2020. The lowest mean WP values were recorded in autumn 2020, with one of the YM sites (YM2-1) recording a mean WP of -3618 kPa and a YR (YR09) a mean WP of -3161 kPa. The extremely low WP in *P. drouynianus* in autumn 2020, both at the YM and YR, is most probably due to the low rainfall over the wet season of 2019 (**Section 3.1**, above).

3.2.6 Correlation between Mine Areas and Reference Sites

There were two species that were monitored in both the YM and YR areas, one shrub species (*P. drouynianus*) and one tree species (*E. marginata*).

Correlation between mean WP in *P. drouynianus* within the YM and YR, September 2016 – May 2020 is shown in **Figure 12**. Correlation between mean WP in *E. marginata* within the YM and YR Sites, September 2016 – May 2020 is shown in **Figure 13.**

Figure 12 shows the Mean WP values at YM and YR sites for *P. drouynianus*. There is a general decline in mean WPs over the period September 2016-May 2020 for both the YM and YR sites.

It is notable that WPs were higher (i.e. less negative) in *P. drouynianus,* over the summer/autumn period in 2018/19 and again in 2019/2020 (over -2,500 kPa) summer, for both YM and YR sites.

Figure 13 shows the Mean WP values at YM and YR sites for *E. marginata*. As per the shrub species there is a general decline in mean WPs over the period September 2016-May 2020 for both the YM and YR sites for the tree species.

It is notable that WPs were higher (i.e. less negative) over the summer/autumn period in 2018/19 and again in summer 2019-2020. The mean WP at YR sites during the period January-April in 2018 was -1,940 kPa whereas during January-April 2019 it was -1,657 kPa. At the YM sites for the same periods the average was -2,188 kPa in 2018 compared with -2,088 kPa in 2019. The explanation for the less negative WPs in the January-April period in 2019 compared to 2018 may be explained by significant rainfall recorded at Yoongarillup in early March 2019 and again in mid-April. 2020 was a dry year and therefore both the monitored species at the YM and YR sites show the greatest levels of stress during this summer (over -2,500 kPa).

4 Conclusions

There was a trend of declining mean WP in the three tree species and two shrub species over the period September 2016 to May 2020. This trend was reinforced by the very low WP recorded in autumn 2020 following the very dry 2019 wet season.

In the 2018-2019 monitoring year there was some evidence that either clearing, or mining activities were having an effect on WP in monitored species adjacent to the Mine Area A with higher stress (lower values) generally recorded adjacent to the mine than at reference sites. This is was particularly the case for four of the five monitored species: *C. calophylla*, *C haematoxylon*, *K. rostrata* and *P. drouynianus* (Ecoedge, 2019). However, none of the differences between YM and YR sites were statistically significant.

This situation appears to have stabilized in the 2019-2020 monitoring year and following the revegetation of the Mine Area in autumn-winter 2019 any edge effects along the boundary between the Mine Area and State forest should continue to dissipate.

5 References

Ecoedge (2018). Water Potential Monitoring at Yoongarillup 2017-2018. Unpublished report to Doral Mineral Sands.

Ecoedge (2019). Annual Report - Yoongarillup Water Potential Monitoring. Unpublished report to Doral Mineral Sands.

Ecoedge (2020). 2019-2020 Annual Report: Yoongarillup Visual Health Monitoring. Unpublished report to Doral Mineral Sands.

Scholander, P. F., Bradstreet, E. D., Hemmingsen, E., & Hammel, H. (1965). Sap Pressure in Vascular Plants; Negative Hydrostatic Pressure Can Be Measured in Plants. *Science*, 148, 339-346.

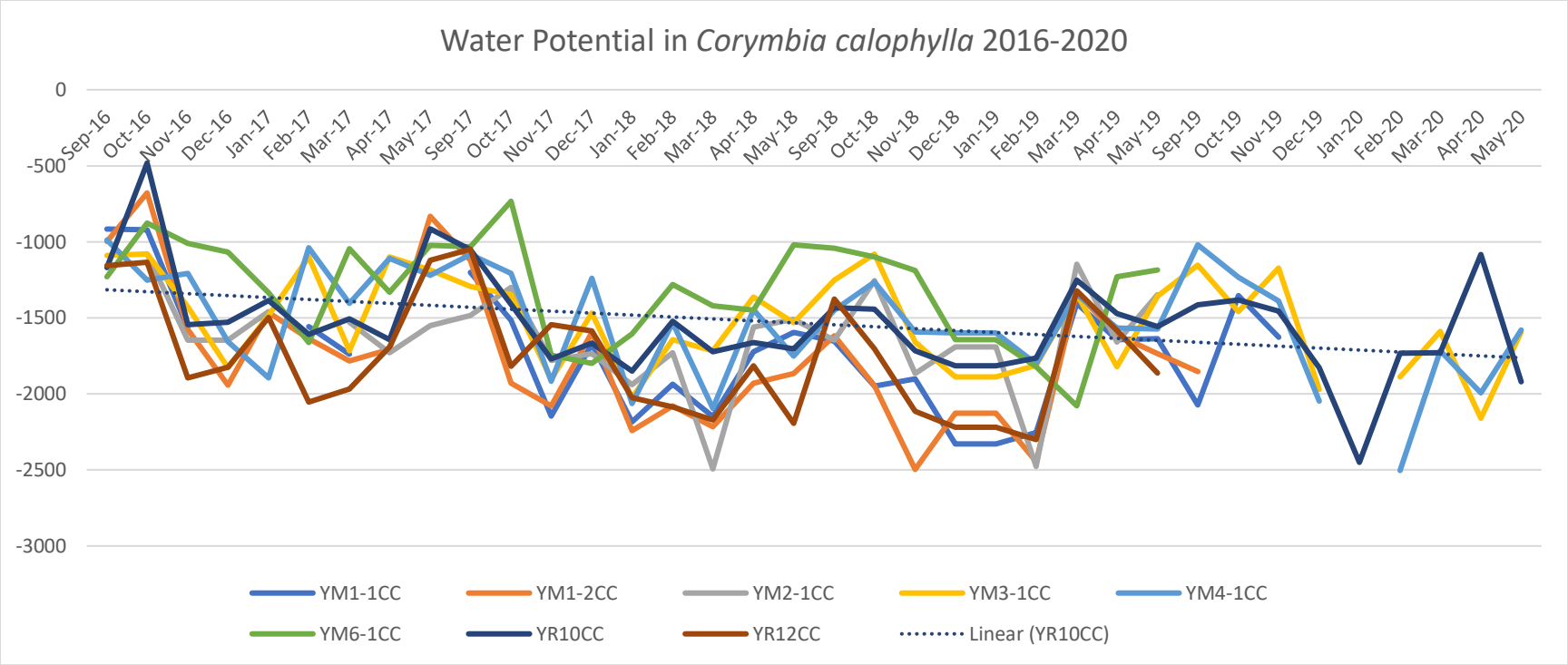

Figure 5.Mean water potential values in *Corymbia calophylla* at the six Mine Area (YM) and two Reference (YR) sites where monitoring was carried out. A “trend line” based on the values at site YR10 is shown.

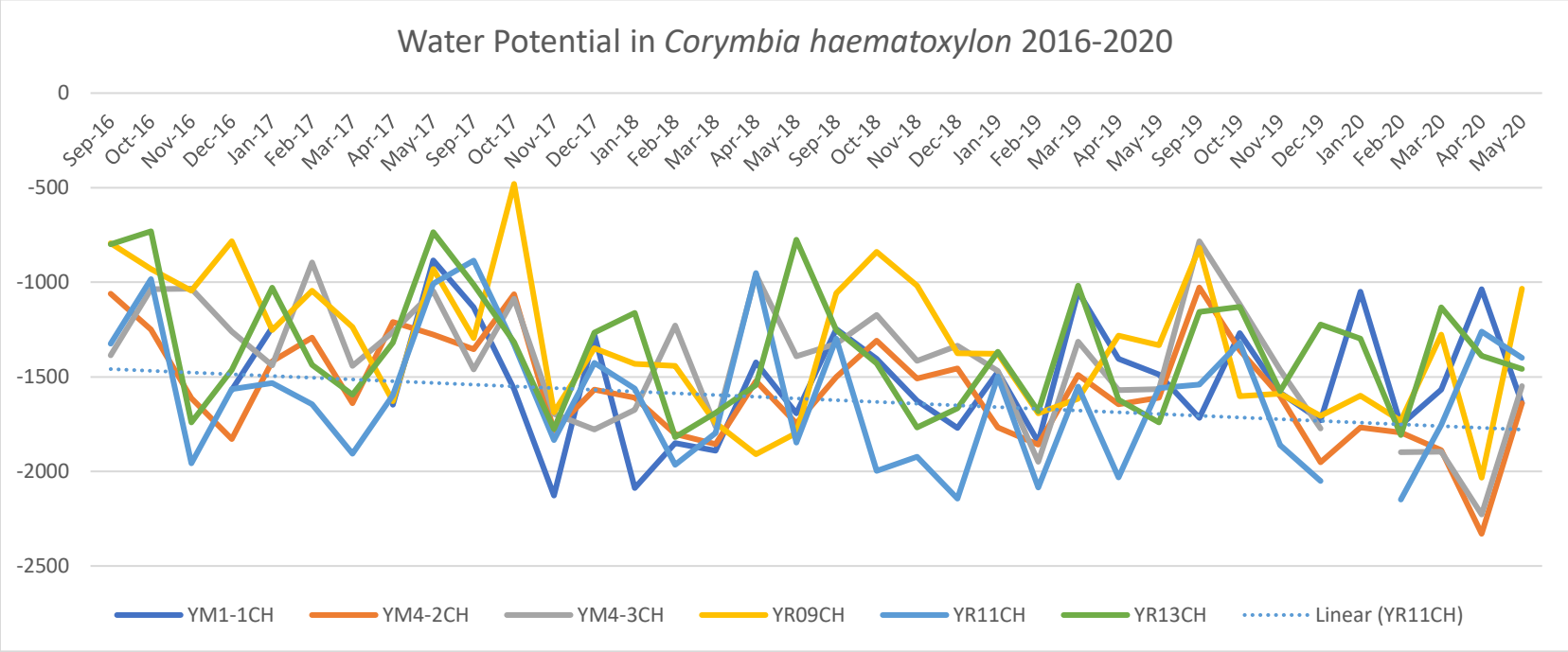

Figure 6. Mean water potential values in *Corymbia haematoxylon* at the three Mine Area (YM) and three Reference (YR) sites where monitoring was carried out. A “trend line” based on the values at site YR11 is shown.

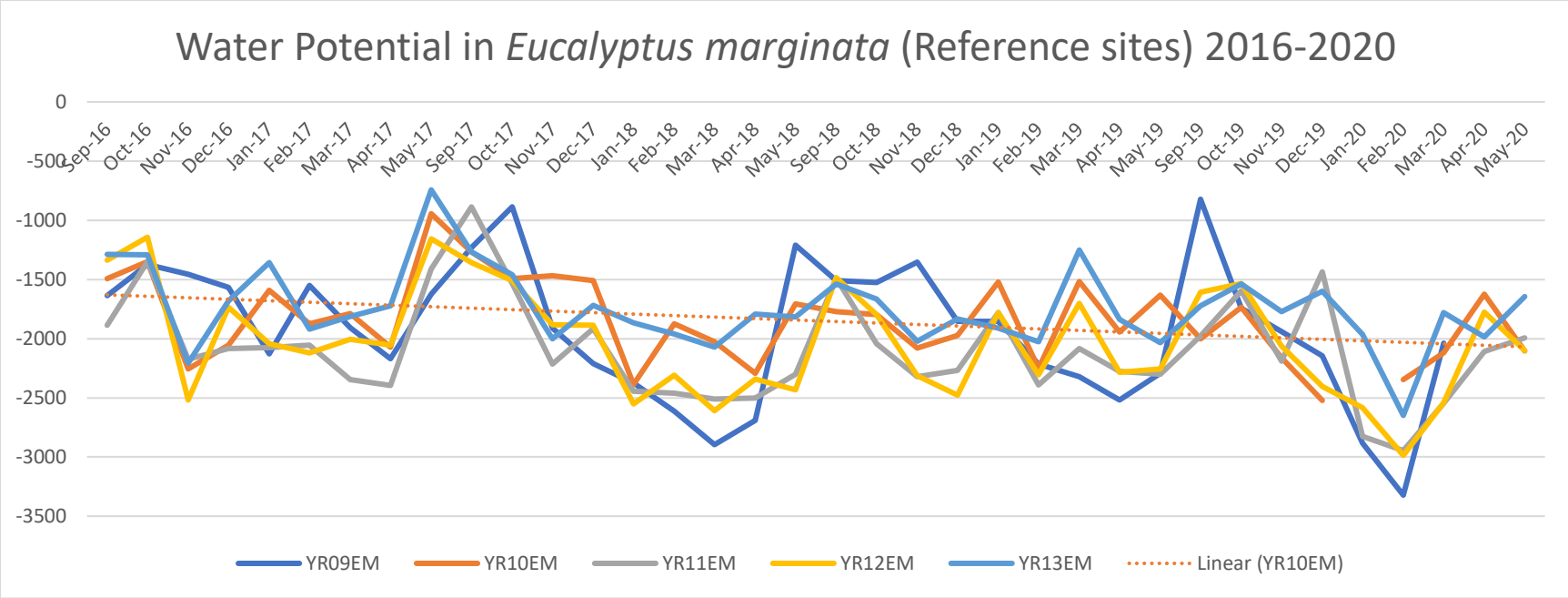

Figure 7. Mean water potential values in *Eucalyptus marginata* at the five YR over the full period of monitoring. A trend line based on site YR10 is shown.

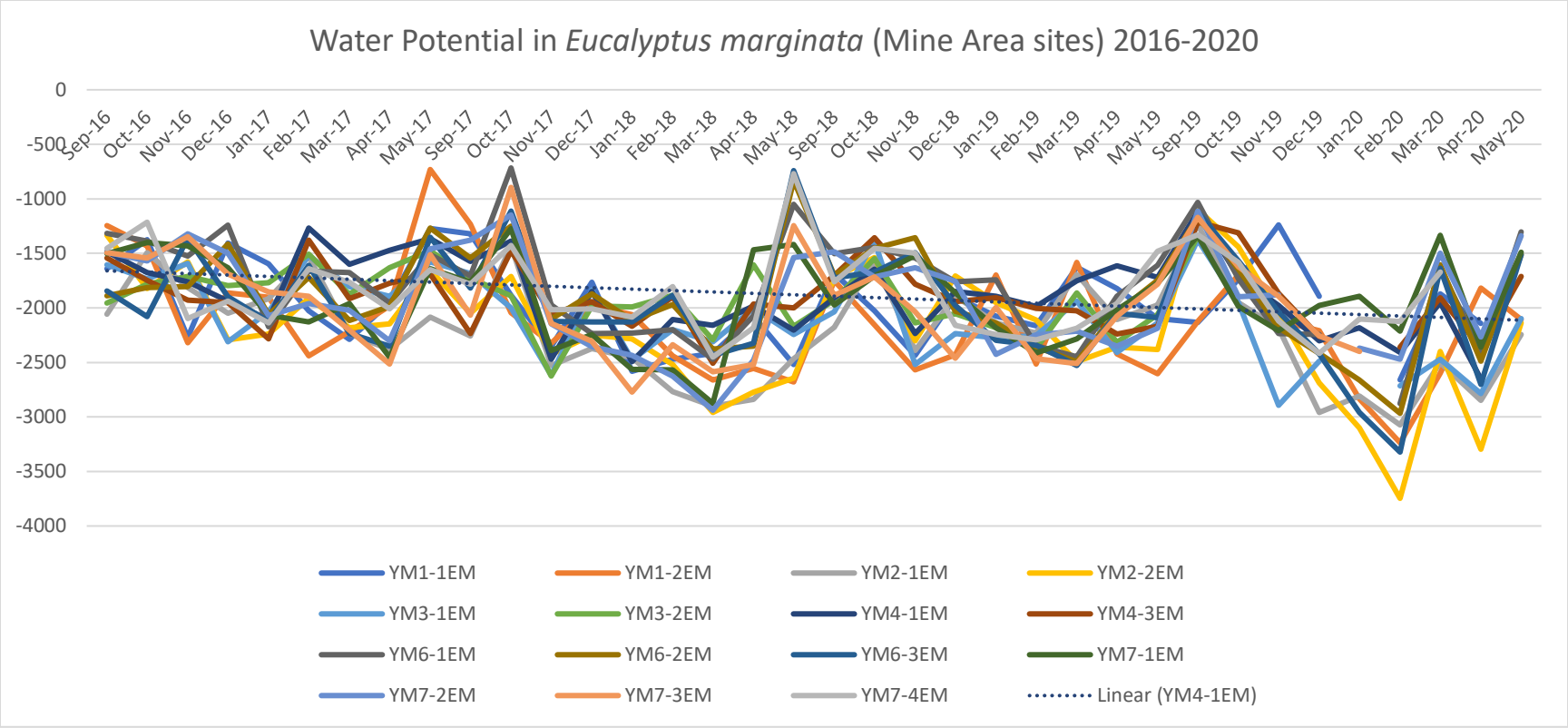

Figure 8. Mean water potential values in *Eucalyptus marginata* at the fifteen Mine Area sites over the full period of monitoring. A trend line based on site YM4-1 is shown.

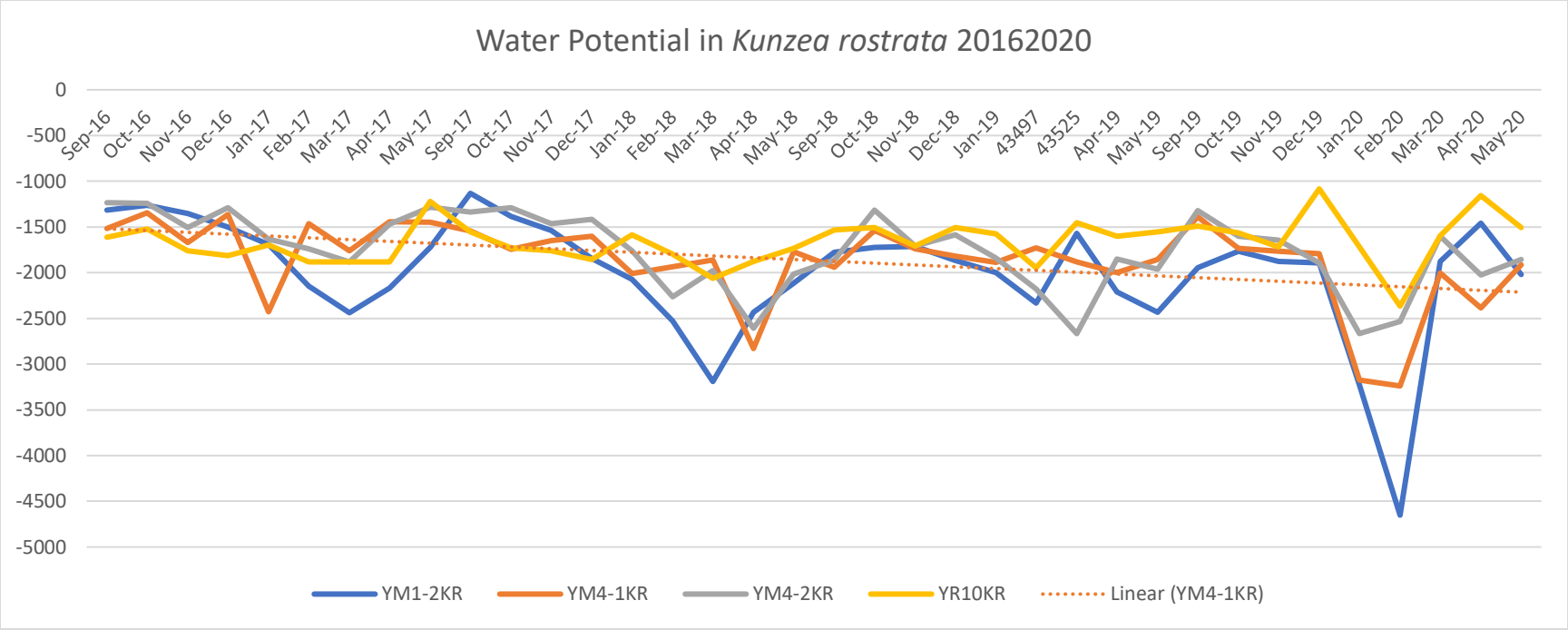

Figure 9. Mean water potential values in *Kunzea rostrata* over the over the full period of monitoring. A trend line based on site YM4-1 is shown.

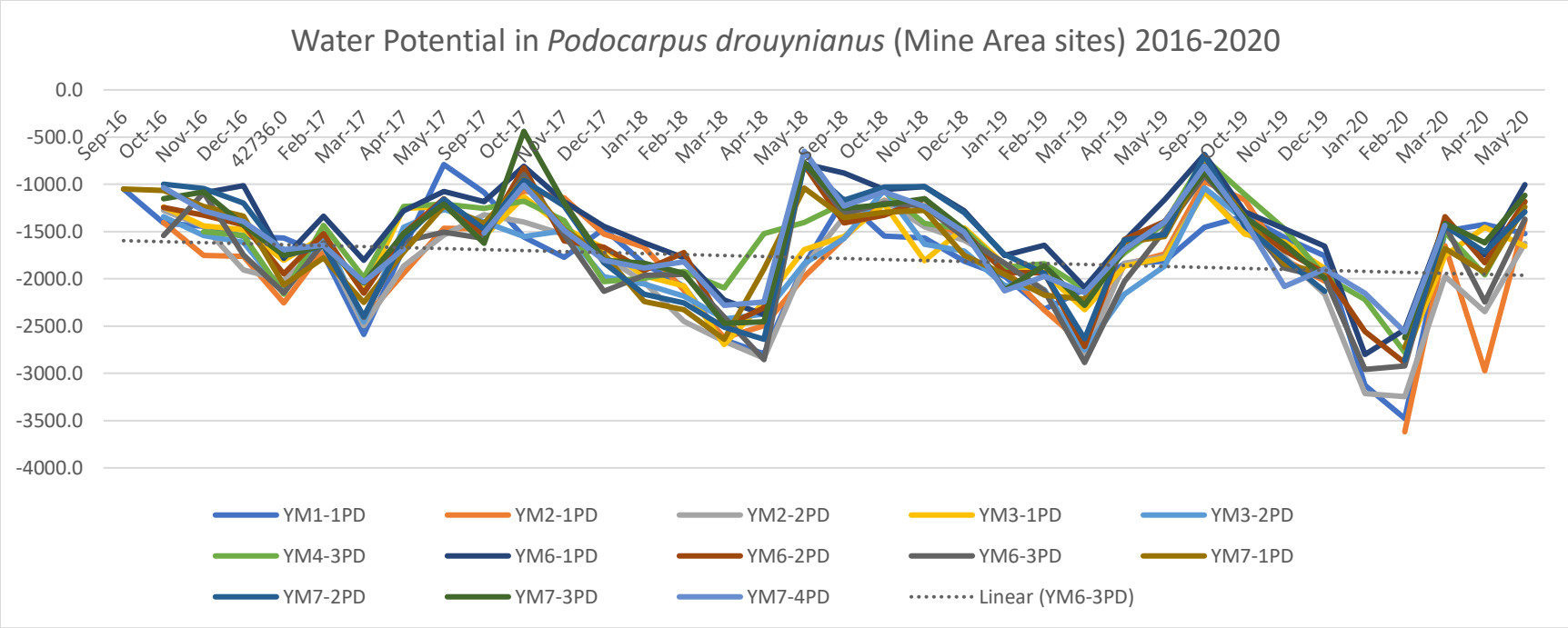

Figure 10. Mean water potential values in *Podocarpus drouynianus* (Mine Area sites only) over the full period of monitoring. A trend line based on site YM6-3 is shown.

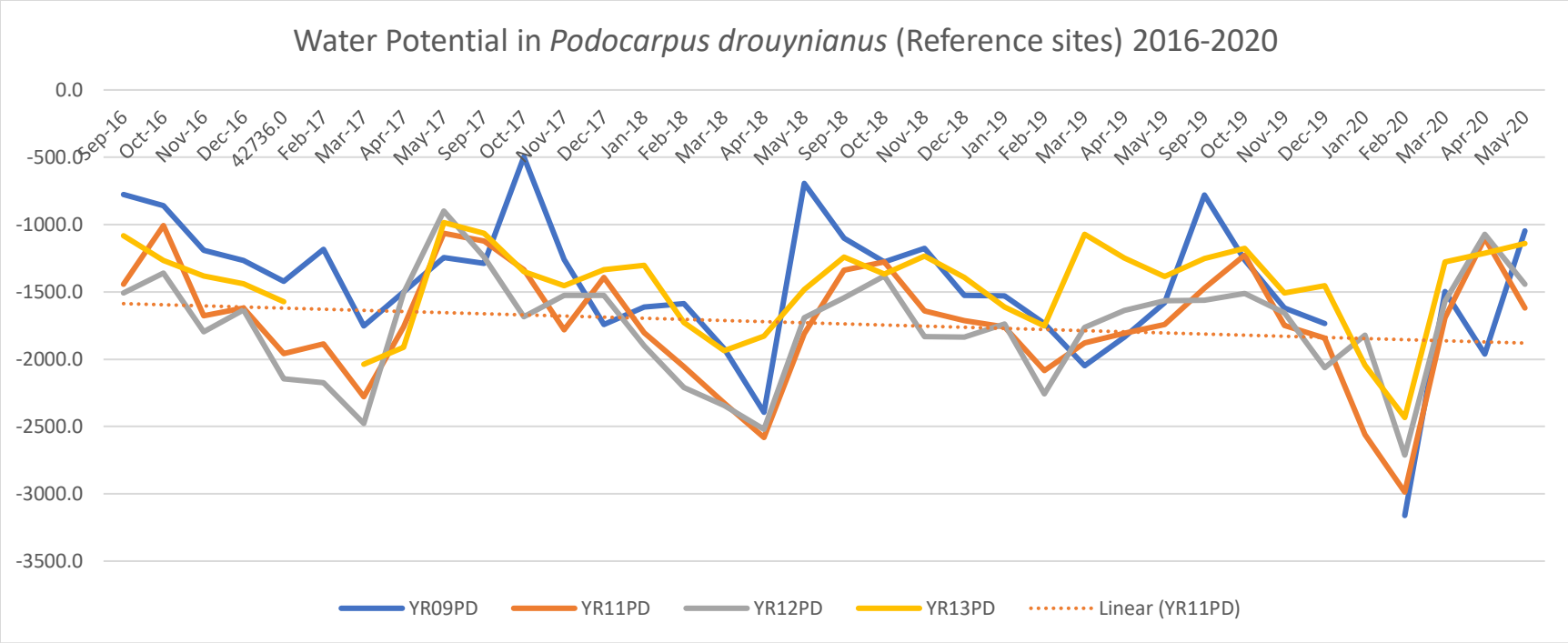

Figure 11. Mean water potential values in *Podocarpus drouynianus* (YR only) over the over the full period of monitoring. A trend line based on site YR11 is shown

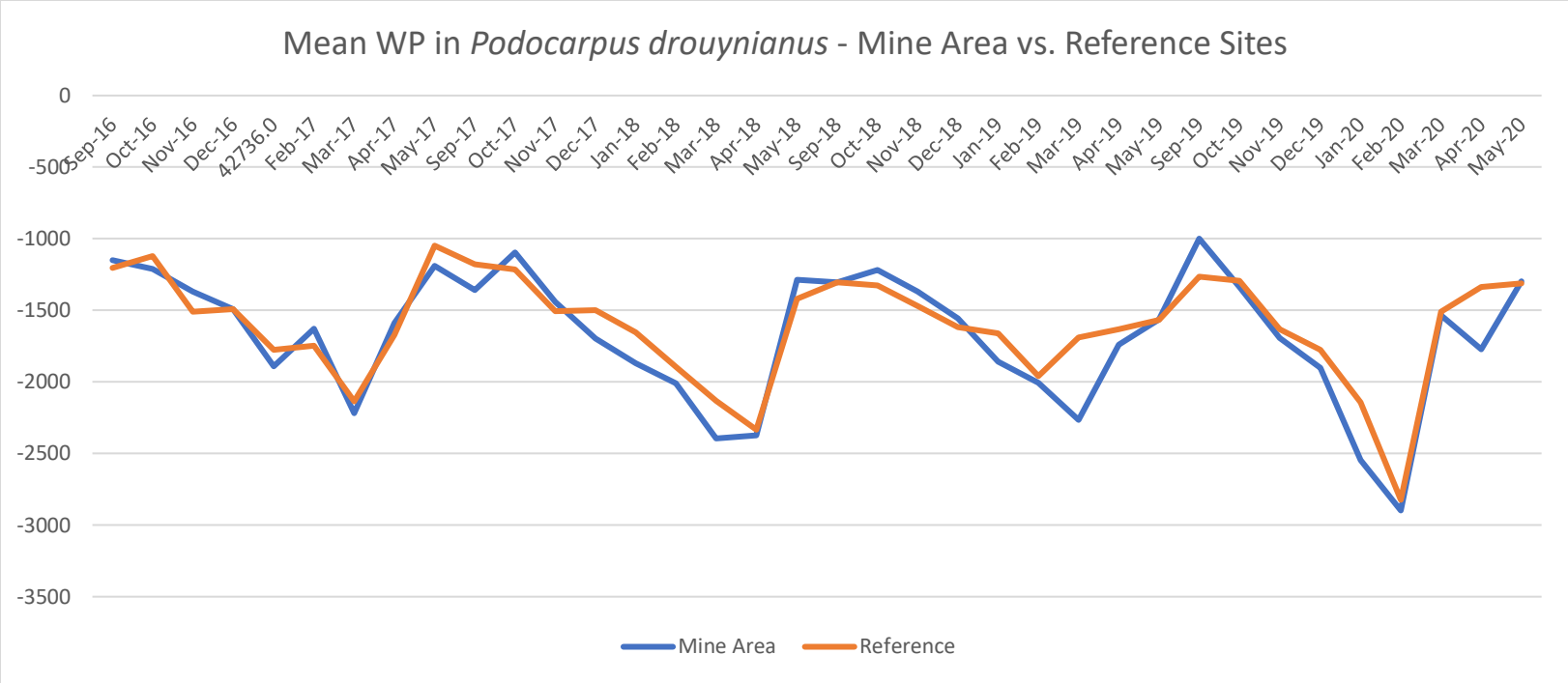

Figure 12. Correlation between mean WP in *Podocarpus drouynianus* within the YM and YR, September 2016 – May 2020.

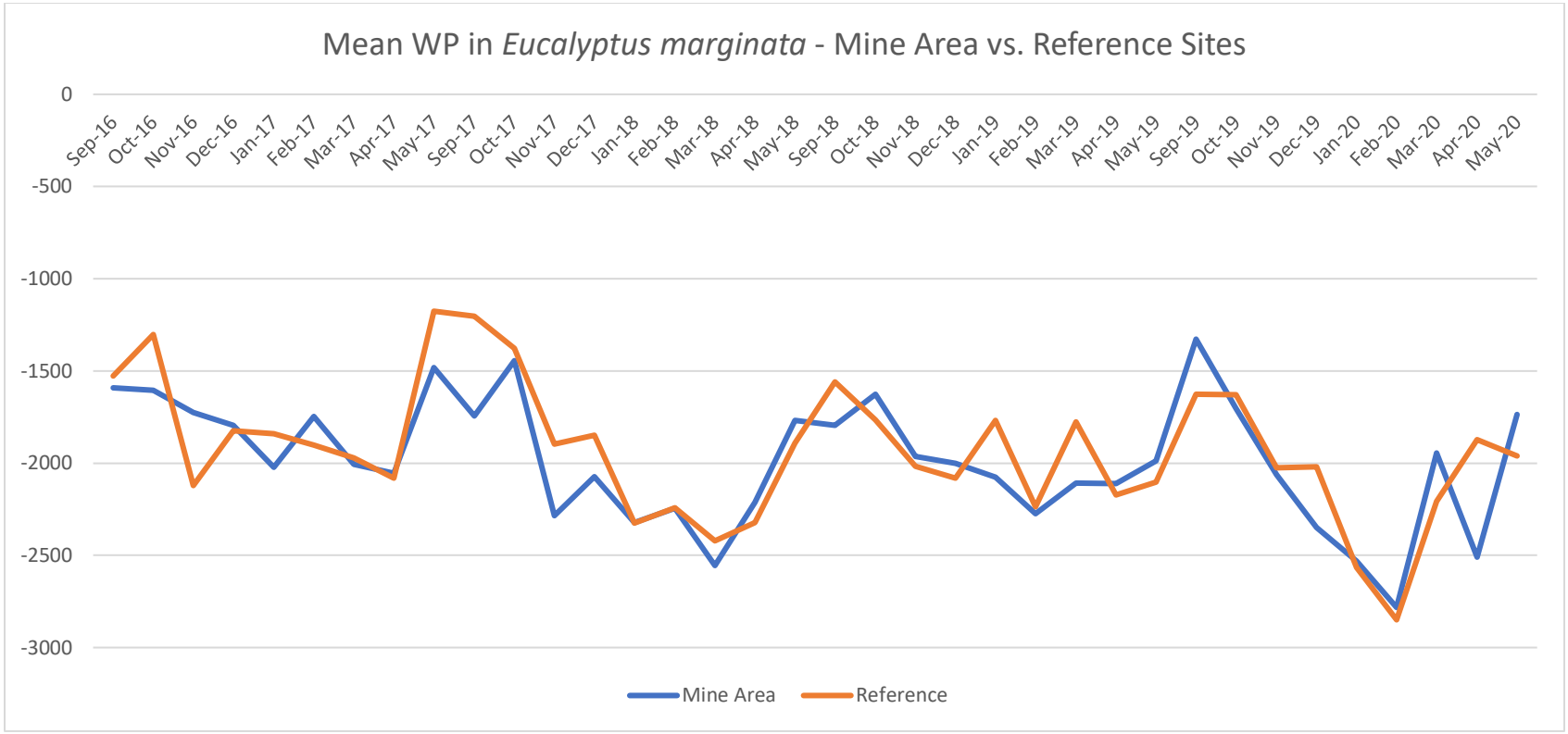

Figure 13. Correlation between mean WP in *Eucalyptus marginata* within the YM and YR, September 2016 – May 2020.

APPENDIX 4

Annual Report on Visual Health Monitoring at Yoongarillup Mine

2016-2020 Annual Report

Yoongarillup Visual Health Monitoring

Prepared for Doral Mineral Sands
June 2020

Ecoedge

PO Box 9179, Picton WA 6229

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Version	Origin	Review	Review date	Release approval	Issue date
V1	R. Smith	D. Brace	1/6/2020	Ecoedge	4/6/2020
Final Draft	D. Brace	J. Edwards		Doral	10/6/2020
Final	Doral	D. Brace	16/6/2020	Ecoedge	17/6/2020

Executive Summary

- Annual rainfall in 2019 at Yoongarillup was 28% below average and this was reflected in the marked increase in foliage yellowing and die-off observed the three monitored tree species over summer 2019/20, compared to previous years.
- There was a continued decline in canopy density scores observed in the previous three years.
- In *Eucalyptus marginata* and *Corymbia calophylla* the four-year reduction in canopy density was similar at Mine Area and Reference Sites, but in *C. haematoxylon* it was 30% higher at Mine Area sites.
- Foliage yellowing and death in all three tree species was similar at Mine Area and Reference Sites.
- There were no deaths amongst the three trees or *Podocarpus drouynianus* shrubs being monitored over the period 2016-2020, however, one third of the *Kunzea rostrata* plants being monitored over the period died – this was most likely due to the consistent decline in rainfall over the period.

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1 Background

On 7 June 2016 Doral Mineral Sands Pty Ltd (Doral) obtained environmental approvals under the *Environmental Protection Act 1986* to undertake the Yoongarillup Mineral Sands Project subject to a compliance with range of Ministerial conditions. These included preparation and implementation of a Flora and Vegetation Monitoring Plan (FVMP) to ensure that the proposal did not result in significant loss of native vegetation within State Forest No. 33 (SF No.33) beyond the boundary of Area A (**Figure 1** and **Figure 2**).

This plan included monitoring of:

- New tip growth and epicormic growth,
- Canopy density,
- Foliage yellowing or leaf dying and
- Shrub health score.

This report provides the results and conclusions of VH monitoring component of the FVMP all years from 2016-2020 and is the fourth year of reporting.

The FVMP monitoring program will to continue until the Chief Executive Officer of the Environmental Protection Authority can confirm no loss of vegetation or potential ongoing loss of vegetation outside of Area A as a result of the proposal, based on the advice of the Department of Parks and Wildlife and the Department of Water and Environmental Regulation.

Visual health monitoring at Yoongarillup has previously been reported in Ecoedge (2017, 2018a, 2018b, 2019).

Mining ceased in the 'Mine Area' shown in **Figure 2**, below, in early 2019, the pit was progressively backfilled and the area revegetated with local provenance seed in autumn and early winter 2019.

2 Methods[1]

In 2016, twenty-one sites were established in (SF No.33) for use in VH monitoring (**Figure 1**). Seventeen of these are referred to as "Mine Area" sites (YM) as they are within the potential water drawdown zone, and are therefore potential impact sites. Five sites are "Reference" sites (YR), located outside of the potential drawdown impact zone and therefore not likely to be affected by mining operations (**Figure 2**).

The VH assessments were made of three tree species *Eucalyptus marginata, Corymbia calophylla* and *C. haematoxylon* and two shrub species, *Kunzea rostrata* and *Podocarpus drouynianus*. These species were monitored at each of the sites on nine occasions per year between September and

[1] The VH methodology and associated scales are described in further detail in the FVMP (Doral, 2016; pp. 26-27).

May, and not during the winter months of June, July and August due to reduced water stress during wetter months.

The VH assessments were made in the field according to the four scales shown in **Table 1** to **Table 4**. Results were recorded on field sheets (**Appendix 1**) and later transferred to an Excel spreadsheet. The average scores for each species recorded for all sites is presented in graphs.

Table 1. Crown Extent and Density Score (Souter *et al*., 2009, Backstrom *et al*., 2010).

Score	Crown Extent and Density
0	None (0%)
1	Minimal (1-10%)
2	Sparse (11-20%)
3	Sparse-Medium (21-40%)
4	Medium (41-60%)
5	Medium-Major (61-80%)
6	Major (81-90%)
7	Maximum (91-100%)

Table 2. New Tip Growth and Live Epicormic Growth Score
(Souter *et al*., 2009, Backstrom *et al*., 2010).

Score	Description	Definition with regards to assessable crown.
0	Absent	Effect is not visible
1	Scarce	Effect is present but not readily visible
2	Common	Effect is clearly visible throughout
3	Abundant	Effect dominates the appearance

Table 3. Leaf Die-off or Yellowing Score
(Souter *et al*. 2009, Backstrom *et al*., 2010).

Score	Description	Definition
0	Absent	Effect is not visible
1	Scarce	Effect is present but not readily visible
2	Common	Effect is clearly visible throughout
3	Abundant	Effect dominates the appearance

Table 4. Shrub Health Score (adapted from Lay & Meissner, 1985).

Score	Description
0	Dead shrub.
1	Shrub with <20% of original canopy; most main branches dead; remaining leaves mostly dying off.
2	Shrub with 21- 40% of original canopy present; some main branches dead (50 -80% canopy); abundant leaf yellowing (>41% canopy).
3	Shrub with 41-60% of the original canopy present; some smaller dead branches evident (21-40% canopy); moderate amount of leaf yellowing (21-40% canopy) .
4	Shrub with 61 – 80% of the original canopy present; occasional dead branches (< 20% of canopy); small patches of leaf yellowing (< 20% of canopy) .
5	Shrub with >81% of the original canopy present; healthy overall; little or no leaf yellowing.

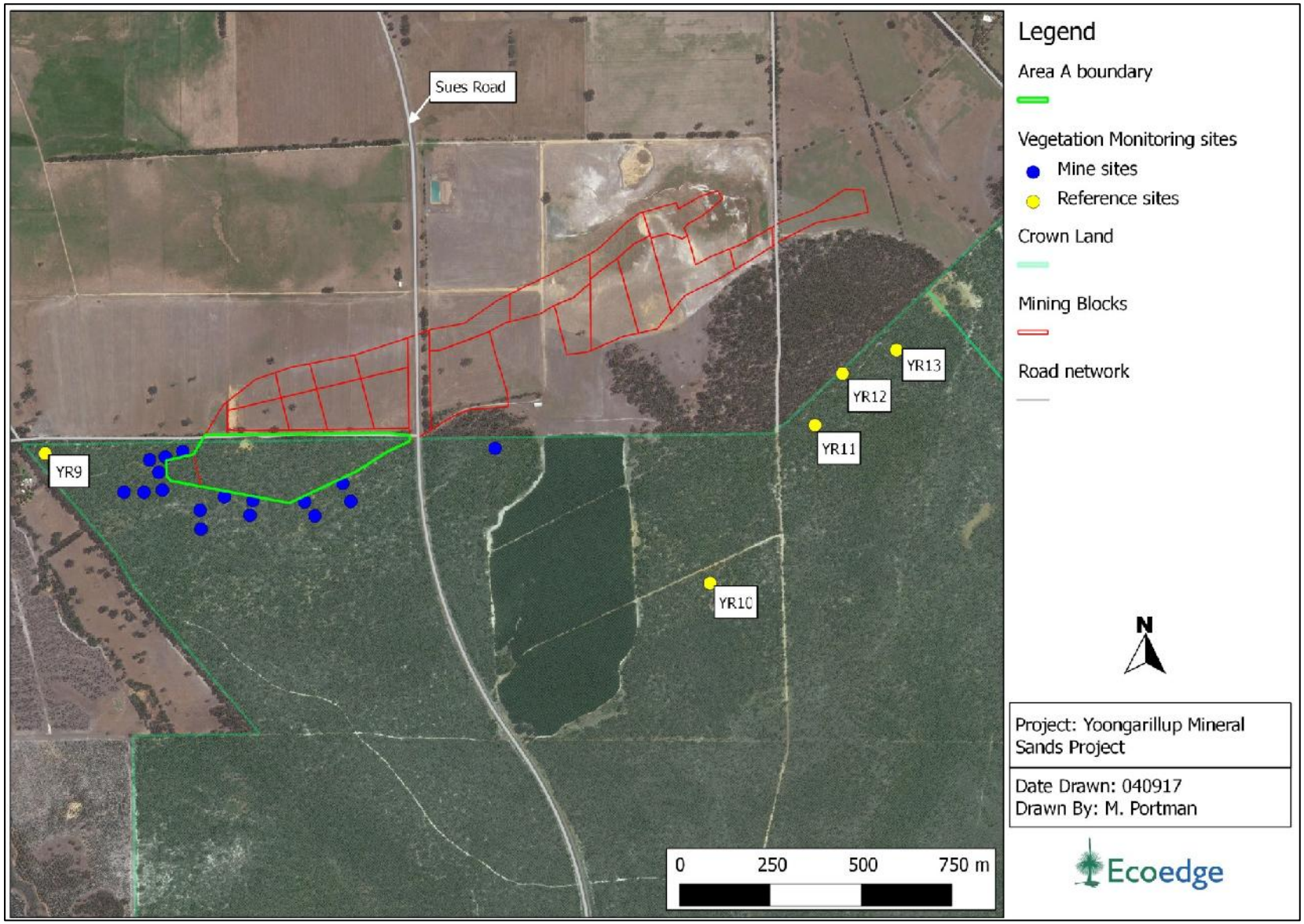

Figure 1. Location of vegetation monitoring sites at Yoongarillup.

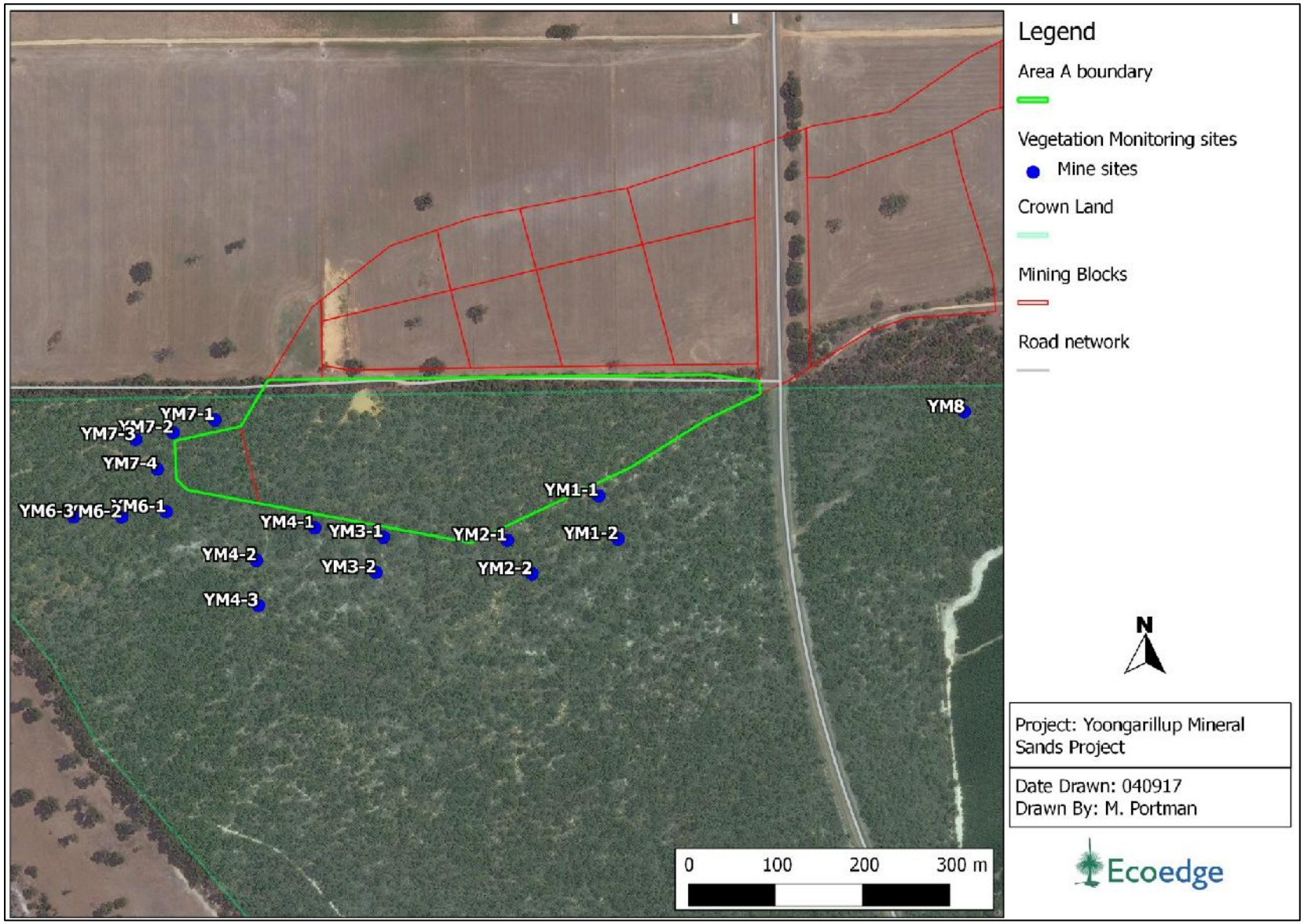

Figure 2. 'Mine area' vegetation monitoring sites at Yoongarillup.

3 Results and Discussion

3.1 Rainfall

Rainfall at Yoongarillup is shown below for 2016-2020 and the first five months of 2020 (**Figure 3**). Rainfall has declined over the four years. The mean rainfall at Yoongarillup over the 60 years of records is 847 mm.

- 2017 (851 mm) was average
- 2018 (785 mm) was 8%below average, and
- 2019 (609 mm) was 28% below average.

Rainfall for the first five months of 2020 is just above average. Rainfall decline has been going on for a long time in the Busselton area. The mean rainfall at Busselton, the nearest station with long-term rainfall records, declined from about 814 mm over the seven years from 1956-1963 to 580 mm in the seven years 2010-2016 (**Figure 4**).

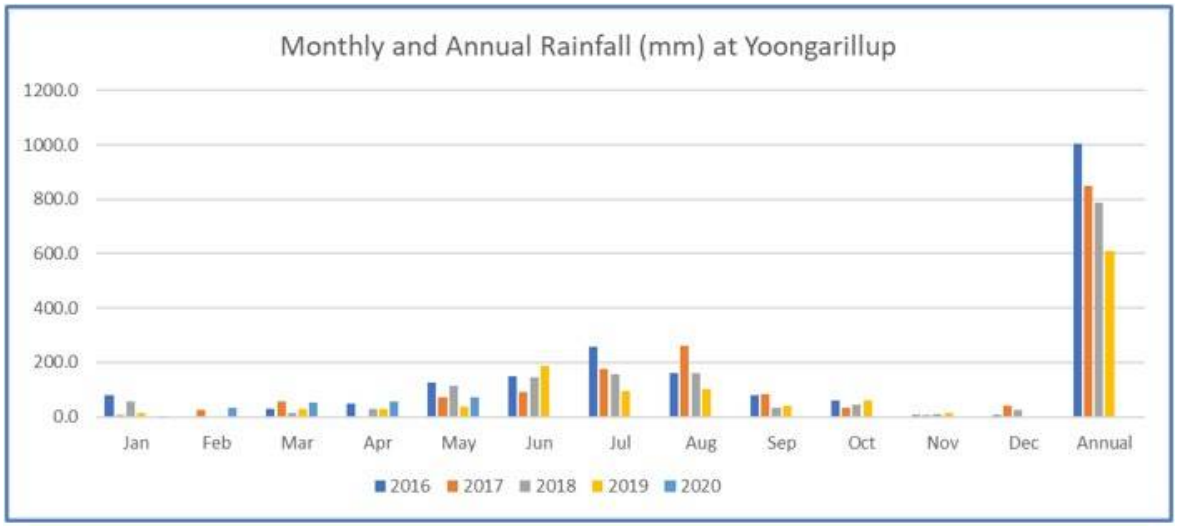

Figure 3. Rainfall at Yoongarillup Mine Site.

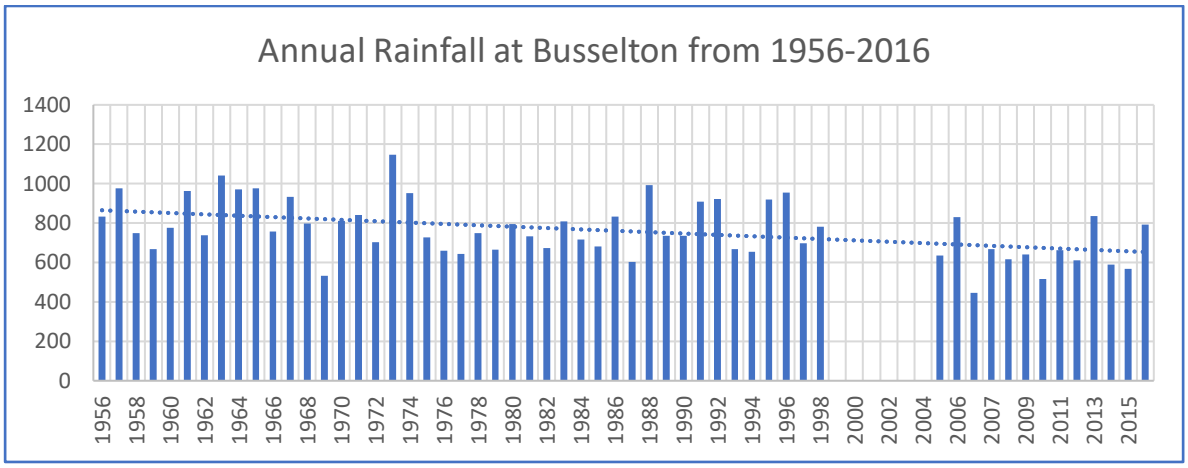

Figure 4. Rainfall at the Busselton townsite over 60 years (1956-2016)[2].

[2] Records for Ludlow, a station 16 km east of Busselton, are used for the period 2005-2009.

3.2 Tree Health

The results of plant VH monitoring for the years 2016-2020 are presented in a series of graphs below. Results for trees (*Eucalyptus marginata*, *Corymbia calophylla*, *C. haematoxylon*) are presented separately from shrubs (*Kunzea rostrata*, *Podocarpus drouynianus*) because of the different methods of scoring plant health.

3.2.1 New Tip Growth and Epicormic Growth

The data score for new tip growth in the trees referred to in **Table 2** is presented in **Figure 5**. Data for epicormic growth are not presented here but the data is available. Peak new tip growth (which represents the annual 'flush' of new growth of twigs and leaves) for the three species is generally during the period November-January. The amount of epicormic growth (a response to stress) has varied little through the period of monitoring from 2016 to present. In general, *Corymbia calophylla* has little or no epicormic growth, whereas both *C. haematoxylon* and *Eucalyptus marginata* have average scores ranging from 1.5 to 3.0.

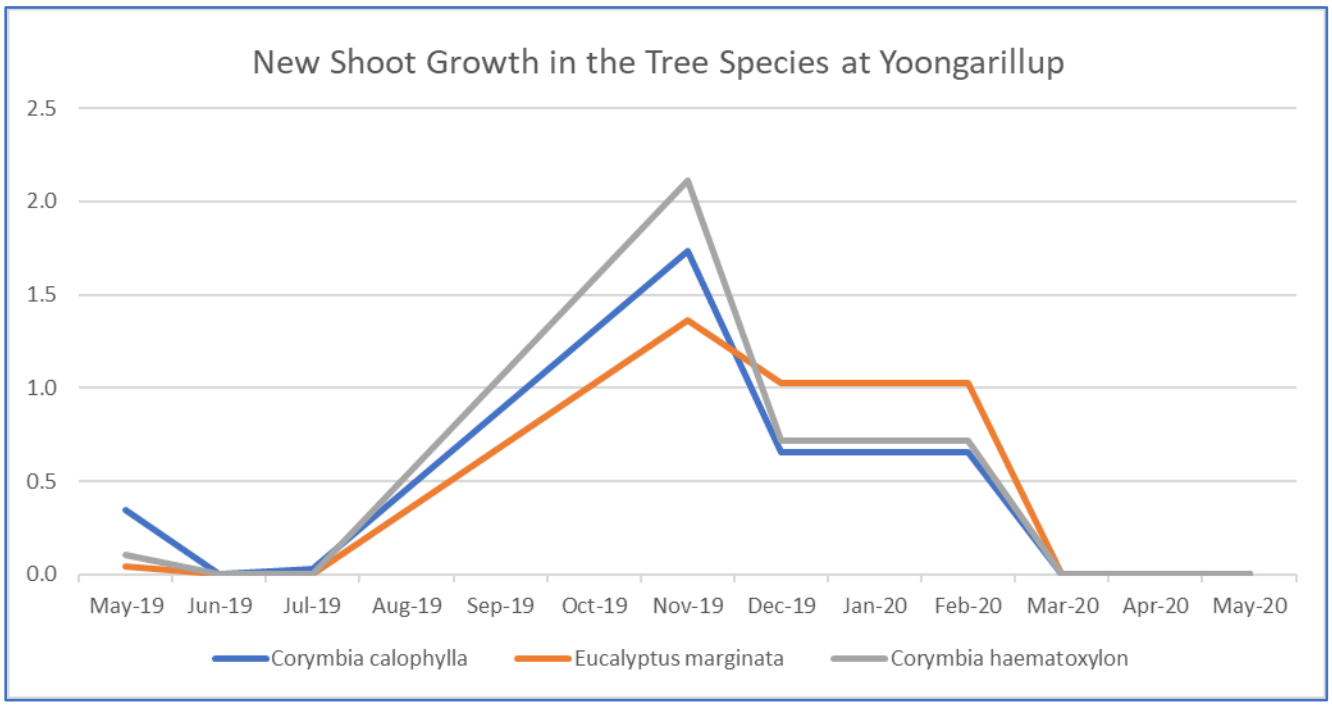

Figure 5. Seasonality of new shoot growth on *Corymbia calophylla*, *C. haematoxylon* and *Eucalyptus marginata* at Yoongarillup.

3.2.2 Canopy Density Score

3.2.2.1 Eucalyptus marginata

There is a general downward progression of canopy density scores (CD score) in *Eucalyptus marginata* over the monitoring period (2016-2020). This decline is apparent in both the Mine Area (YM) sites (**Figure 6**) and the Reference (YR) sites (**Figure 7**). At the YM sites the mean score in September 2016 was 4.7 – this had declined to 3.6 in May 2020. At the YR sites the mean CD declined from 4.8 to 3.8. Hence there was a similar level of decline in canopy scores at both YM sites and YR sites and the cause was likely declining rainfall rather than mining activities.

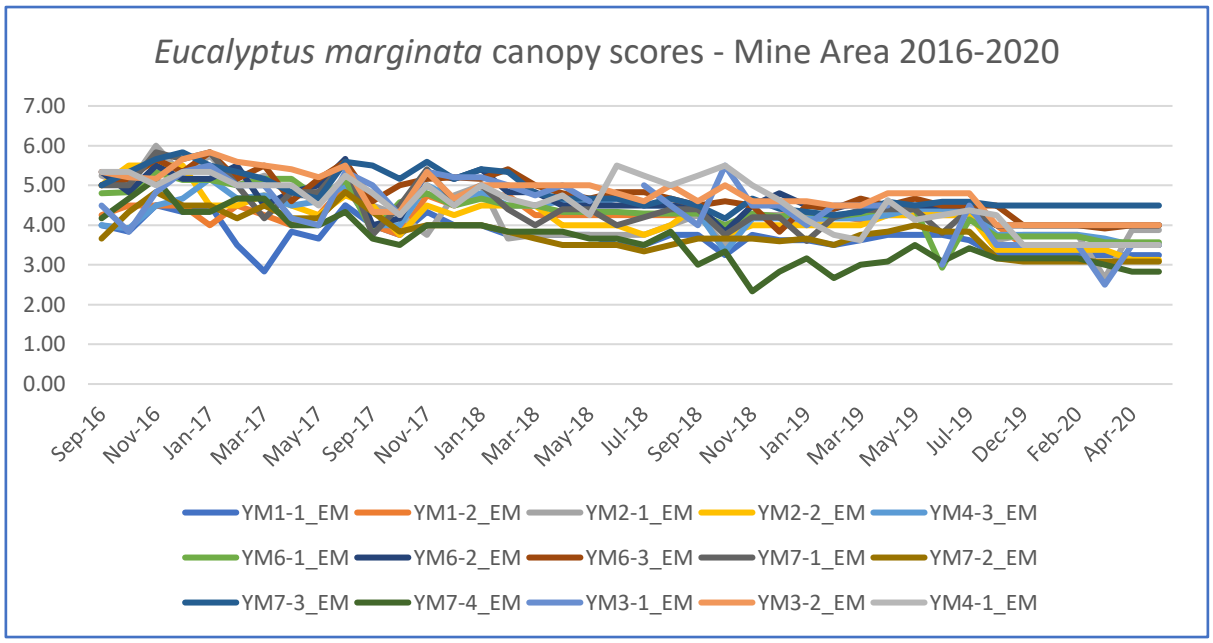

Figure 6. Canopy Density in *Eucalyptus marginata* at the Mine Area (YM) sites during the 2016-2020 period

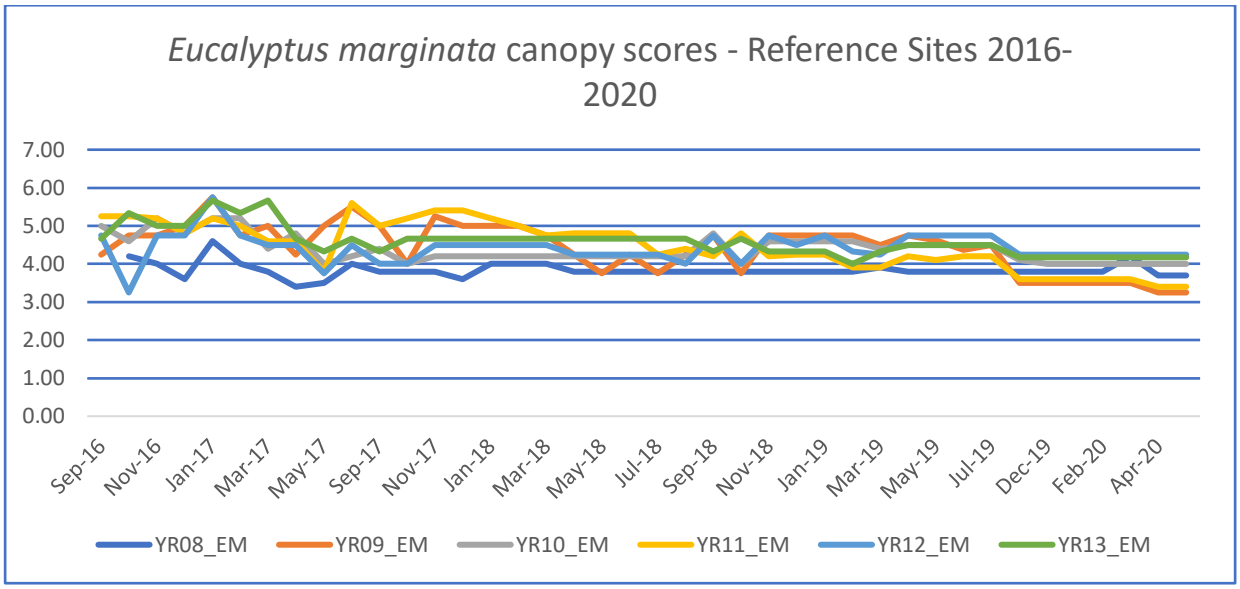

Figure 7. Canopy Density in *Eucalyptus marginata* at Reference sites (YR) during the 2016-2020 period.

3.2.2.2 *Corymbia calophylla*

Canopy density scores in *Corymbia calophylla* also generally declined at all sites during the monitoring period (**Figure 8**). However, the largest fall in mean CD values was at the six Mine Area sites[3], with the mean of 5.1 in September 2016 falling to 3.8 (a decline of 1.3 points), whereas at the two Reference sites it only fell from 4.7 to 4.0 (a decline of 0.7 points).

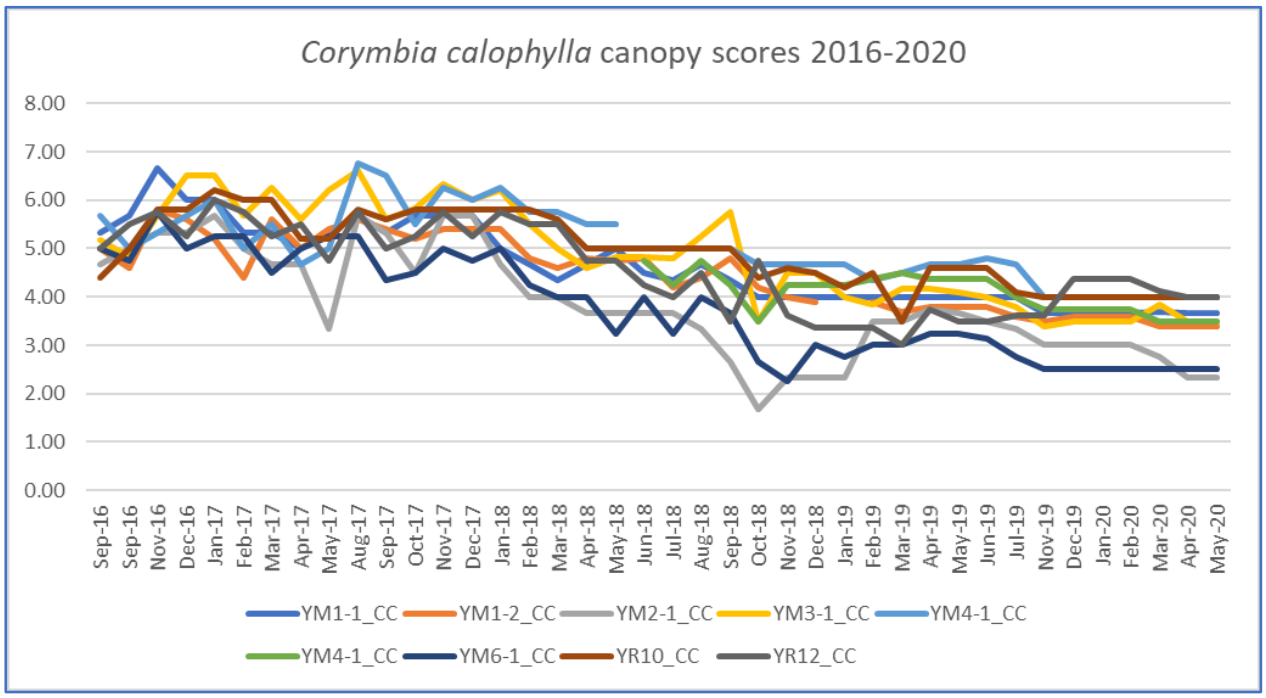

Figure 8. Canopy Density in *Corymbia calophylla* at Mine Area and Reference sites during the 2016-2020 period.

3.2.2.3 *Corymbia haematoxylon*

As with the other two tree species, there was a general decline of mean canopy density for *Corymbia haematoxylon* over the 2016-2020 monitoring period (**Figure 9**). However, there was a somewhat greater decline at the YM sites. At the YM sites[4] mean CD declined from 5.5 in September 2016 to 3.8 in May 2020 (a fall of 1.7 points). At the four YR sites mean CD declined from 4.4 to 3.1 (a decline of 1.3 points).

[3] There were only five sites where *Corymbia calophylla* was assessed over the period Sep 2016-May2018.
[4] *C. haematoxylon* was assessed at two YM sites from Sep 2016-May 2017 and at three from there on.

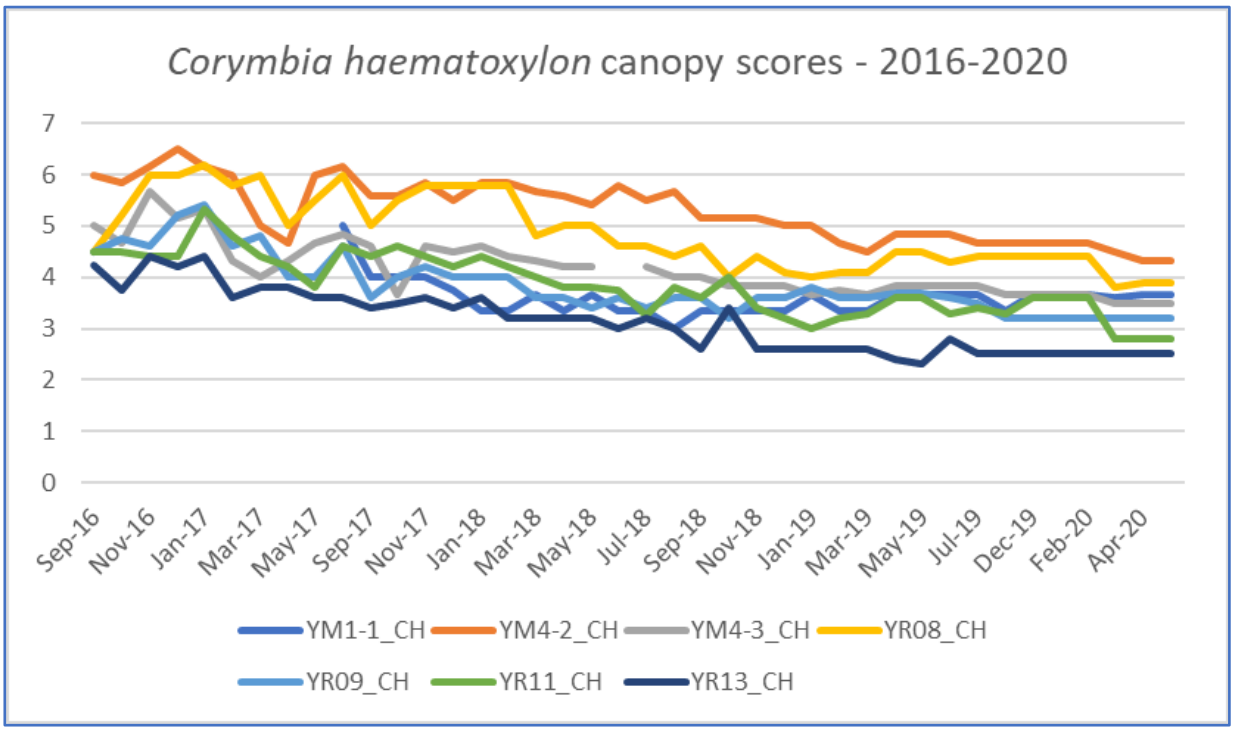

Figure 9. Canopy Density in *Corymbia haematoxylon* at Mine Area and Reference sites during the 2018/2019 monitoring period.

3.2.3 Foliage Yellowing and Death Score

Canopy yellowing, which in the Study Area is usually a sign of leaf death associated with naturally occurring seasonal turnover of leaves in eucalypts, is caused by soil moisture deficits and higher temperatures (Burrows and Burrows, 1994). At Yoongarillup the main period of leaf fall is the summer and autumn months (November-April).

3.2.3.1 Eucalyptus marginata

In *E. marginata* foliage yellowing and leaf death usually peaks in December or January, followed by a decline, caused by the loss of dead leaves, giving the canopy a less yellow aspect. Foliage yellowing and death is shown for the Mine Area and Reference sites in **Figure 10** and **Figure 11**, below. The trajectories of foliage yellowing and death is similar over summer 2016/2017, 2017/2018 and 2018/2019 but the degree of leaf yellowing is higher at some YM and YR sites over summer 2019/2020. This is probably related to the fact that rainfall in 2019 was substantially below average.

Overall, the degree of foliage yellowing and death is similar at YM and YR sites.

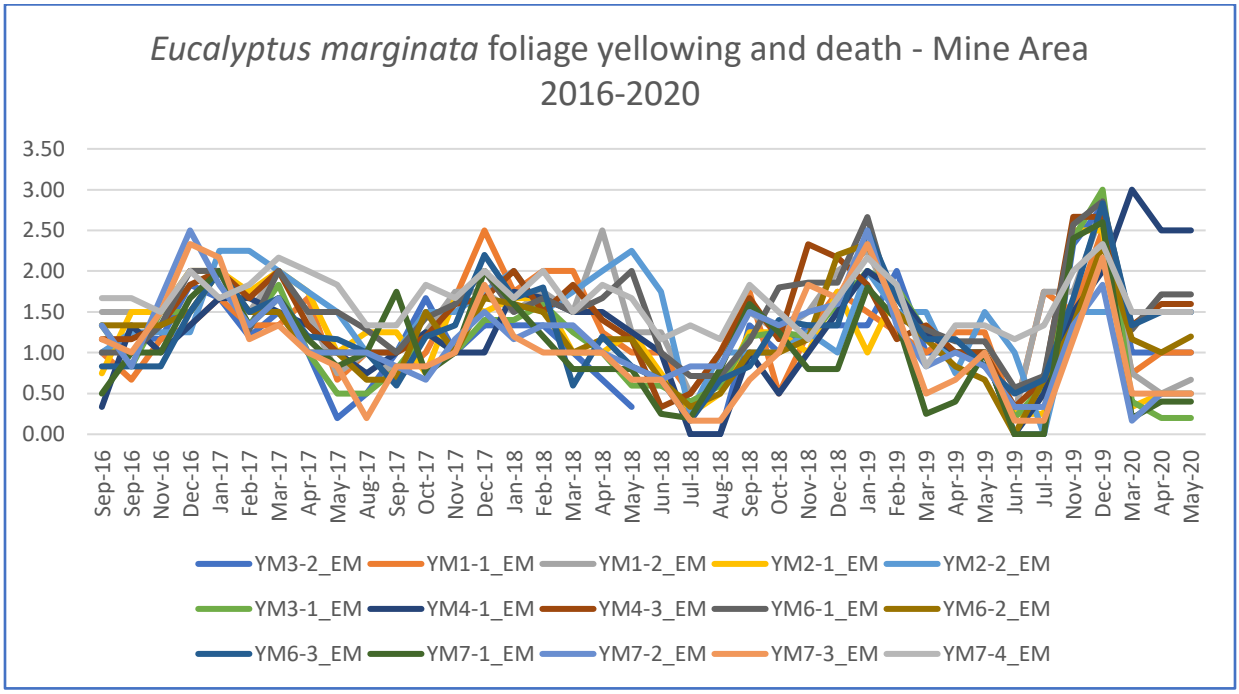

Figure 10. Canopy Yellowing in *Eucalyptus marginata* at Mine Area Sites (YM) during 2016-2020 period.

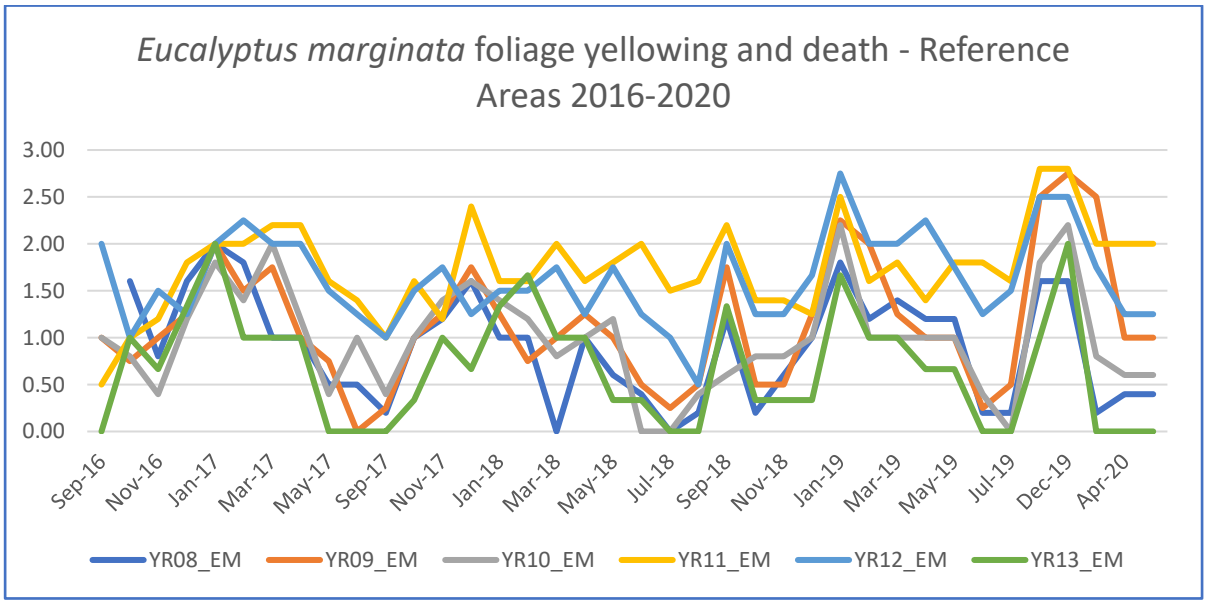

Figure 11. Canopy Yellowing in *Eucalyptus marginata* at Reference Sites (YR) during the 2016-2020 period.

3.2.3.2 Corymbia calophylla

The degree of canopy yellowing tends to be lower in *C. calophylla* than in *E. marginata*, with average scores rarely reaching 2.0 (**Figure 12**). This is probably because it is situated lower in the landscape on somewhat moister soils. As with *E. marginata*, the peak for canopy yellowing in December and January. However, over the summer of 2019/2020 the degree of foliage die-off is substantially higher that in previous years and probably reflects the much lower than average rainfall in 2019.

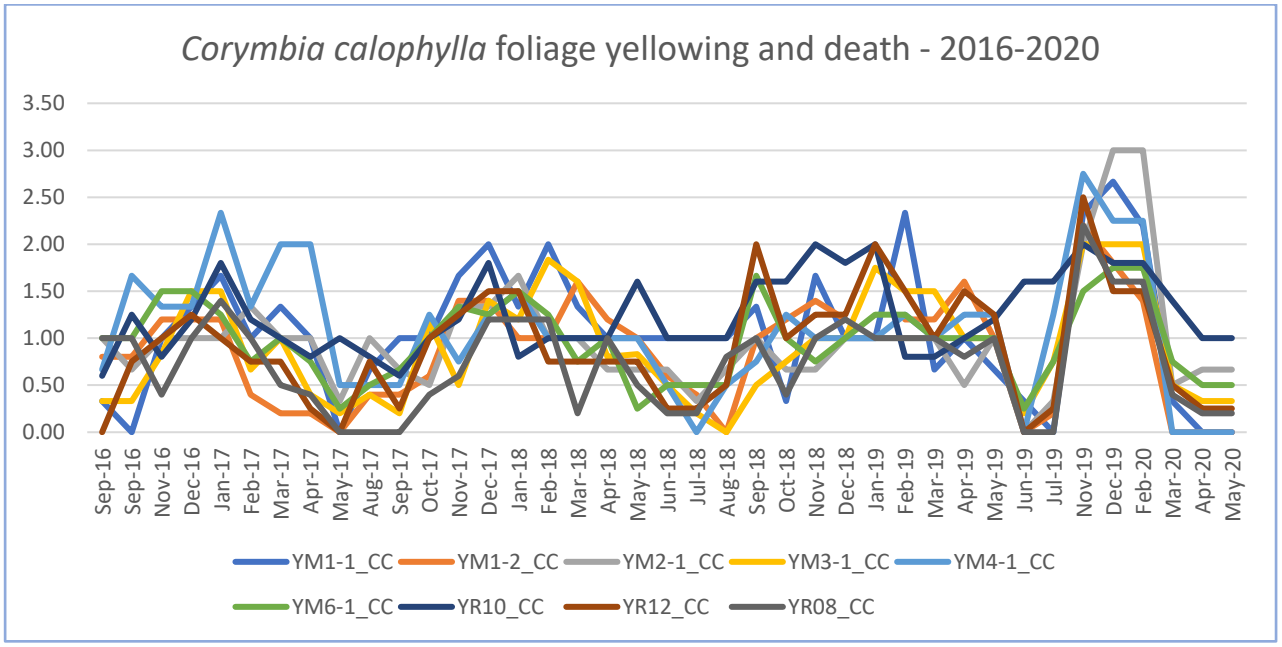

Figure 12. Canopy Yellowing in *Corymbia calophylla* during the 2016-2020 period.

3.2.3.3 Corymbia haematoxylon

Corymbia haematoxylon had similar mean levels of foliar yellowing and death to *Eucalyptus marginata* and higher levels than *C. calophylla*. (**Figure 13**). As with the other two tree species, it is evident that levels of leaf yellowing in *C. haematoxylon* were substantially higher in summer 2019/2020 than in the previous three summers.

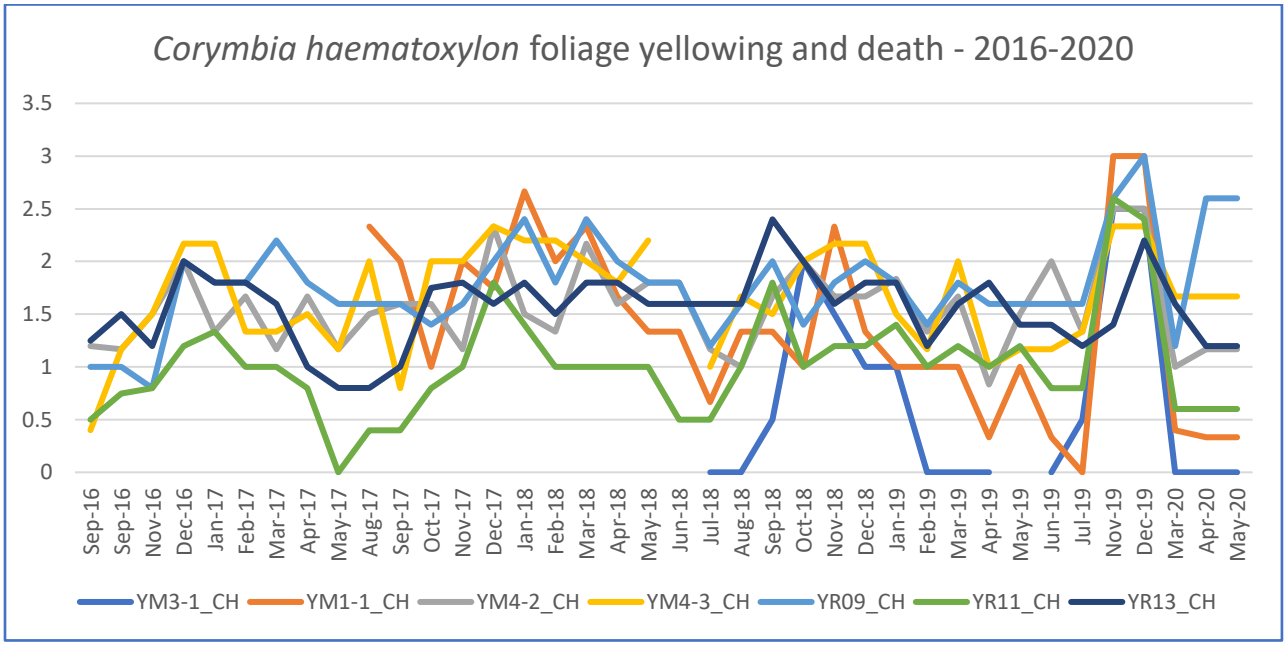

Figure 13. Canopy Yellowing in *Corymbia haematoxylon* during the 2016-2020 period.

Of the three tree species *C. haematoxylon* displayed the greatest amount of foliage yellowing and death over the four years (**Figure 14**), while *C. calophylla*, as would be expected from its downslope habitat had the lowest.

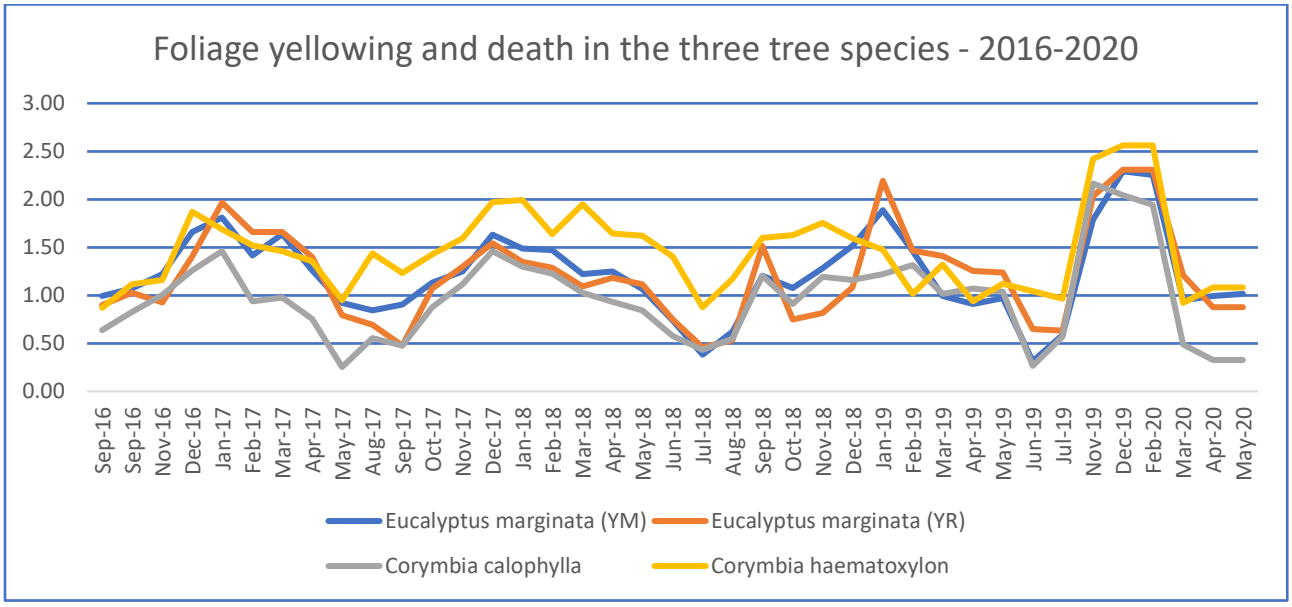

Figure 14. Mean values for foliage yellowing and death in the three tree species at Yoongarillup over the period 2016-2020.

3.2.4 Shrub Health Scores

3.2.4.1 Kunzea rostrata

Plant health scores for *K. rostrata* declined over the period, particularly after April 2018 (**Figure 15**). There was also a total of 10 deaths among the monitored *K. rostrata* by May 2020 which was a third of those being monitored (**Table 5**). *Kunzea rostrata* appears to be a relatively short-lived shrub and also susceptible to the effects of drought. Its normal habitat is sandy wetlands with a clayey subsoil, so the occurrences at Yoongarillup, which are not in or near a swamp, are probably marginal.

The decline in health scores was similar at two of Mine Area sites and the Reference site. However, at one of the Mine Area sites (YM1-2) there was a particularly steep fall in plant health scores in February 2020. This site is 55 m upslope from the edge of the mining area whereas one of the others Mine Area sites (YM4-1), with a smaller decrease in mean health score, is right at the edge of the mining area. Consequently, it more likely that the large decrease in health score at YM4-1 is as a result of the low rainfall in 2019.

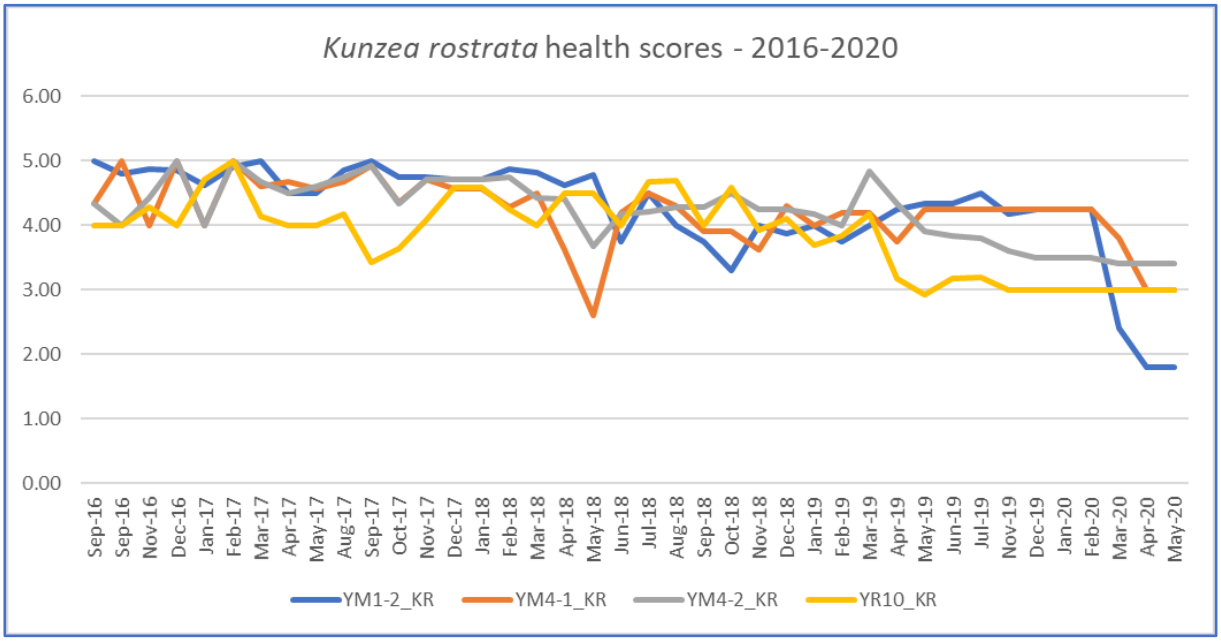

Figure 15. Plant health scores in *Kunzea rostrata* during the 2016-2020 period.

Month	Site	Number dead	Total
May 2017		0	0
May 2018	YM1-2	1	4
	YM4-1	2	
	YR10	1	
May 2019	YM1-2	2	7
	YM4-1	3	
	YM4-2	1	
	YR10	1	
May 2020	YM1-2	3	10
	YM4-1	3	
	YM4-2	2	
	YR10	2	

Table 5. Plant deaths in monitored *K. rostrata*

3.2.4.2 Podocarpus drouynianus

Plant health scores in *P. drouynianus* varied little over the monitoring period (**Figure 16**), and apart from at a few sites there is little yellowing of the leaves as a visible sign of plant water stress. No *P. drouynianus* plants died over the four-year period of monitoring. However, plants at two Mine Area sites (YM3-1 and YM3-2) and one Reference site (YR11) showed substantial levels of water stress by May 2020.

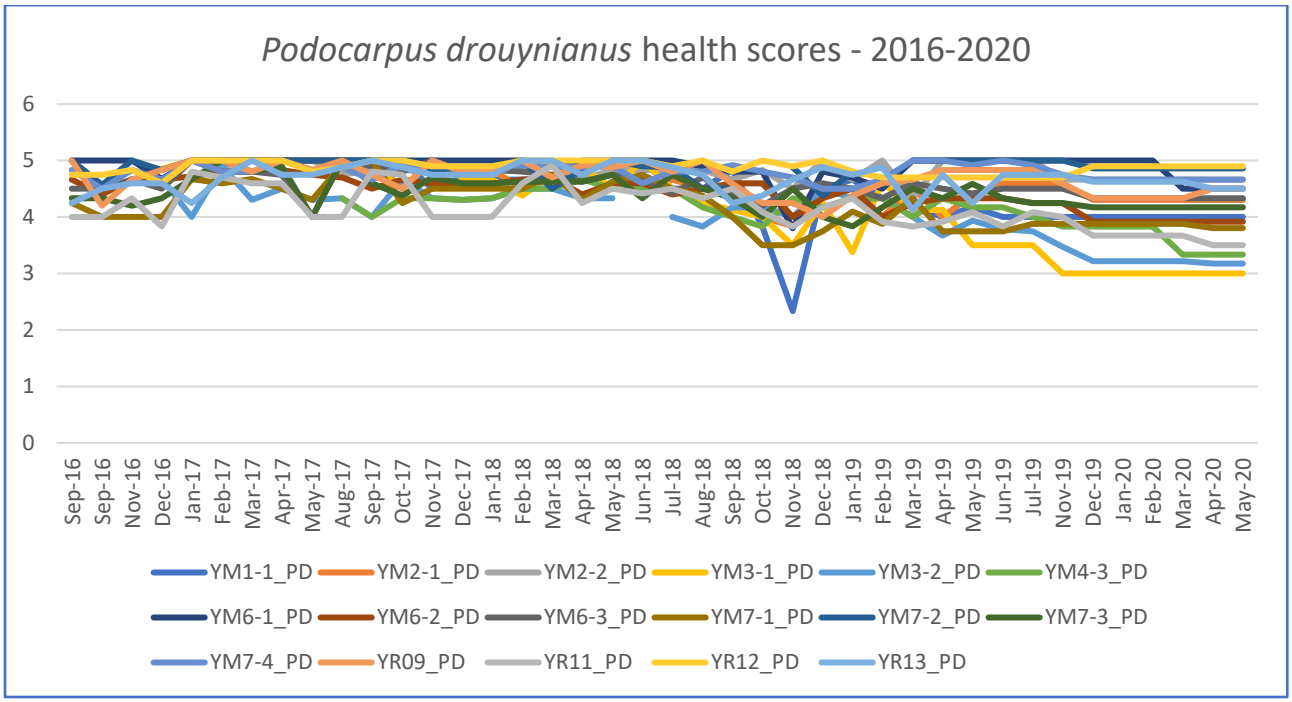

Figure 16. Plant health scores in *Podocarpus drouynianus* during the 2016-2020 period.

4 Conclusion

Total rainfall at Yoongarillup declined over the period of monitoring from 1003 mm in 2016 to 609 mm in 2019, a 40% reduction. As can be seen in **Section 3.1**, above, rainfall decline has been occurring in the Busselton area for more than 50 years, and this is no doubt the cause of the abundance of 'stags' (large dead branches) on the larger trees adjacent to the minesite at Yoongarillup.

There was a general downward progression of canopy density scores in *Eucalyptus marginata* over the monitoring period (2016-2020). There was a similar level of decline in canopy scores at both YM sites and YR sites and so there was no apparent effect of Mine Area activities on *E. marginata* canopy density.

Canopy density scores in *Corymbia calophylla* also generally declined at all sites over the period 2016-2020. However, the decline in mean canopy scores at Mine Area sites was twice that at Reference sites, indicating a potential mining activity affect. However, at the end of the monitoring period (May 2020), canopy density scores were similar at Mine Area sites (3.8) to those at Reference sites (4.0).

As with the other two tree species, there was a general decline in *C. haematoxylon* canopy density at all sites over the period 2016-2020. The fall in mean canopy density scores was 30% greater at Mine Area sites than Reference sites. However, at the end of the monitoring period canopy density was 22% higher at Mine Area sites than Reference sites.

Foliage yellowing and death in all three tree species followed the usual pattern of summer/early autumn maxima and winter minima over the four years of monitoring. Overall, the degree of foliar death was similar at Mine Area and Reference sites. The degree of foliage yellowing and death was much higher in summer 2019/20 than it had been in previous years. This was particularly marked in *C. calophylla*, which had the lowest scores in the three previous years, but in the summer and autumn 2019/20 had levels of foliage yellowing and death similar to the other two species.

Plant health scores for *K. rostrata* declined over the four-year period, particularly in the last two years. In addition, a third of the *K. rostrata* plants being monitored died over the period. *Kunzea rostrata* is a species adapted to living in or near wetlands hence its occurrence at Yoongarillup is probably marginal in terms of habitat suitability. It is most likely that the substantial decline in *K. rostrata* mean health scores at Yoongarillup after March 2019 is as a result of the much lower than average winter rainfall that year.

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Appendix 1. Example of Visual Health Monitoring Form

SITE: ____YM1-1__________________________ DATE: _______________________

	TREES				SHRUBS
PLANT CODE	CROWN EXTENT AND DENSITY (0-7)	NEW TIP GROWTH (0 – 3)	LIVE EPICORMIC GROWTH (0 – 3)	LEAF DIE-OFF OR YELLOWING (0 – 3)	HEALTH SCORE

Notes:

LEGENDS

Tree Crown Extent and Density

Score	Crown Extent and Density
0	None (0%)
1	Minimal (1-10%)
2	Sparse (11-20%)
3	Sparse-Medium (21-40%)
4	Medium (41-60%)
5	Medium-Major (61-80%)
6	Major (81-90%)
7	Maximum (91-100%)

New Tip Growth, Epicormic Growth & Leaf-die-off or Yellowing

Score	Description	Definition (With regard to the assessable crown)
0	Absent	Effect is not visible
1	Scarce	Effect is present but not readily visible
2	Common	Effect is clearly visible throughout
3	Abundant	Effect dominates the appearance

Shrubs

Score	Description
0	Dead shrub.
1	Shrub with <20% of original canopy; most main branches dead; remaining leaves mostly dying off.
2	Shrub with 21- 40% of original canopy present; some main branches dead (50 -80% canopy); abundant leaf yellowing (>41% canopy).
3	Shrub with 41-60% of the original canopy present; some smaller dead branches evident (21-40% canopy); moderate amount of leaf yellowing (21-40% canopy) .
4	Shrub with 61 – 80% of the original canopy present; occasional dead branches (< 20% of canopy); small patches of leaf yellowing (< 20% of canopy) .
5	Shrub with >81% of the original canopy present; healthy overall; little or no leaf yellowing.

APPENDIX 5

Annual Report on Soil Moisture and Perched Water Dipwell Monitoring at Yoongarillup Mine

YOONGARILLUP MINERAL SANDS PROJECT

SOIL MOISTURE MONITORING REPORT 2021

1. INTRODUCTION

The Yoongarillup Mineral Sands Project was approved by the Department of Water and Environmental Regulation (DWER, formerly the Office of the Environmental Protection Authority) on the 7th June 2016 and Ministerial Statement 1030 was issued. As per Condition 6-2, a Flora and Vegetation Monitoring Plan was developed and approved. In September 2020 version 8 of the Flora and Vegetation Monitoring Plan was submitted and was approved 17th December 2020.

Rationale for the updated Flora and Vegetation Monitoring Plan was largely due to the completion of rehabilitation activities in State Forest Area A in May 2019, the inability to implement contingency actions due to the removal of infrastructure from the area, the presence of Dieback in SF33 and Perched Water bores being consistently dry prior to, during and at the completion of mining. To date soil moisture monitoring has continued for 24 months post rehabilitation.

The installation and monitoring of soil moisture and perched groundwater was included to enable the early identification of a reduction in soil moisture requiring intervention. Nine soil moisture sites shown in Figure 1 were installed in January 2017, with three of these being reference sites and six being adjacent to mining voids. Three perched water sites were also installed at the locations of the soil moisture sites adjacent to the south of the mining void 'Area A' within the State Forest 33.

The soil moisture monitoring method uses a neutron emitting radioactive source and records the neutron scatter as a result of the presence of hydrogen in the surrounding (water) environment. The count data is therefore relative to the water present at the site immediately surrounding the monitoring tube. Soil moisture levels at monitoring depth intervals of 30cm are shown graphically in Section 3 of this report and provide a visual display of the moisture profiles and seasonal variations. From the profiles shown in Section 3, the effects of rainfall are apparent and provide an accurate guide as to when soil moisture and therefore the availability of water to vegetation roots is reduced.

Soil moisture monitoring was reduced to quarterly monitoring and perched water monitoring was ceased March 2021 as per Version 8 of the Flora and Vegetation Management Plan.

The monitoring represented within this report includes baseline, or pre-mining prior to the commencement of clearing in October 2017, mining, backfilling, rehabilitation throughout 2018/2019 and post rehabilitation 2020/2021. Soil moisture monitoring data is missing for June 2021 as continued mine rehabilitation and heavy rainfall received, limited access to the area.

Throughout the entire mining of the western side of Sues Rd there was no mining pit dewatering required.

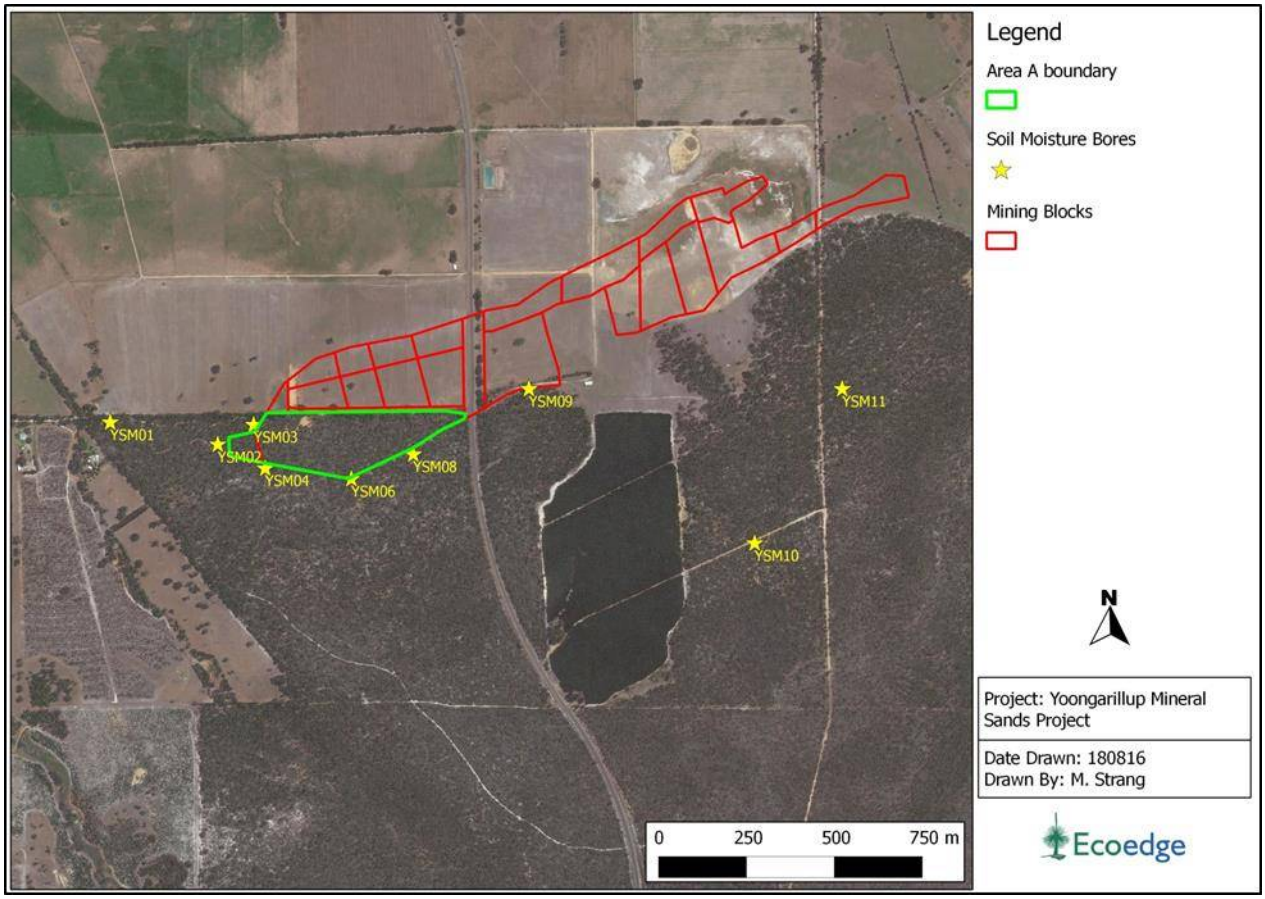

Figure 1 Soil Moisture Monitoring Locations

2. ENVIRONMENTAL CONDITIONS

Rainfall

Rainfall recorded within the rain gauge located on site 2020/2021 is shown in Figure 2 below and indicates above average rainfall for spring, summer and autumn of 2020/2021 with 182.5mm, 71mm and 271.5mm respectively, relative to Busselton Airport historical readings of 128.7mm in spring, 30.9mm in summer and 101.8mm in autumn.

Notable site rainfall events in 2020/2021 include 87mm in November 2020. February 2021 recorded 71mm followed by another 100mm in April 2021.

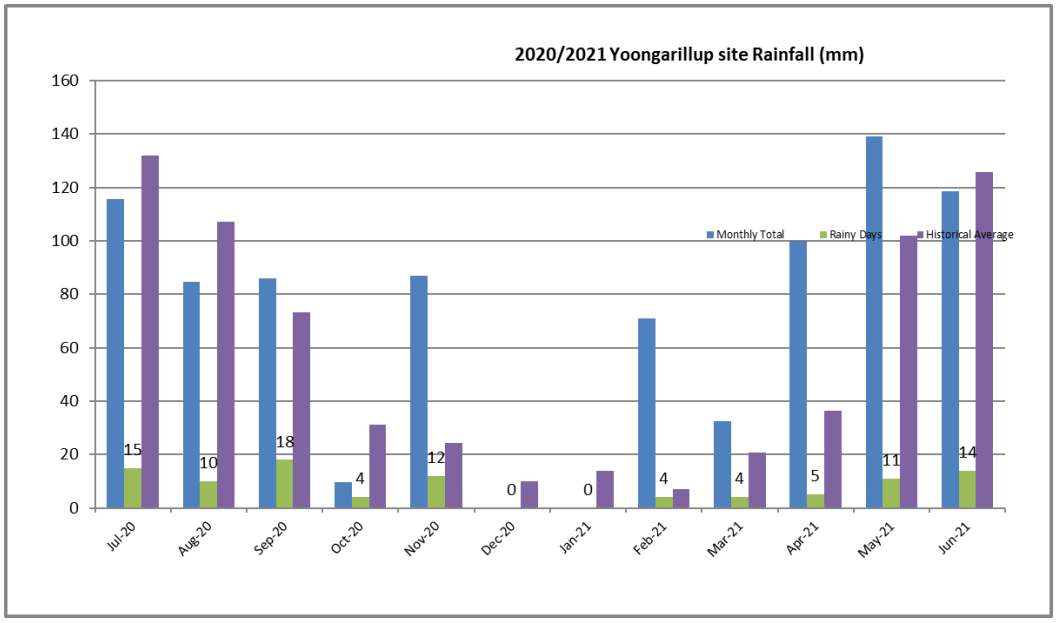

Figure 2 2020/2021 Rainfall Yoongarillup Site

Temperature

As shown below, throughout 2020/2021 the monthly average temperature (recorded at Busselton Airport) remained similar to the historical average.

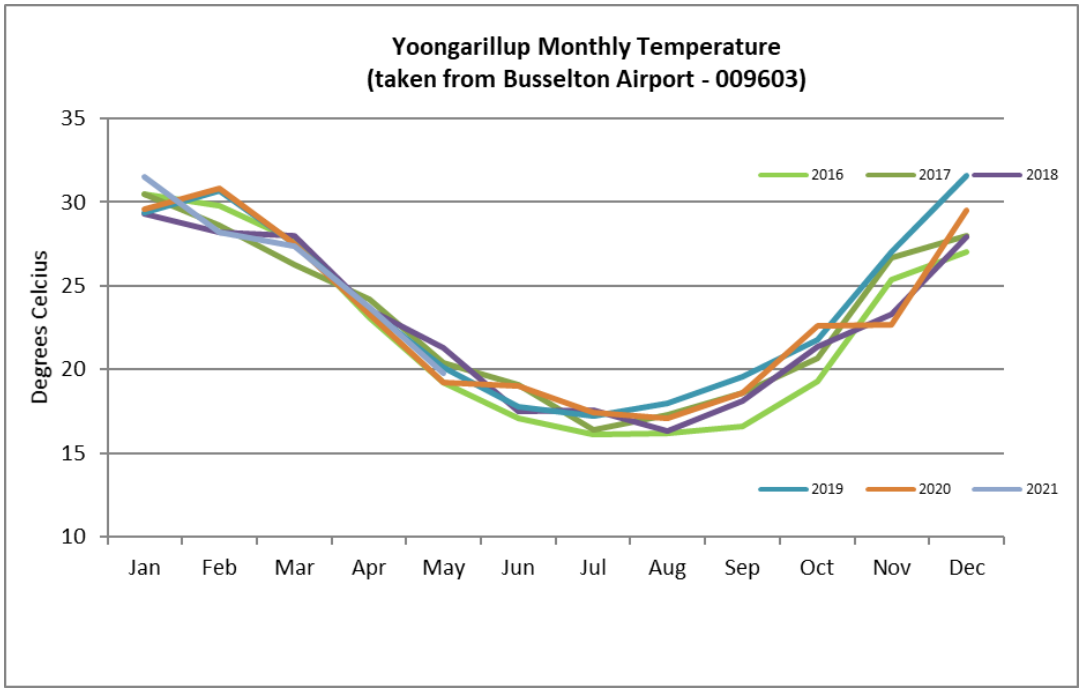

Figure 3 Yoongarillup Monthly Temperature

3. RESULTS

As mentioned in previous reports the highest and lowest stage of the monitoring tubes for July 2018 onwards indicates a reduction of moisture however this may be due to a shorter cord resulting from repairs in June 2018. The effect is not observed in all monitoring bores. For bores YSM005 – YSM009 the first stage may now be recorded above the soil level and the lowest stage could possibly sit at a height above the base of the tube thus it would not normally measure the base soil.

As data has been collected since 2017 (pre-mining) to March 2021 charts have been rationalised to increase current data visibility. Charts include seasonal background data representing the peak of each season as well as data related to the current reporting period (Jul 2020 – June 2021).

Site 1 (YSM001)

Site 1 is a reference site located to the west of the disturbance boundary within State Forest 33 and approximately 300m from the 'Area A' mine void. The lithological description of the core sample taken during installation describes the soil profile as follows;

- 0 - 0.4m. Grey, fine to medium grained, sub-rounded, well sorted sand.
- 0.4 - 3.0m. Orange brown, medium grained, sub rounded sandy clay
- 3.0 - 4.2m. Orange brown, medium grained, sub-rounded sandy clay, with hard laterite gravel.

From the soil moisture profile shown in Figure 4 below, the effects of 18 rainy days received over September 2020 can be seen throughout most of the profile with moderate to high moisture levels observed in September and early October. The entire profile became progressively drier from late October 2020 with the greatest reduction observed in the top metre and the driest moistures were recorded in January 2021 and March 2021 deeper in the profile. This is expected as per seasonal fluctuations and is relative to the 2017 background profiles prior to autumn rains.

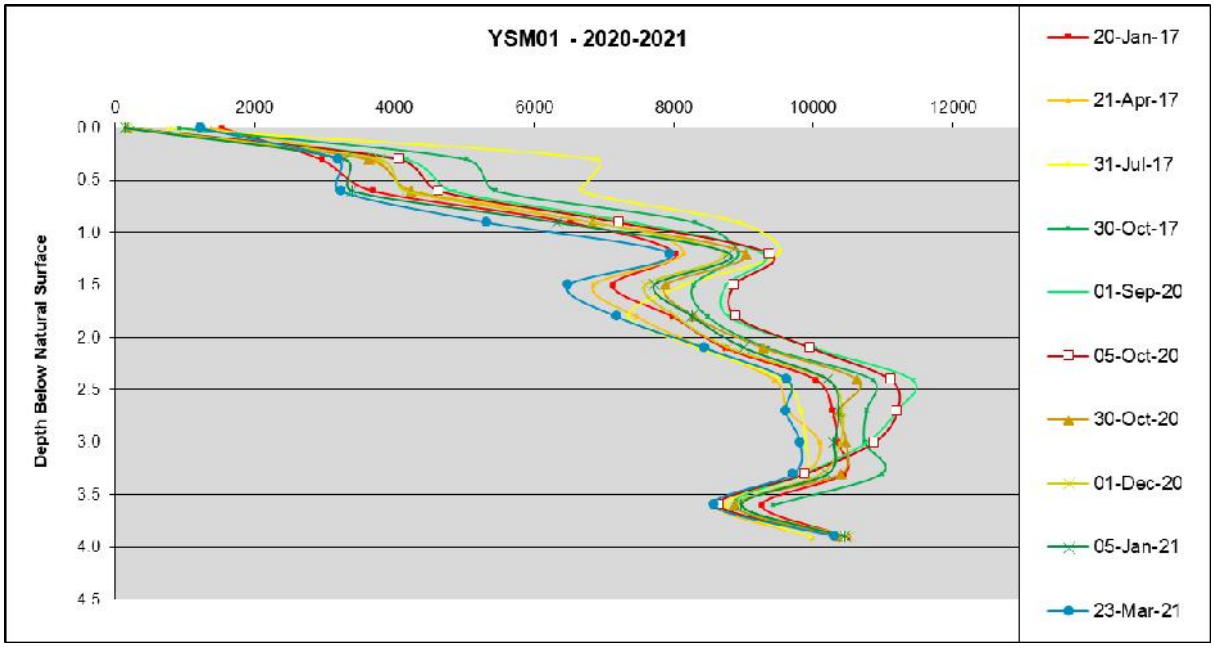

Figure 4 Soil Moisture YSM01 (including 2017 background profiles)

Site 2 (YSM002)

Site 2 is located approximately 15m to the western edge of the mine void 'Area A' within State Forest 33. The lithological description of the core sample taken during installation describes the soil profile as follows

- 0 - 4.0m. Orange brown, medium grained, sub-rounded, sandy clay

Backfilling of the pit in 'Area A' was completed in May of 2019. Rehabilitation was completed in June 2019.

As seen in Figure 5, soil moistures throughout summer were relative to previous years. March experienced the driest profile for the reporting period due to low rainfall over summer. Above average rainfall was received in May 2021 however access for June monitoring was limited by rainfall and rehabilitation activities.

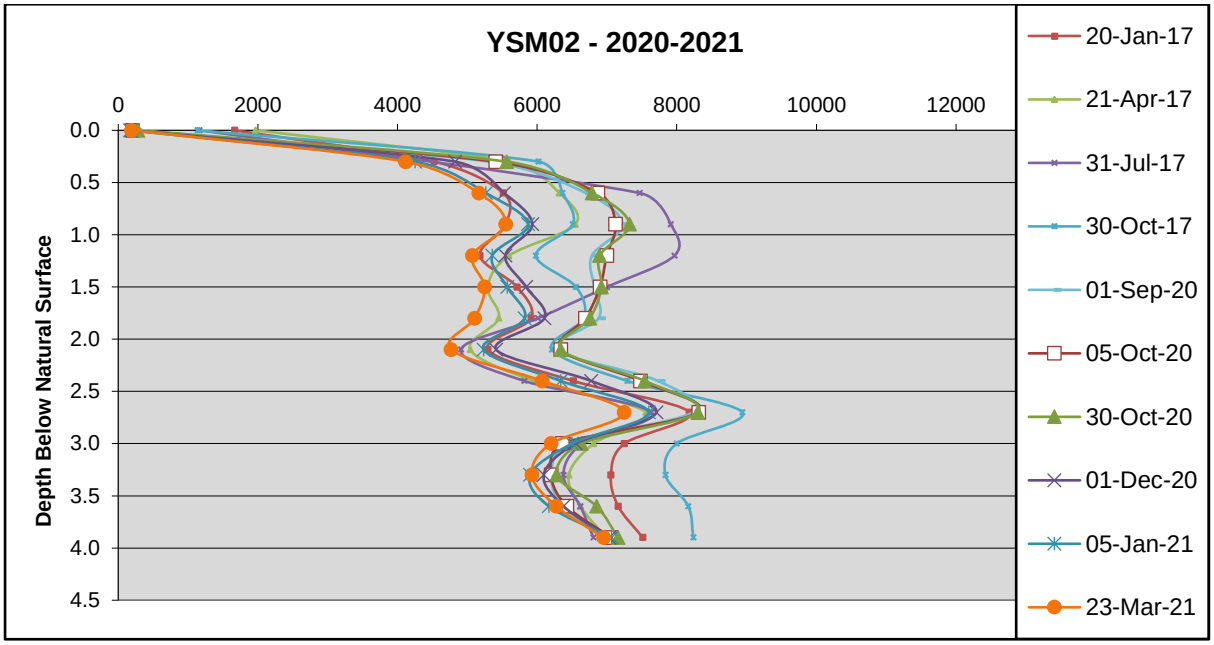

Figure 5 Soil Moisture YSM02 (including 2017 background profiles)

Site 3 (YSM003)

Site 3 is located on the boundary of the disturbance area and immediately adjacent to the cleared edge of the mine void 'Area A' within State Forest 33. It is on the down gradient (northern) region of the western mine void edge and the lithological description of the core sample taken during installation describes the soil profile as follows;

- 0 - 1.2m. Orange brown, medium grained, sub-rounded sandy clay
- 1.2 - 2.5m. Orange brown, laterite gravel and medium grained, sub-rounded sandy clay.
- 2.5 - 2.8m. Orange brown, medium grained, sub-rounded sandy clay with some laterite gravel.
- 2.8 - 3.0m. Grey medium grained, sub-rounded sandy clay.
- 3.0 - 4.0m. Mottled grey and orange/brown, medium grained, sub-rounded sandy clay, with some laterite gravel.

The soil moisture profile shown in Figure 6 shows similar moisture levels to the pre-mining profiles with exception of January and March 2021 which experience lower soil moistures deeper in the profile after receiving no rainfall on site during December 2020 and January 2021.

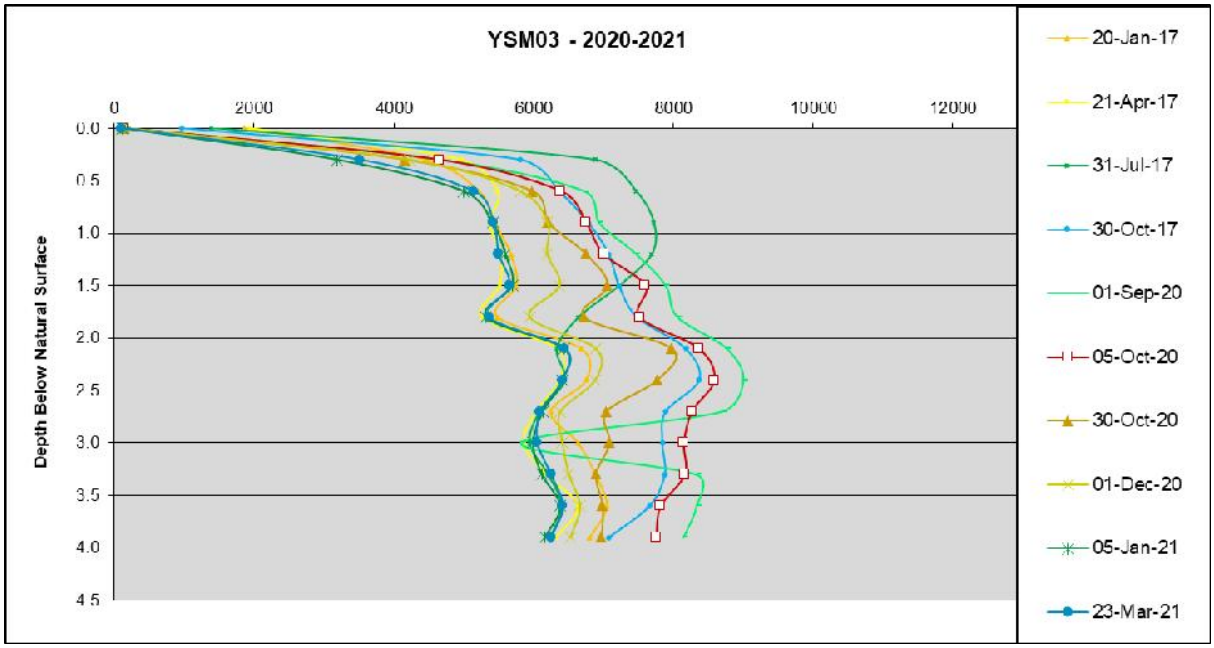

Figure 6 Soil Moisture YSM03 (including 2017 background profiles)

Site 4 (YSM004)

Site 4 is located immediately up gradient from the south western edge of the mine void 'Area A' within State Forest 33 and is also the site of Dip Well YMB10S. No adjacent mining excavation was undertaken during the reporting period as topsoil and mulch was stockpiled nearby. The lithological description of the core sample taken during installation describes the soil profile as follows;

- 0 - 2.0m. Pale yellow brown, fine to medium grained, sub-rounded, well sorted sandy clay.
- 2.0 - 4.0m. Orange brown, medium grained, sub-rounded sandy clay, with hard laterite gravel

As seen at other sites Figure 7 shows a lower soil moisture deep within the profile for March 2021, likely because of not receiving rainfall throughout December 2020 and January 2021. The March profile does, however, also reflect the January 2017 pre mining profile indicating this is within normal seasonal variation.

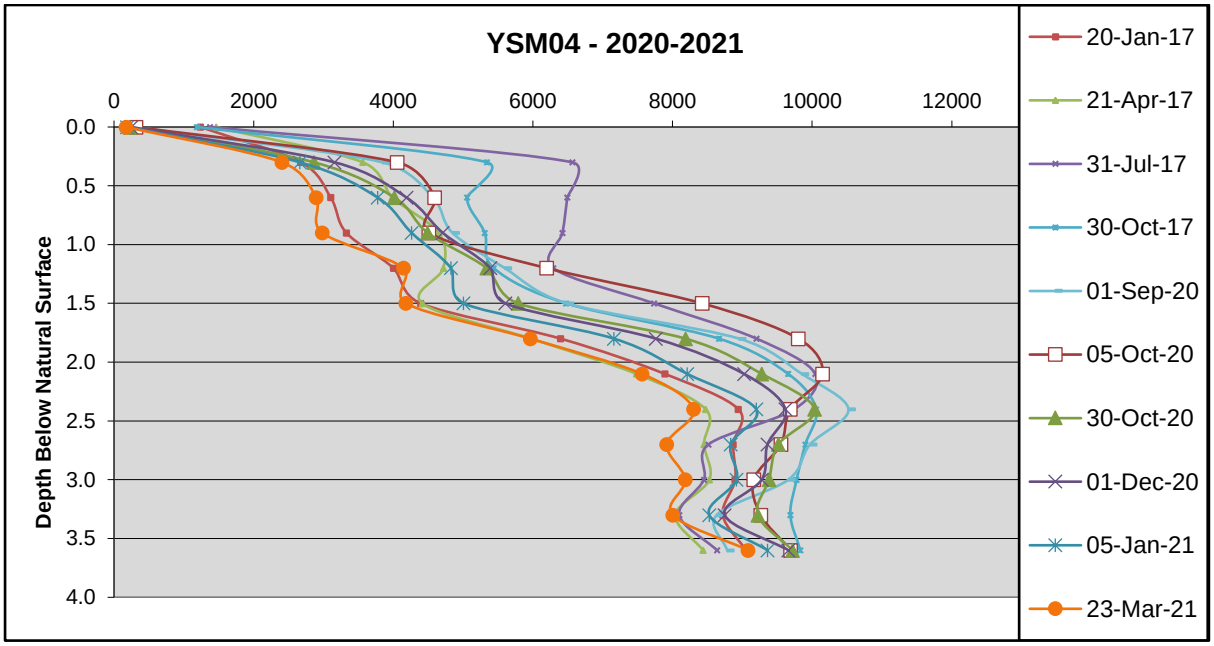

Figure 7 Soil Moisture YSM04 (including 2017 background profiles)

Dip well YMB10S, which is located at site YSM004 has a depth of 6.64m and has been monitored monthly since installation in December 2016. At every monthly monitoring occasion to date the bore has been dry.

Site 5 (YSM005)

Site 5 is located immediately up gradient from the south western edge of the mine void 'Area A' within State Forest 33 and is also the site of Dip Well YMB11S. The site was adjacent to excavation activities from approximately May 2018. The lithological description of the core sample taken during installation describes the soil profile as follows;

- 0 - 2.0m. Pale yellow brown, fine to medium grained, sub-rounded, well sorted sandy clay.
- 2.0 - 4.0m. Orange brown, medium grained, sub-rounded sandy clay, with hard laterite gravel.

The soil moisture profiles shown in Figure 8 show a lower moisture profile for March 2021 as expected with no rainfall being received for December 2020 and January 2021. The March 2021 profile is not too dissimilar to pre mining profiles for the same period which is a reflection of seasonal variation.

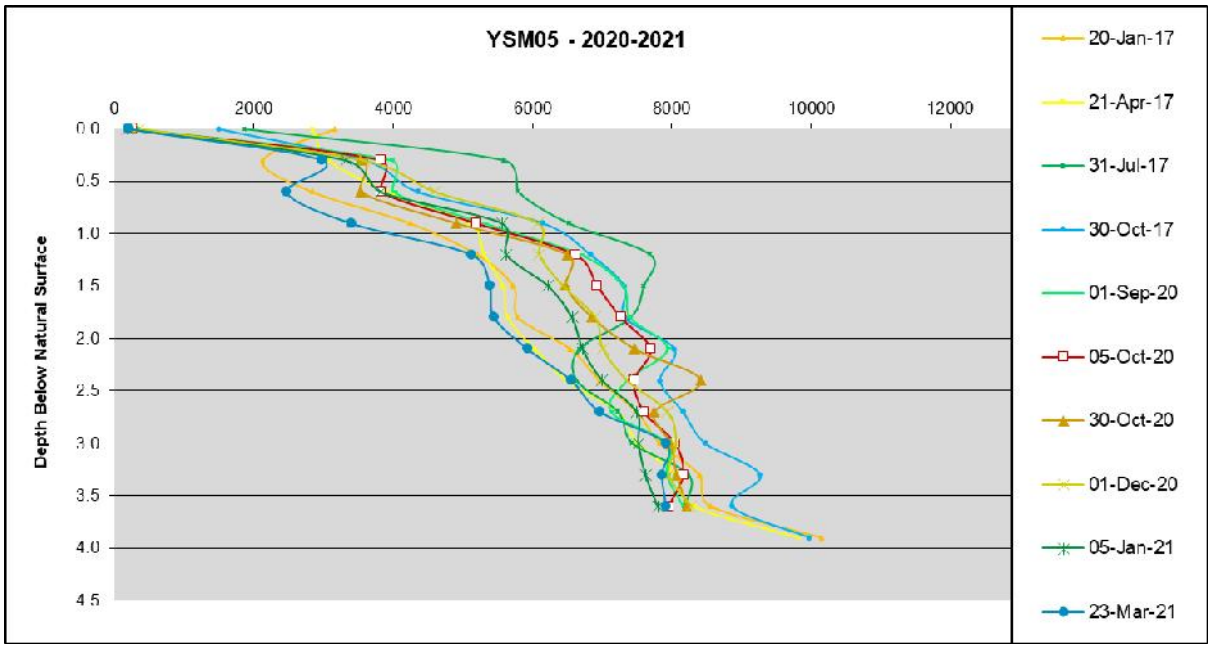

Figure 8 Soil Moisture YSM05 (including 2017 background profiles)

Dip well YMB11S, which is located at site YSM005 has a depth of 9.5m and has been monitored monthly since installation in December 2016. At every monthly monitoring occasion to date the bore has been dry.

Site 6 (YSM006)

Site 6 is located immediately up gradient on the south eastern edge of the mine void 'Area A' within State Forest 33 and is also the site of Dip Well YMB12S. The site was adjacent to mine excavation from the beginning of 2018. The lithological description of the core sample taken during installation describes the soil profile as follows;

- 0 - 0.4m. Pale yellow brown, fine to medium grained, sub-rounded, well sorted sand.
- 0.4 - 4.0m. Mottled orange/pale brown, medium grained, sub-rounded sandy clay, with hard laterite gravel.

The soil moisture profile shown below (Figure 9) is consistent with historical seasonal fluctuation and March 2021 reflects the lack of rainfall received in December 2020 and January 2021. The site did receive above average rainfall in May 2021.

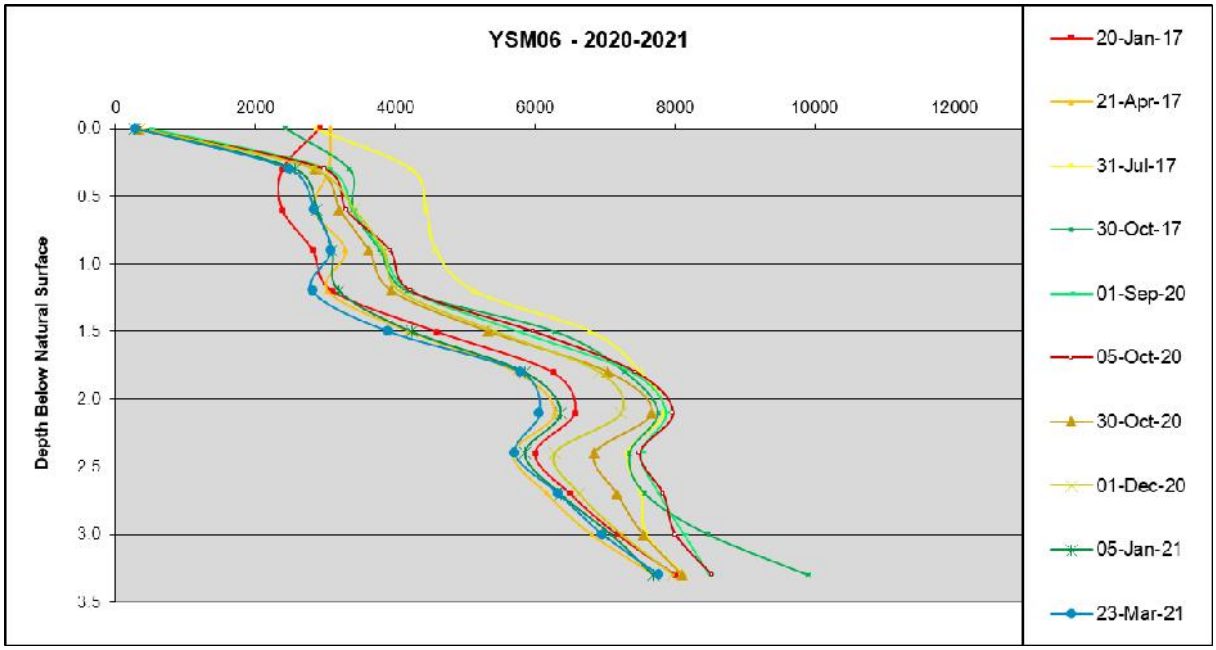

Figure 9 Soil Moisture YSM06 (including 2017 background profiles)

Dip well YMB12S, which is located at site YSM006 has a depth of 6.5m and has been monitored monthly since installation in December 2016. YMB12S was dry for the 2020/2021 reporting period.

Site 7 (YSM007)

Site 7 is located approximately 80m on the eastern side of Sues Rd and is on private property between the mining void and the Goulden Rd road reserve. The lithological description of the core sample taken during installation describes the soil profile as follows;

- 0 - 0.1m. Grey, medium grained, sub-rounded, well sorted sand
- 0.1 - 4.0m. Red brown, hard laterite gravel
- 4.0 - 5.0m. Grey/red brown, medium grained, sub-rounded, moderately sorted sandy clay.
- 5.0 - 6.0m. Grey, medium grained, sub-rounded, moderately sorted sandy clay.

The soil moisture profile shown in Figure 10 indicates a relatively consistent level of moisture displaying seasonal fluctuations.

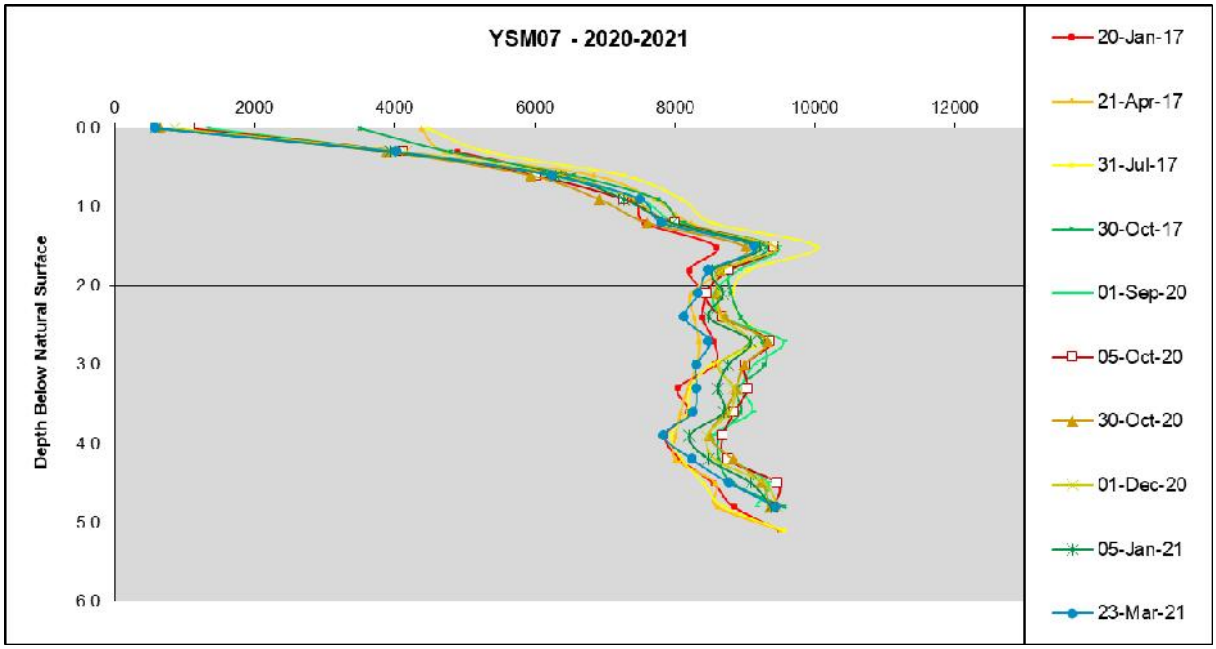

Figure 10 Soil Moisture YSM07 (including 2017 background profiles)

Site 8 (YSM008)

Site 8 is a reference site located approximately 620m south of the eastern mining void, up the scarp and in the National Park. The site is adjacent to a track extending from the pine plantation to Goulden Rd. The lithological description of the core sample taken during installation describes the soil profile as follows;

- 0 - 0.9m. Brown, medium grained, sub-rounded, moderately sorted sandy clay.
- 0.9 - 4.0m. Red/brown, clayey gravel (laterite).

The soil moisture profile shown below indicates a relatively varied level of moisture at 0.4-0.9m which could be a result of the water holding capacity of the material in this zone, given that it is medium grained sandy clay. Summer profiles are consistent with expected seasonal fluctuations and winter rainfall raised soil moistures to be comparable with historical levels.

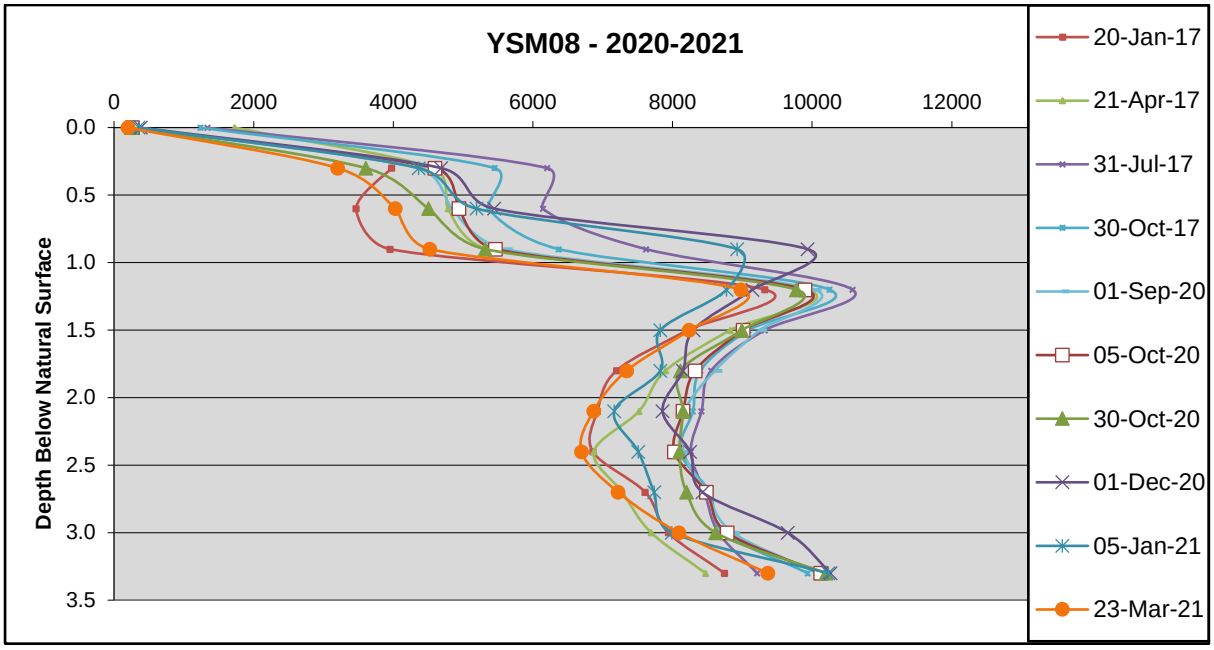

Figure 11 Soil Moisture YSM08 (including 2017 background profiles)

Site 9 (YSM009)

Site 9 is a reference site located approximately 500m south east of the eastern mining void, up the scarp and in the National Park. The site is east of the north-south section of Goulden Rd. The lithological description of the core sample taken during installation describes the soil profile as follows;

- 0 - 2.4m. Brown, medium grained, sub-rounded, well sorted sandy clay.
- 2.4 - 3.0m. Red brown, hard laterite gravel
- 3.0 - 4.0m. Grey, clay

The soil moisture profile shown below (Figure 12) indicates a relatively consistent profile however has noticeably lower levels of soil moisture at depth than the other monitoring sites. The profile indicates seasonal fluctuations and is comparable with baseline data.

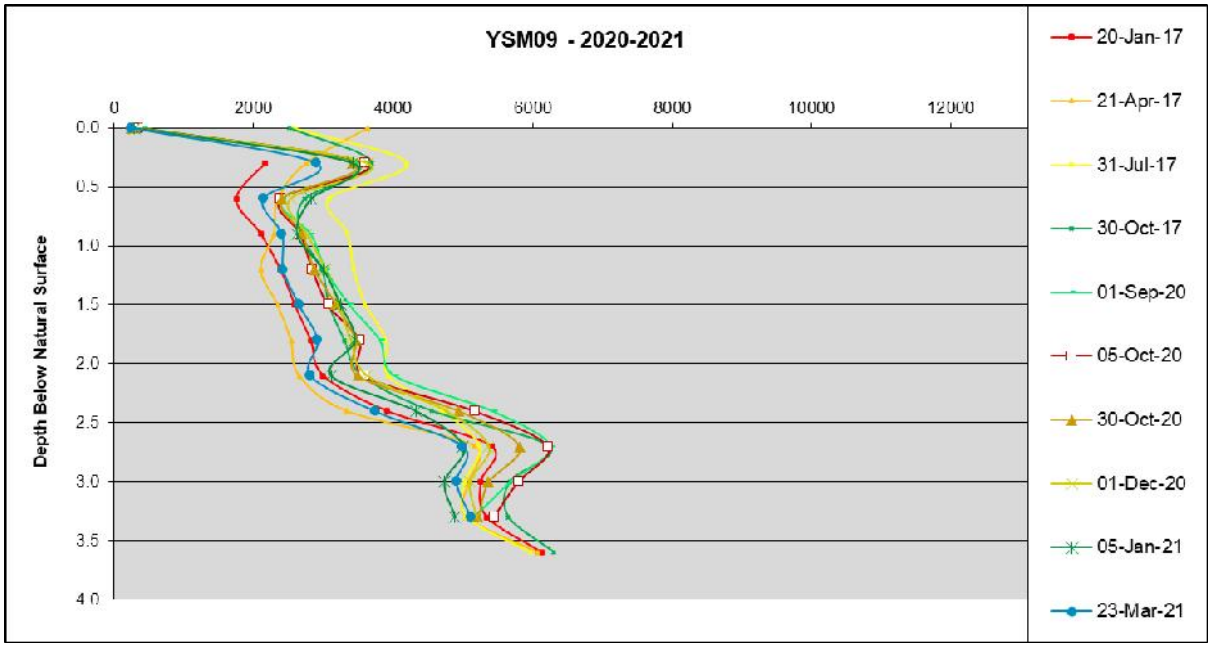

Figure 12 Soil Moisture YSM09 (including 2017 background profiles)

4. DISCUSSION AND CONCLUSION

Within this report the results of monthly/quarterly soil moistures are discussed, and a clear relationship is shown between rainfall and effects within the moisture profile at depth. The graphical representations displayed using baseline data, provides a good basis to enable the identification of a significant reduction in soil moisture relative to seasonal fluctuations. Remediation in the form of artificial irrigation ceased in April 2019. Soil Moistures adjacent to 'Area A' do not appear to have been affected by cessation of irrigation in the State Forrest post rehabilitation of 'Area A'.

APPENDIX 6

Yoongarillup Vegetation Monitoring Report 2022 (Cape Life)

Yoongarillup Mineral Sands Project State Forest - Area A

2022 Annual Rehabilitation Monitoring Report

Prepared for Doral Mineral Sands

Prepared by

Cape Life Pty Ltd

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Version	Prepared By	Approved for Issue	Issue Date
1.0	Ben Miro	B. Devine	7/12/22

1. Introduction

Doral Mineral Sands Pty Ltd (Doral) commenced ground disturbance at their Yoongarillup Mining Operations in January 2017. The mine plan included 8.9 hectares of State Forest to be cleared (Area A), with clearing commencing in October 2017. In 2018 Doral began a rehabilitation program of Area A in accordance with the 'State Forest – Area A Management Plan' (Ecoedge, 2016).

The rehabilitation program follows the stated aims within the EPA's Guidance Statement No. 6, 'Rehabilitation of Terrestrial Ecosystems' to "ensure the long-term stability of soils, landforms and hydrology required for the sustainability of sites" and to "repair the capacity of ecosystems to provide habitats for biota" (EPA, 2006). The program consisted of provenance seed collection, seedling propagation, soil profiling, topsoil return, surface preparation, direct seeding, planting, maintenance, and monitoring.

This report will summarise findings from the four monitoring events conducted in 2022 and is the fourth annual report to be compiled to date. The monitoring events were conducted in Autumn, Winter, early Spring, and late Spring of 2022. These monitoring events will provide data for assessing how the project is progressing in relation to the closure criteria set out in in Section 9.4 – 'Re-establishment of Native Vegetation', of the Area A Management Plan while also providing baseline date to assess future trends (Ecoedge, 2016).

1.1 Site Location & Biogeographic Region

Located within the City of Busselton, the Area A rehabilitation site is situated 5.5 km south of Yoongarillup and 17 km south of Busselton (See figure 2 below). The site covers 8.90 hectares within Millbrook State Forest (State Forest No. 33) and is managed by the Department of Biodiversity, Conservation and Attractions. The site borders rehabilitated pasture to the north, Sues Road to the east and Millbrook State Forest to the south and west. The Area A rehabilitation site is located within the Southern Jarrah Forest sub-region of the Jarrah Forest IBRA Bioregion, as defined in the Interim Biogeographical Regionalisation for Australia (IBRA) (Australian Government, 2009).

1.2 Climate

Average (mean) rainfall for the area is 786 mm a year with most rain falling between May and September (Station 9971 – Acton Park). In 2019 the annual rainfall was well below average at 662 mm, in 2020 it was just below the average at 727 mm and in 2021 well above (+183 mm) the average at 969 mm. This year's annual rainfall is currently at 706mm (as of December 6th, 2022), which is below (-80 mm) the historical average. It should be noted that the rainfall did not deviate significantly from the historic average throughout every month. A graph outlining the monthly rainfall for 2019, 2020, 2021 and 2022 against the monthly historical averages is provided in Figure 1 below.

Figure 1: Monthly and Mean Rainfall Data

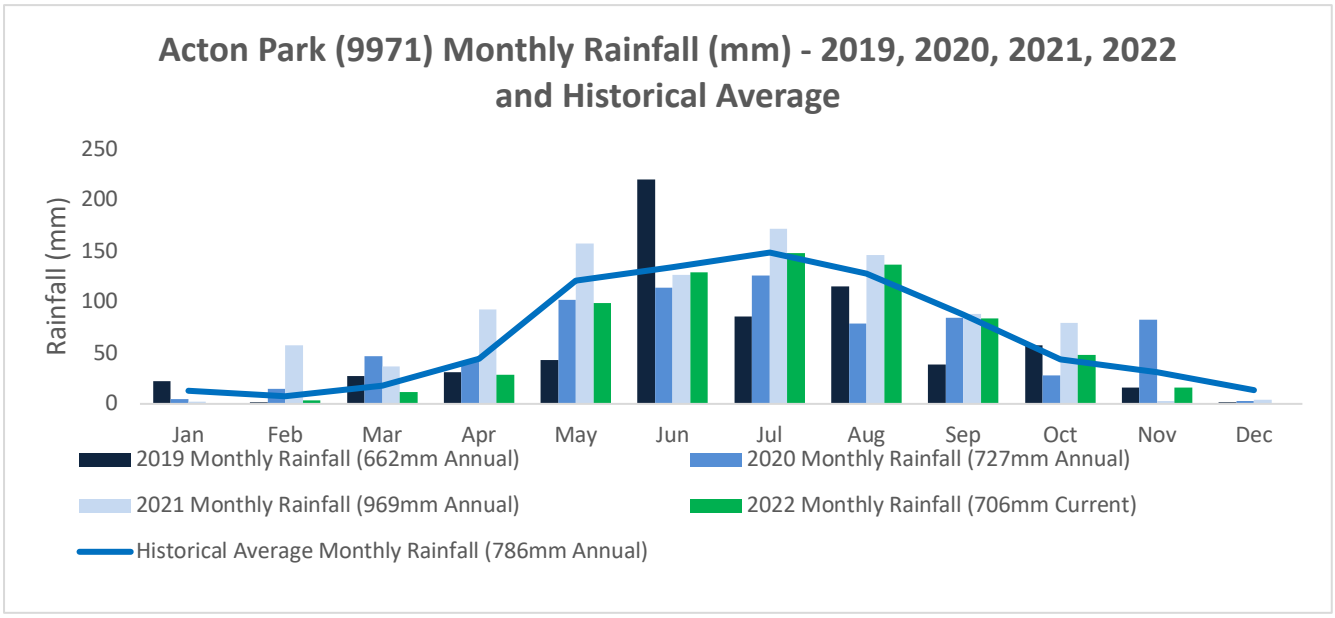

Figure 2: Map Showing Regional Context

1.3 Geology

Situated on the 'Central Whicher Scarp' the location of the Area A rehabilitation site is described by Keighery et al. (2008) as having moderate north facing slopes with areas of laterite capped rises and soils ranging from deep sands to sand, gravel, silt, clay and ironstone combinations. The soils are mapped under the 214Ws soil landscape system (Tille and Lantzke, 1990), which is described as consisting of "gentle lateritic slopes with gravels". These slopes form a low scarp which separates the Swan Coastal Plain and the Blackwood Plateau. Due to the underlying soils and geology the Whicher Scarp has affinities with the Swan Coastal Plain (Ecoedge, 2013).

1.4 Vegetation

The vegetation within Area A and the surrounding area was surveyed prior to clearing by Ecoedge and Mattiske and summarised in the report 'Level 2 Flora and Vegetation survey at Yoongarillup' (Ecoedge, 2013). Three vegetation units (A3, B1 and C2) were mapped within Area A by Ecoedge (2014). Following analysis of Mattiske (2012) and Ecoedge (2014) a total of 156 species were identified as occurring within Area A, of which 45 have been identified as 'keystone' species (Ecoedge, 2016). Unit C2 corresponds to a Priority One Priority Ecological Community (P1 PEC) 'Central Whicher Scarp Jarrah woodland'.

The three vegetation units mapped by Ecoedge (2013) are described below.

> A3*: Eucalyptus marginata*, *Corymbia calophylla* open forest/woodland over *Banksia grandis*, (*Persoonia longifolia*) low woodland over *Acacia extensa*, *Adenanthos barbiger*, *Boronia crenulata*, *Daviesia cordata*, *Grevillea trifida*, *Hakea ruscifolia*, *Hibbertia hypericoides*, *Hypocalymma robustum*, *Macrozamia riedlei*, *Mirbelia dilatata*, *Podocarpus drouynianus*, *Xanthorrhoea gracilis*, *X. preissii* shrubland/low shrubland over *Hypolaena exsulca*, *Loxocarya cinerea* open sedgeland and *Patersonia umbrosa* var. *xanthina* scattered herbs on red-brown loam.
>
> B1: *Eucalyptus marginata*, (*Corymbia calophylla*) woodland over *Banksia grandis,* (*Xylomelum occidentale*) open low woodland over *Acacia pulchella*, *Adenanthos barbiger*, *Dasypogon bromeliifolius*, *D. hookeri*, *Hibbertia hypericoides*, *Hypocalymma robustum*, *Melaleuca thymoides*, *Podocarpus drouynianus*, *Stirlingia latifolia*, *Xanthorrhoea gracilis*, *X. preissii* shrubland/low shrubland over *Anarthria prolifera*, *Desmocladus fasciculatus* open sedgeland on grey-brown loamy sand.
>
> C2: *Eucalyptus marginata, Corymbia calophylla open forest over Banksia dallanneyi, Hakea amplexicaulis, Hibbertia amplexicaulis, H. hypericoides, Hypocalymma robustum* shrubland/low shrubland over *Desmocladus fasciculatus, Tetraria sp. Jarrah Forest open sedgeland and Conostylis aculeata, Opercularia apiciflora, Patersonia umbrosa* var. *xanthina* open herb land on gravelly sand or grey brown loamy sand.

2. Revegetation Works

2.1 Site Preparation

Site preparation was conducted during 2018 and early 2019 following on from soil management activities during the mining phase. Dieback (*Phytophthora* sp.) free topsoil was stripped to a depth of 100 mm and subsoil/overburden was removed to a depth of 150-200 mm with both layers stockpiled separately within Area A. Vegetation and topsoil from areas identified as Dieback infested were removed from the site and either burnt (vegetation) or buried at the pit floor (outside Area A). Post mining the pit was backfilled including the return of sand and clay tails, overburden, subsoil and then topsoil to re-establish the previously mined landform and soil profile. Prior to the return of topsoil and overburden the site was ripped along the contour to a depth of 600mm to reduce compaction and improve infiltration. The retained vegetation matter consisting of pre-existing canopy salvaged during clearing, was screened, and inoculated with fungi and bacteria prior to being progressively incorporated into the topsoil during spreading. Immediately before seeding the site was scarified using shallow tynes to increase the surface capacity for retaining seed and reducing topsoil run off during rain events. Large logs and branches retained from the previous clearing were distributed across each cell to provide habitat for native fauna. To assist with installation of

seedlings, direct seeding, and future maintenance activities, the site was broken up into 12 cells of varying sizes separated by bunds and access tracks (Figure 3). A separate cell within the Goulden Road Reserve was also established. Fencing was erected around the site to reduce the impact by grazing fauna including kangaroos and rabbits. Biosoil treatments were administered on 4 occasions between 2018 and 2020, as detailed in Appendix 5.

2.2 Provenance Seed collection

Seed collection was conducted during Spring and Summer of 2017/18, 2018/19 and 2019/20. Collection areas included Area A (prior to clearing) and from similar vegetation within a 10 km provenance area along the Whicher Scarp (See Appendix 1 for full collection record). 55 species were collected amounting to a total volume of 31.92 kg. Keystone species as identified by Ecoedge (2014) were targeted as priority species. Seed was processed at Cape Life's RIAWA (Revegetation Industry Association of Western Australia) accredited facility to A Grade standard under RIAWA guidelines. Prior to seeding, pre-treatments of the processed seed were undertaken according to species requirements such as smoke, hot water, or heat.

2.3 Planting and Seeding – Initial Installation 2019

Prior to seedling installation and seeding, 104 Grass Trees (*Xanthorrhoea preissii*) and other monocot species salvaged from Area A prior to clearing were planted. Reticulation was installed by Doral to drip irrigate the Grass Trees transplanted in clusters across each cell. Seed was batched homogenously with worm castings prior to seeding and divided into 104 bags. Bags were then assigned to each cell according to size to allow for an even distribution of seed across the site. The seed mix was hand broadcast at a rate of 3.77 kilograms per hectare in June of 2019. Seeding was conducted prior to forecast rains to enhance germination and survival.

Seedlings installed in Area A throughout all planting events were grown from the local provenance seed/material sourced from targeted collections for the site. Recalcitrant species that don't germinate readily from seed or are difficult to collect seed from were the focus of propagation using cuttings or from tissue culture.

A total of 16,322 seedlings including 50 different species were installed mid-June 2019 after seeding was completed. Seedlings were a combination of cell, large cell, tube stock and semi-mature plants sourced from Nuts About Natives (seedlings), Geographe Community Nursery (Seedlings) and Hamel Nursery (seedlings and semi-matures). A further 1,675 seedlings were installed during August 2019, supplied by Nuts About Natives (NAN). Species lists detailing planted seedlings are provided in Appendix 2. Seedlings of overstory species were evenly batched and planted at the same density across the twelve cells at 600 stems/ha. Semi-mature *Corymbia calophylla, Eucalyptus marginata* and *Corymbia haematoxylon* plants were installed in groups around the salvaged *Xanthorrhoea preissii* clusters. Understory species were community planted to restore species assemblages recorded prior to clearing. 10% of the total seedlings installed were tree guarded, focusing on species with low numbers or species that were considered at high risk of predation.

2.4 Follow-up Planting 2020, 2021 & 2022

A total of 12,459 seedlings across 60 species from NAN (Appendix 2.1) along with *Podocarpus drouynianus* seed were planted into the main rehab area during May and late August 2020. Additionally, 2000 seedlings from Geographe Community Nursery were installed throughout the Goulden Rd Reserve in mid-August 2020 (Appendix 2.2).

In 2021, infill planting was also undertaken to install an additional 5,218 seedlings across 41 species (Appendix 2.3). All seedlings were understorey species, installed in bare sections within the rehabilitation where seedling germination had lower success (predominantly due to winter washouts or water inundation).

In the current year (June 2022) additional infill planting was conducted with a focus on infilling bare areas, specifically into disturbed sections where bunds had been removed, areas that had been previously inundated, and into tracks between cells (excluding the perimeter and central tracks). 1113 understorey across 19 species and 1440 overstorey species consisting of *Eucalyptus marginata* and *Corymbia calophylla* (Appendix 2.4) were planted. Considering that tracks had not been prepared with topsoil and mulch in the same manner as the rest of Area A, all overstorey seedlings were installed with a 1-year slow-release native tree fertiliser tablet to aid establishment.

Table 1. Summary of Seedlings Installed

Year	Seedlings
2019	17997
2020	14459
2021	5218
2022	2553
2023	3000 Expected – focused on keystone species*
2024	3000 Expected – focused on keystone species*
Total	**46227 Seedlings**

** Keystone species seedlings focused for installation due to the 2021 Annual Report highlighting a shortfall in keystone species completion criteria, measured by the mean keystone native species richness within sub quadrats, triggering remedial action (See section '9.4.9 – Triggers' in the 'Area A Management Plan 2017' or Section 3.2 and Table 2 of this report).*

2.5 Post-Installation Works

Infrastructure has been progressively removed as the revegetation area continues to establish. The sprinkler systems irrigating the salvaged *Xanthorrhoea preissii* clusters over the Summer months were removed in early 2021. Tree guards were progressively removed as plants outgrew them; with all tree guards completely removed by Spring 2021. Bunds originally installed for access and retaining water were removed in Autumn of 2022. Bunds were removed by spreading the soil across the existing tracks, with any significant vegetation that had established on the bunds being retained. Removing the bunds and blending tracks into the revegetation cells has closed access around the site, other than the outer perimeter and main central track. Shade cloth originally installed to reduce wind-dispersal of plant material to or from the rehabilitation site was removed in Spring 2022, as it became ineffective and was not necessary with the ongoing establishment and maintenance of the rehabilitation site.

Figure 3: Map Showing Revegetation Area: Cells, Tree Clusters and Quadrat Locations

3. Monitoring

3.1 Methodology

A 5 Year monitoring program was established to track progress against the vegetation component of the closure criteria set out in Section 9.4 – 'Re-establishment of Native Vegetation', within the Area A Management Plan (Ecoedge, 2016). The monitoring program consists of quarterly monitoring events conducted in Autumn, Winter, early Spring, and late Spring each year. Additional species richness metrics are recorded biannually during the late Spring and Autumn monitoring events.

Monitoring quadrats were set up in accordance with the standard procedures set out in EPA Guidance Statement 6 (EPA, 2006). 15 Permanent 10 x 10 m quadrats (Figure 3) were positioned using a stratified random method across Area A (excluding Goulden Rd Reserve), at approximately 1.7 quadrats per hectare. Additionally, a single 5 x 5 m sub-quadrat was set within the northwest corner of each of the 15 quadrats for assessing species richness.

In 2022 the four annual monitoring events (including two biannual events) were conducted during Autumn (11/4/22), Winter (28/7/22), early Spring (31/10/22) and late Spring (28/11/21). Information was recorded in the field using Cape Life field monitoring data sheets modified to include the specific metrics outlined within the Area A Management Plan (Ecoedge, 2016). A photo was taken at the NW corner of each site and the location recorded with a Garmin GPS. Relevant observations were also recorded opportunistically across the site.

The following parameters were recorded for each quadrat:

- Total species list within the 5 x 5 m quadrat (biannually - in Autumn and late Spring).
- Cover/abundance of native and non-native species (quarterly).
- Average height of trees and cover of shrub species (quarterly).
- Average health of overstorey and understorey species (quarterly).
- An estimate of the number of stems/ha of overstorey and understorey (quarterly).
- Assessment of species richness (biannually, in Autumn and late Spring).

3.2 Closure Criteria

As outlined within the Area A Management Plan (Ecoedge, 2016) the observations recorded during monitoring will be assessed against the following closure criteria.

- Within 5 years:
    - Vegetation composition on the rehabilitated area is representative of the pre-mining state of Area A in species diversity and (potential) vegetation structure.
    - Mean cover of native species in all 10 x 10 m monitoring quadrats is no less than 70%.
    - Mean weed cover in 25 m^2 monitoring sub-quadrats is no greater than 150% of baseline levels.
    - Mean stems/ha count of species that comprise Black Cockatoo habitat shall be +/- 10% of pre-clearing density.
    - Mean species richness within 10 x 10 m monitoring quadrats is greater than 50% (and greater than 85% for overstorey species) of the mean value recorded in all 10 x 10 m reference plots in comparable unmined areas.
    - Mean species richness of identified keystone species, as detailed in Appendices 1 and 2, in all 10 x 10 m monitoring quadrats is no less than 70% of the total amount recorded.
    - 60% of all species present within Area A prior to mining are present within 5 years post-mining.
    - Average annual health scores of overstorey and understorey plants within 10 x 10 m monitoring quadrats is no less than 3 out of a maximum possible score of 5 (or equivalent rating).
- Measured on an annual basis, plants show consistent growth (height or area covered).
- Within 3 years, overstorey species average a minimum of 3 m in height or are likely to attain that height in the short-term future without the need for remedial action.
- All plant material used in rehabilitation sourced from within 10 km of the rehabilitation area.

- Within 15 years of completion of rehabilitation, rehabilitated areas have the potential to regenerate after fire.
- Vegetation structural complexity is restored 12 years post-mining.
- Fire is excluded from Area A rehabilitation for a minimum of 15 years to allow sufficient establishment and resilience of vegetation to fire.

3.3 Limitations

This annual report has been compiled based on monitoring events since 2019, with a focus on the fourth year of revegetation. Some species occurring from natural recruitment, or the topsoil seed bank may not have been formally identified. Predicted outcomes of closure criteria in the discussion and recommendations in this report rely on likelihood rehabilitation trends continuing but are subject to natural variability (such as rainfall). Due to these limitations, the interpretation of the results and their relation to closure criteria may differ.

4. Results

Table 2: Rehabilitation Performance Against Closure Criteria Set in The Area A Management Plan (Ecoedge, 2016).

Criteria	Performance Indicator	Target	2019 Observations	2020 Observations	2021 Observations	2022 Observations	2022 Comments
Vegetation Cover	Cover % of native species in 10 x 10 m quadrats	> 70 %	Mean cover of native species is currently between 30-70%	Mean cover of native species is currently between 30-70%	Mean cover of native species is currently >70%	Mean cover of native species is currently >70%	The very high number of stems per hectare for both understory and overstory species are continuing to show good health and growth, vegetation cover is expected to maintain target.
Species Richness	Mean native species richness within 10 x 10 m quadrats	> 50% (and > 85% for overstory species) of the mean value recorded in all reference plots in comparable unmined areas Mean value in comparable unmined reference plots was 47.2 taxa Mean value for overstory taxa in comparable unmined reference plots was 3.29 taxa	Mean native species richness across 10 x 10 m quadrats is 11.86 species with a range of 6 to 15 across all quadrats Mean overstory species richness across 5 x 5 m sub quadrats is 2.26 species with a range of 0 to 5 across all quadrats.	Mean native species richness across 10 x 10 m quadrats is 38.87 species with a range of 27 to 48 across all quadrats Mean overstory species richness across 5 x 5 m sub quadrats is 5.53 species with a range of 4 to 7 across all quadrats	Mean native species richness across 10 x 10 m quadrats is 44.53 species with a range of 32 to 58 across all quadrats - 94.34 % of mean value in comparable unmined reference plots Mean overstory species richness across 5 x 5 m sub quadrats is 5.8 species with a range of 4 to 7 across all quadrats - 176.29% of mean value in comparable unmined reference plots	Mean native species richness across 10 x 10 m quadrats is 43.93 species with a range of 32 to 52 across all quadrats - 94.07 % of mean value in comparable unmined reference plots Mean overstory species richness across 5 x 5 m sub quadrats is 5.2 species with a range of 4 to 7 across all quadrats - 158% of mean value in comparable unmined reference plots	Understorey species richness decreased by 1.35 %, Overstorey species richness decreased by 10.35% between 2021 - 2022 Decrease is expected as revegetation matures, closure criteria still expected to be met. Both mean native species richness performance metrics within 10 x 10 m quadrats are well above targets (> 50% general >85% overstorey).
Keystone Species Richness	Mean keystone native species richness within sub quadrats	No less than 70% of the 44 total possible species	Mean keystone native species richness across sub quadrats is 6.73 species, which is 15.3 % of the total possible species	Mean keystone native species richness across sub quadrats is 18.2 species, which is 41.4 % of the total possible species	Mean keystone native species richness across sub quadrats is 21.47 species, which is 48.8 % of the total possible species	Mean keystone native species richness across sub quadrats is 22.33 species, which is 50.75% of the total possible species	Mean keystone native species richness increased by 4%. This metric is just above the 50% trigger mark, as detailed in section '9.4.9 – Triggers' in the 'Area A Management Plan 2017'. This metric was triggered in the 2021 annual report and management actions are underway to amend this shortfall.

Criteria	Performance Indicator	Target	2019 Observations	2020 Observations	2021 Observations	2022 Observations	2022 Comments
Weed species	Cover (% Rehab area)	< 150 % Baseline Levels No new weed species found within Area A	No weed species were observed during monitoring	Minor amounts of weeds observed in some areas.	Minor amounts of weeds observed in some areas (salvaged *Xanthorrhoea* clusters and randomly throughout) Moenchia erecta present throughout winter – wet areas of site. Juncus microcephalus numbers spreading from grass tree clusters to winter-wet areas	Minor amounts of weeds observed in some areas (salvaged *Xanthorrhoea* clusters and randomly throughout) Moenchia erecta present throughout winter – wet areas of site. Juncus microcephalus numbers highly reduced after continual weed-control - ongoing Fleabane, Flatweed and Stinkwort numbers increasing but still very minor – control ongoing	Minor weed control undertaken in Winter 2020, 2021 and 2022. Moenchia erecta is not a significant weed that affects performance of rehabilitation – no action recommended. Juncus microcephalus, Fleabane, Stinkwort and Flatweed observed sporadically – weed control undertaken has targeted these species. Entire site and specifically Winter-wet areas and salvaged *Xanthorrhoea* clusters need ongoing monitoring and maintenance for weeds.
Black Cockatoo habitat	Abundance (stems per hectare) of species that comprise habitat	+/- 10% of pre-clearing density of 110 trees or 12.36 stems / ha	800 stems / ha	547 stems / ha	667 stems / ha	733 stems / ha	Increase in stems/ha since 2021 observations due to minor but ongoing germination and infill planting. During early stage of rehabilitation high stem/ha counts have been recorded. This metric will increase in importance as the rehabilitation progresses.
Plant Health (Overstory)	Crown extent and density (See Table 2 below) New tip growth, epicormic growth and leaf die off (See Table 3 below)	No less than 3/5 – or relatively, no less than 60 % No target metrics	78.6 % healthy tree canopy Leaf die-off/yellowing scarce, new tip growth clearly visible throughout and epicormic growth not visible	81-90% healthy tree canopy Leaf die-off/yellowing scarce, new tip growth clearly visible throughout and epicormic growth not visible	81-90% healthy tree canopy Leaf die-off/yellowing scarce, new tip growth scarce and epicormic growth not visible	91 – 100% healthy tree canopy Leaf die-off/yellowing scarce, new tip growth scarce and epicormic growth not visible	Overstorey deaths observed throughout, though significantly less than previous years, new germination also observed, established individuals continuing to show growth and good health. Some insect damage in Spring 2022 observed on *Eucalyptus marginata* and *Corymbia calophylla.*
Plant Health (Understory)	Shrub Health Scale Scored 0-5 (See Table 4 below)	Average score no less than 3/5	Average score 4.6/5	Average score 4.9/5 >81% original canopy present	Average score 4.3/5 61-80% original canopy present	Average score 4.7/5 >81% original canopy present	Understorey species deaths observed by way of natural thinning of colonising species (eg. *Kennedia* sp. *A.pulchella*),

Criteria	Performance Indicator	Target	2019 Observations	2020 Observations	2021 Observations	2022 Observations	2022 Comments
							otherwise any loss of health is likely sporadic and due to natural attrition.
Consistent Growth	Positive Height (m) or Area Covered (%)	Positive growth, measured annually	N/A	Cover/abundance of species within quadrat averages have moved from 'Common over whole area' (30%-70%) in 2019 to currently 'Completely dominating' (>70%). Average plant heights have increased between 2019 and 2020 from: Overstorey 202 mm to 241 mm and Understorey 156 mm to 244 mm	Cover/abundance of species within quadrat averages are currently 'Completely dominating' (>70%). Average plant heights have increased between 2020 and 2021 from: Overstorey 241 mm to 341 mm and Understorey 244 mm to 466 mm	Cover/abundance of species within quadrat averages are currently 'Completely dominating' (>70%). Average plant heights: Overstorey 410 mm and Understorey 512 mm	Consistent growth in both overstorey and understorey observed. Higher understorey heights likely to be overtaken by overstorey heights in future. Average plant heights have increased between 2021 and 2022 by 20% overstorey and 9.8% understorey.
Overstory Height	Overstory species height (m)	Average > 3 m within 3 years or are likely to attain that height in the short-term future without the need for remedial action	Average overstory heights (mm) : Planted: 325 mm Planted (Mature): 335 mm Germinants: 89.4 mm	Average overstorey heights are 244 mm	Average overstorey heights are 341 mm	Average overstorey heights are 410 mm	Overstory species observed to be healthy. No remedial action for overstory species is required.
Fire Regeneration Ability	Ability to regenerate after fire	Ability to regenerate post fire after 15 years	N/A	N/A	N/A	N/A	Beyond time frame of this monitoring program. Positive indicators will be seeding of obligate seeders and development of a soil seed bank, and obligate resprouters developing below ground root system to allow for resprouting.
Fire Exclusion to allow sufficient establishment and resilience of vegetation	Presence of fire	Minimum of 15 years exclusion	Fire excluded from rehabilitation site to date of monitoring	Fire excluded from rehabilitation site to date of monitoring	Fire excluded from rehabilitation site to date of monitoring	Fire excluded from rehabilitation site to date of monitoring	Maintain fire breaks and water points around site as part of the Bushfire Management Plan.

Criteria	Performance Indicator	Target	2019 Observations	2020 Observations	2021 Observations	2022 Observations	2022 Comments
Vegetation composition on the rehabilitated area is representative of the pre-mining state	Species diversity and (potential) vegetation structure	60% of all species present within Area A prior to mining are present within 5 years post-mining (Refer to Area A management plan (Ecoedge 2016) for comprehensive species list) Vegetation structural complexity is restored 12 years post-mining	29 out of 156 species recorded (20%)	85 out of 156 species recorded (54.5%)	98 out of 156 species recorded (62.8%)	113 out of 156 species recorded (72.4%)	Target achieved but must be maintained.

Table 3. Category Scale For Reporting Crown Extent and Crown Density Assessments

Score	Crown Extent and Density
0	None (0%)
1	Minimal (1-10%)
2	Sparse (11-20%)
3	Sparse-Medium (21-40%)
4	Medium (41-60%)
5	Medium-Major (61-80%)
6	Major (81-90%)
7	Maximum (91-100%)

Table 4. Category Scale For Reporting New Tip Growth, Epicormic Growth and Leaf Die Off

Score	Description	Definition (With regard to the assessable crown)	New tip growth	Epicormic growth	Leaf die-off or yellowing
0	Absent	Effect is not visible			
1	Scarce	Effect is present but not readily visible			
2	Common	Effect is clearly visible throughout			
3	Abundant	Effect dominates the appearance			

- Tables 2 & 3 sourced from (Backstrom et al., 2010).

Table 5. Small Tree (Banksia) and Shrub Health Scale (Partly Based On Lay And Meissner, 1985).

Score	Description
0	Dead shrub.
1	Shrub with <20% of original canopy; most main branches dead; remaining leaves mostly dying off.
2	Shrub with 21- 40% of original canopy present; some main branches dead (50 -80% canopy); abundant leaf yellowing (>41% canopy).
3	Shrub with 41-60% of the original canopy present; some smaller dead branches evident (21-40% canopy); moderate amount of leaf yellowing (21-40% canopy) .
4	Shrub with 61 – 80% of the original canopy present; occasional dead branches (< 20% of canopy); small patches of leaf yellowing (< 20% of canopy) .
5	Shrub with >81% of the original canopy present; healthy overall; little or no leaf yellowing.

5. Discussion

This report constitutes the fourth monitoring report within the 5-year monitoring plan and summarises four monitoring events conducted in 2022. The data summarised within this report provides a record of works undertaken and to establish future trends against the fulfillment of closure criteria. Assessment of the Yoongarillup Area A rehabilitation will become more robust with each successive year of reporting, although will still hold limitations as detailed in Section 3.3 of this report.

The general trend of the rehabilitation within Area A is positive with most metrics trending towards closure criteria. Monitoring photos in Figures 4 to 7 are taken from the northwest corner of Quadrat 1 and give a visual understanding of the change typically seen across the site each year. It was previously discussed that the south/southeast area of the site was shown to out-perform the west/northwest area in all metrics, likely due to the west/northwest corner being the low point and experiencing inundation and erosion in higher rainfall months. Although some areas have had a better establishment period than others, this trend has become less obvious, with the vegetation becoming more diverse in species and consistent in growth and health as it matures.

Seed germination from direct seeding is still ongoing, with some additional species establishing via natural recruitment and the returned topsoil, however as expected germination has significantly reduced since the first two years of rehabilitation. Development of a soil seed bank is becoming evident where in the past two years, certain species installed during revegetation works have matured and set seed, and germination is being observed (Figure 8). The most significant new species identified on site was *Daviesia elongata subsp. elongata* (listed as threatened flora) (Figure 9), with two individuals showing positive signs of growth and development of immature seed pod in November 2022. The initial direct seeding of Area A produced a stem count that was higher than any static natural germination events and therefore natural succession reducing the number of stems was expected. This is observed in the density metrics where stems per hectare of all native species have reduced by 12% between 2020 and 2021, and further reduced by 20% between 2021 and 2022. Currently the total average density count across site is 56120 stems per hectare.

Vegetation health and survival has been positive in 2022, likely due to the extended cool and stable climate throughout Spring and continuing resilience of the revegetation as it establishes. In 2021 the effects of exposure were commonly observed where tips of both established and unestablished understorey species across the site were found to be burnt or very dry (wilting/curling). These effects have been significantly less evident this year. Currently the closure criteria of understorey species health are scored at the maximum metric of >81 % of original canopy present. The closure criteria of overstorey species health are also scored at the maximum metric of 91–100% healthy tree canopy, with leaf die-off/yellowing scarce, new tip growth scarce and epicormic growth not visible.

The removal of bunds between each cell and track in Autumn this year has been a key difference in the structure of site this year, as the movement of water throughout site drains much more evenly over the high rainfall period in Winter. Inundation is minimal and erosion has been reduced, stabilising washouts and topsoil across the site.

Vegetative cover of native species has increased in % cover consistently and is still recorded at the closure criteria's maximum target of >70 %. Considering the very high number of stems per hectare and continued growth for both understory and overstory, the vegetation cover criteria is expected to maintain target.

Species richness measured within 10 x 10m quadrats has remained similar this year. A decrease by 1.35 % for understorey species richness, -10.35 % overstorey species richness and an increase of 4 % keystone species richness. Natural losses are likely due to several minor factors in these early stages of revegetation rather than any significant events, the rate of recruitment has likely plateaued as expected, and is evident in the stems per hectare metrics recorded over time. Both mean native species richness performance metrics are expected to meet closure criteria, within 10 x 10 m quadrats well above targets. The > 50 % understorey target is currently recorded at 94.07 %, and the > 85 % overstorey target is currently recorded at 158%.

The mean keystone native species richness across 5 x 5-metre sub quadrats is 22.33 species, which is 50.75 % of the total possible species and up from 21.47 species or 48.8%. As detailed in the Appendices 1 and 2 of 'Area A

Management Plan 2017' this metric is just above of the minimum performance score of >50% to be on track towards closure criteria of >70%. Last year being under the 50% threshold, the data recorded triggered a response to correct the trajectory towards target. Propagating additional keystone species has been anticipated and further infill planting in 2023 and 2024 will act as a contingency response to this result.

The mean stems per hectare count of overstory species that can provide habitat of conservation significant Black-Cockatoos is based upon three major tree species - *Corymbia calophylla, Corymbia haematoxylon* and *Eucalyptus marginata.* The Spring monitoring event observed 773 stems/ha of these three species and when extrapolated estimates show the current number of potential habitat trees across the site is 6523 stems. While the number of trees expected to become habitat (i.e. achieve Diameter at Breast Height (DBH) >50cm) or breeding trees (containing large hollows) is uncertain, the current numbers represent a positive trend towards achieving the pre-clearing density of 110 Black-Cockatoo habitat trees, 10 suitable breeding hollows and 1 night roosting site.

Weeds observed at site are generally at low levels and not impacting revegetation performance. During maintenance work all weeds observed have been treated with herbicide or manually removed including, Fleabane (*erigeron bonariensis)*, Stinkwort (*Ditrichia graveolens),* Wild Radish (*Raphanus raphanistrum),* Blackberry Nightshade (*Solanum nigrum*), *Juncus microcephalus* and Sowthistle (*Sonchus oleraceus*). Previously spreading *Juncus microcephalus* numbers have been significantly reduced through weed control undertaken in Winter/spring 2020, 2021 and 2022. Chickweed (*Moenchia erecta*) was observed across the site but is unlikely to pose any threat to rehabilitation as it is a very small annual plant likely to be outcompeted by establishing natives, and thus has not been a focus for control. The main source of weeds has been the translocated *Xanthorrhoea preissii* clusters and from the pasture that lies adjacent to the site on the northern edge. Other weeds observed are minimal and have only been dispersed sporadically by natural vectors (wind, birds, etc.). The entire site and specifically Winter-wet areas and salvaged Xanthorrhoea clusters need ongoing monitoring for weeds.

The Whicher Scarp is a floristically diverse area with 156 species recorded within and surrounding the site (Ecoedge, 2014). Achieving the criteria of 60% site species richness, > 50% mean species richness in quadrats (and > 85% for overstory species) and 70% mean keystone species richness in quadrats will continue to be key metrics to focus upon.

6. Recommendations

Based on this monitoring report, following are recommendations for continuing rehabilitation work towards achieving the Area A site's rehabilitation closure criteria:

- Continue to monitor the *Xanthorrhoea preissii* clusters, Winter-wet areas, and areas near farmland for weed incursions, undertaking weed maintenance as planned/required.
- Ongoing infill planting to reach closure criteria focusing on the 44 keystone species, species recorded on initial floristic surveys that are not already present in the site, and those that are at a low number to establish a viable population that is stable long-term.
- Continued Infill planting of tracks and bare sections of Area A.
- Vehicle and machinery movement should be minimised, and hygiene should be maintained prior to accessing site to ensure no new weed or dieback infestations are introduced.
- Maintain a Bushfire Management Plan for the site.

7. References

Ecoedge Environmental (2013). Level 2 Flora and Vegetation Survey at Yoongarillup. Unpublished report prepared for Doral Mineral Sands Pty Ltd. Revised November 2013.

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Figure 4: Quadrat 1 Photo - 1st Monitoring Event November 7th 2019

Figure 5: Quadrat 1 Photo - Late Spring Monitoring Event November 27th 2020

Figure 6: Quadrat 1 Photo - Late Spring Monitoring Event November 23rd 2021

Figure 7: Quadrat 1 Photo - Most Recent Late Spring Monitoring Event November 28th 2022

Figure 8: - Self-Seeded germinants of *Grevillea trifida* and *Dampiera linearis*

Figure 9: *Daviesia elongata subsp. elongata (T)*

Appendix 1 – Seed Collection Record

Doral Yoongarillup Collection Record Master Sheet

Species	Batch ID	Date	Quantity (g)
Acacia extensa	YN161220	20/12/16	215
Acacia extensa	YN301117-D	12/12/17	867
Acacia pulchella var. glaberrima	YN1215	15/12/16	2200
Acacia pulchella var. glaberrima	YN291117-B	29/11/17	641
Agrostocrinum hirsutum	YN041217-C	4/12/17	9
Allocasuarina fraseriana	YN161228A	11/1/17	123
Allocasuarina fraseriana	YN090217-A	9/2/17	298
Allocasuarina fraseriana	YN170228C	28/2/17	220
Allocasuarina fraseriana	YN160317	16/3/17	192
Allocasuarina fraseriana	YN230118A	23/1/18	335
Allocasuarina fraseriana	YN230118-A	30/1/18	9
Amphipogon amphipogonoides	YN210120-B	21/1/20	4
Anarthria prolifera	YN210120-A	21/1/20	2
Banksia attenuata	YN24117-C	10/2/17	170
Banksia attenuata	YN200317	20/3/17	16
Banksia attenuata	YN070218-A	14/2/18	1102
Banksia grandis	YN200317-C	20/3/17	722
Banksia grandis	YN190417F	19/4/17	1027.5
Banksia grandis	YN180228A	28/2/18	948.5
Bossiaea ornata	YN161220C	29/12/16	780
Bossiaea ornata	YN121217-A	12/12/17	481
Bossiaea ornata	YN301117-B	30/11/17	328
Calothamnus sanguineus	YN210218-A	21/2/18	204
Chorizema glycinifolium	YN020119-C	2/1/19	1.5
Comesperma virgatum	YN140219-B	14/2/19	6
Comosperma virgatum	YN270220-B	27/2/20	1.5
Corymbia calophylla	YN140217-C	14/2/17	84
Corymbia calophylla	YN170309-C	9/3/17	252
Corymbia calophylla	YN180218-B	28/2/18	201
Corymbia calophylla	YN300118-C	30/1/18	474
Corymbia calophylla	YN030418-B	3/4/18	114.5
Corymbia haemotoxylon	YN170309-D	9/3/17	182
Corymbia haemotoxylon	YN190118D	23/1/18	709
Corymbia haemotoxylon	YN190118-D	30/1/18	78
Daviesia cordata	YO90117-A	9/1/17	71
Daviesia cordata	YN121217-B	12/12/17	39
Daviesia cordata	YN301117-A	30/11/17	121
Daviesia physodes	YN161228-E	28/12/16	2
Daviesia physodes	YN061217-D	12/12/17	15
Eucalyptus marginata	YN170309-A	9/3/17	530
Eucalyptus marginata	YN160318-B	16/3/18	1286
Gompholobium knightianum	YN171218-A	17/12/18	4
Gompholobium marginatum	YN01215B	15/12/16	40
Gompholobium marginatum	YN01215B	15/12/16	10
Gompholobium polymorphum	YN010217B	1/2/17	2.5
Gompholobium polymorphum	YN020119-G	2/1/19	0.5
Gompholobium preisii	YN301117-C	30/11/17	2
Gompholobium venustum	YN161222B	22/12/16	18
Grevillea trifida	YN161229	29/12/16	11
Grevillea trifida	YN041217-A	4/12/17	4.5
Haemodorum laxum	YN190319-A	19/3/19	0.25
Haemodorum spicatum	YN210218-B	21/2/18	16
Haemodorum spicatum	YN210218-B	28/2/18	32
Hakea amplexicaulis	YN24117-B	24/1/17	56
Hakea amplexicaulis	YN080217-A	8/2/17	166
Hakea amplexicaulis	YN170228-A	28/2/17	18
Hakea amplexicaulis	YN080118-C	8/1/18	21
Hakea amplexicaulis	YN190118-A	19/1/18	7
Hakea amplexicaulis	YN300118-A	30/1/18	28
Hakea amplexicaulis	YN160318-D	16/3/18	32
Hakea amplexicaulis	YN170418-C	17/4/18	10
Hakea amplexicaulis	YN080120-C	8/1/20	154
Hakea ruscifolia	YN170221-A	21/2/17	14
Hakea ruscifolia	YN160318C	16/3/18	21
Hakea ruscifolia	YN300118-D	30/1/18	24
Hakea ruscifolia	YN020119-B	2/1/19	6

Species	Batch ID	Date	Quantity (g)
Hardenbergia comptoniana	YN120117A	12/1/17	446
Hardenbergia comptoniana	YN300117-B	30/1/17	62
Hardenbergia comptoniana	YN150118-A	15/1/18	156
Hardenbergia comptoniana *	YN10116-F	10/1/16	512
Hibbertia vaginata	YN020119-D	2/1/19	0.25
Hovea chorizemifolia	YN061218-A	6/12/18	5.5
Hovea trisperma	YN231118-A	23/11/18	5
Hypocalymma robustum	YN131218-A	13/12/18	0.5
Isopogon sphaerocephalus	YN140219-A	14/2/19	0.5
Kennedia carinata	YN090117-B	9/1/17	66
Kennedia carinata	YN120117-C	12/1/17	350
Kennedia carinata	YN300117-A	30/1/17	138
Kennedia carinata	YN090118-B	9/1/18	26
Kennedia carinata	YN281217-B	28/12/17	137
Kennedia carinata	YN121217-C	12/12/17	4
Kennedia coccinea	YN120117B	12/1/17	594
Kennedia coccinea	YN161228C	28/12/16	628
Kennedia coccinea	YN061217-E	6/12/17	371
Kennedia coccinea	YN281217-A	28/12/17	888
Kennedia coccinea	YN090118	9/1/18	143
Kunzea rostrata	YN160217E	9/3/17	554
Kunzea rostrata	YN160317-A	16/3/17	222
Kunzea rostrata	YN070218-D	7/2/18	150
Kunzea rostrata	YN140218-B	14/2/18	224
Kunzea rostrata	YN170418-A	17/4/18	176
Labichea punctata	YN020119-A	2/1/19	6.5
Lepidosperma ? squamatum	YN270220-C	27/2/20	0.5
Lomandra sp. - large fruit	YN020119-E	2/1/19	5.5
Mesomelaena tetragona	YN080120-D	8/1/20	1
Melaleuca thymoides	YN170228-B	23/2/17	212
Melaleuca thymoides	YN180228-C	28/2/18	180
Melaleuca thymoides	YN140218-C	14/2/18	150
Melaleuca thymoides	YN030418-A	3/4/18	153
Melaleuca thymoides	YN170418-A	17/4/18	570
Nuytsia floribunda	YN160318-A	16/3/18	41
Patersonia occidentalis	YN020217-A	02.02.17	44
Patersonia occidentalis	YN250118A	25/1/18	481
Patersonia umbrosa var. xanthina	YN090117B	9/1/17	350
Patersonia umbrosa var. xanthina	YN020118-A	2/1/18	18
Patersonia umbrosa var. xanthina	YN160118-A	16/1/18	48
*Patersonia umbrosa var. xanthina**	YN050117A	5/1/17	662.5
Patersonia ? sp.	Y090117C	9/1/17	20
Pericalymma ellipticum	YN170309-E	16/3/17	32
Pericalymma ellipticum	YN160318-E	16/3/18	12.5
Pericalymma ellipticum	YN170418-B	17/4/18	21.5
Pericalymma ellipticum	YN200220	20/2/20	191
Podocarpus drouynianus (Supplied by Peter Frost	n/a	1/3/20	4000
Pultenaea reticulata	YN281216F	3/1/17	145
Pultenaea reticulata	YN211217-B	21/12/17	10
Pultenea reticulata	YN171219-A	17/12/19	24.5
Sphaerolobium medium	YN061217-B	6/12/17	0.25
Stackhousia monogyna	YN020119-F	2/1/19	3.5
Stirlingia latifolia	YN171101A	11/1/17	635
Stirlingia latifolia	YN080120-E	8/1/20	99
Xanthorrhoea brunonis	YN190319-B	19/3/19	16
Xanthorrhoea gracilis	YN170309B	9/3/17	36
Xanthorrhoea gracilis	YN230118-B	23/3/18	34.5
Xanthorrhoea gracilis	YN080120-A	8/1/20	11
Xanthorrhoea preissii	YN170308A	9/3/17	5.5
Xanthorrhoea preissii	YN070218C	14/2/18	332
Xanthorrhoea preissii	YN270220-A	27/2/20	84
Xylomelum occidentale	YN170131A	31/1/17	748
Xylomelum occidentale	YN200317D	20/3/17	914

Cape Life

Only 50% of Xanth grac and pries guarded

Yoongarillup 2019 Seedlings

Appendix 2 – Full Species List - Planted and Seeded

Species	Pot Size	Planted on May 19	Cell 1	Cell 2	Cell 3	Cell 4	Cell 5	Cell 6	Cell 7	Cell 8	Cell 9	Cell 10	Cell 11	Cell 12	Totals Including Infill	Tree Guards Total
Size (m2)			**4581**	**3845**	**4529**	**7995**	**5416**	**4908**	**5266**	**6054**	**5266**	**6054**	**5325**	**8159**	**67398**	
% size of site			7	6	7	12	8	7	8	9	8	9	8	12	**100**	
Adenanthos barbiger		17	0	2	2	20	0	0	0	0	0	0	0	0	24	24
Adenanthos meisneri		1328	133	119	112	221	107	97	104	119	104	119	105	161	**1500**	
Adenanthos meisneri	50mm Tube	100	7	6	7	12	8	7	8	9	8	9	8	12	**100**	
Amphipogon amphipogonoides		13	0	0	0	0	0	0	13	0	0	0	0	0	**13**	13
Banksia attenuata	125mm Tube	100	7	6	7	12	8	7	8	9	8	9	8	12	**100**	
Banksia dallanneyi subsp. sylvestris		94	9	5	6	11	8	7	7	8	7	8	7	11	**97**	97
Banksia grandis	125mm Tube	100	7	6	7	12	8	7	8	9	8	9	8	12	**100**	
Banksia sessilis var. sessilis		383	26	22	26	45	31	28	30	34	30	34	30	46	**383**	
Billardiera floribunda		152	10	9	10	20	12	11	12	14	12	14	12	18	**154**	2
Billardiera variifolia		249	23	18	21	38	20	18	19	22	19	22	20	30	**271**	22
Boronia crenulata subsp. pubescens		95	6	5	6	11	8	7	7	9	7	9	8	12	**95**	95
Boronia defoliata		238	21	19	16	34	19	17	19	21	19	21	19	29	**254**	16
Bossiaea ornata		0		15	52	40									**107**	107
Chamaescilla corymbosa		0	8	6	7	21									**42**	42
Corymbia calophylla	5 litre	50	3	3	3	6	4	4	4	4	4	4	4	6	**50**	
Corymbia calophylla	64 Cell	64	4	4	4	8	5	5	5	6	5	6	5	8	**64**	
Corymbia haemotoxylon	64 Cell	64	4	4	4	8	5	5	5	6	5	6	5	8	**64**	
Corymbia haemotoxylon	50mm Tube	400	27	23	27	47	32	29	31	36	31	36	32	48	**400**	
Cyathochaeta equitans		39	0	0	19	0	0	0	0	0	0	20	0	0	**39**	39
Dampiera linearis		25	0	3	0	3	0	0	0	25	0	0	0	0	**31**	31
Daviesia physodes		144	10	8	10	17	12	10	11	13	11	13	11	17	**144**	
Eucalyptus marginata	5 litre	100	7	6	7	12	8	7	8	9	8	9	8	12	**100**	
Eucalyptus marginata	64 Cell	128	9	7	9	15	10	9	10	11	10	11	10	15	**128**	
Eucalyptus marginata	50mm Tube	200	14	11	13	24	16	15	16	18	16	18	16	24	**200**	
Gompholobium marginatum		118	10	9	10	18	9	9	9	11	9	11	9	4	**129**	129
Gompholobium polymorphum		360	33	30	33	53	29	26	28	32	28	32	28	44	**397**	37
Gompholobium venustum		254	22	18	22	36	20	18	20	23	20	23	20	31	**274**	20
Grevillea quercifolia		1110	81	67	79	140	89	81	87	100	79	100	88	142	**1132**	
Grevillea trifida		611	45	35	41	78	49	44	48	55	48	55	48	74	**620**	
Grevillea trifida	50mm Tube	100	7	6	7	12	8	7	8	9	8	9	8	12	**100**	
Haemodorum spicatum		246	17	14	17	29	20	18	19	22	19	22	19	30	**246**	
Hakea amplexicaulis	64 Cell	448	32	26	30	53	36	33	35	40	35	40	35	54	**450**	
Hakea amplexicaulis		315	21	18	21	37	25	23	25	28	25	28	25	38	**315**	
Hakea ruscifolia	64 Cell	448	34	29	30	53	36	33	35	40	35	40	35	54	**455**	
Hakea ruscifolia		381	26	22	26	45	31	28	30	34	30	34	30	46	**381**	
Hakea ruscifolia	50mm Tube	100	7	6	7	12	8	7	8	9	8	9	8	12	**100**	
Hibbertia amplexicaulis		120	16	13	14	22	10	9	9	11	9	11	9	15	**148**	28
Hibbertia glomerata subsp.		600	65	57	63	94	46	44	47	54	47	54	47	75	**693**	93
Hibbertia pilosa		40	24	3	4	3	0	0	0	0	0	0	20	0	**54**	54
Hibbertia vaginata		80	13	14	12	16	6	6	6	7	6	7	6	10	**111**	111
Hovea chorizemifolia		15	0	15	0	1	0	0	0	0	0	0	0	0	**16**	16
Hovea trisperma		0	3												**3**	3
Hypocalymma robustum		45	0	3	4	6	20	0	0	0	25	0	0	0	**58**	13
Hypocalymma robustum	50mm Tube	100	7	6	7	12	8	7	8	9	8	9	8	12	**100**	
Isopogon sphaerocephalus		165	11	9	11	23	13	12	13	15	13	15	13	20	**168**	3
Lechenaultia biloba		1285	100	82	98	171	103	96	100	115	100	115	102	156	**1340**	
Logania serpyllifolia		80	5	5	5	11	6	6	6	7	6	7	6	10	**82**	82
Nuytsia floribunda		120	58	57	58	64	25	24	24	26	9	11	9	15	**380**	
Opercularia apiciflora		177	39	35	42	56	14	13	14	16	14	16	14	21	**294**	117
Patersonia occidentalis		0				5									**5**	5
Petrophile linearis		29	1	0	0	15	0	14	0	0	0	0	0	0	**30**	30
Petrophile serruriae (RS)		496	44	36	40	74	40	36	39	45	39	45	39	60	**536**	40
Philotheca spicata		280	37	31	24	57	23	20	22	25	22	25	22	34	**342**	62
Platysace tenuissima		94	8	5	10	11	8	7	7	9	7	8	7	11	**100**	100
Podocarpus drouynianus		1492	138	127	137	278	120	109	121	134	117	134	118	186	**1718**	
Sphaerolobium medium	64 Cell	192	13	11	13	23	15	14	15	17	15	17	15	23	**192**	
Sphaerolobium medium		200	14	11	13	24	16	15	16	18	16	18	16	24	**200**	
Stackhousia monogyna		400	77	68	77	146	32	29	31	31	31	36	32	53	**644**	
Xanthorrhoea gracilis	64 Cell	768	52	44	52	91	62	56	60	69	60	69	61	93	**768**	384
Xanthorrhoea preisii	64 Cell	896	61	51	60	100	72	65	70	80	70	80	69	116	**895**	448
Xylomelum occidentale	125mm Tube	30	2	2	2	4	2	2	2	3	2	3	2	4	**30**	30
Xylomelum occidentale		44	3	3	3	5	4	3	3	4	3	4	3	5	**44**	44
Total		**16322**	**1465**	**1271**	**1448**	**2516**	**1326**	**1204**	**1290**	**1482**	**1275**	**1466**	**1290**	**1966**	**18010**	2337
Total Required		16322	1109	931	1097	1936	1312	1189	1275	1466	1275	1466	1290	1976	**16322**	
			Cell 1	Cell 2	Cell 3	Cell 4	Cell 5	Cell 6	Cell 7	Cell 8	Cell 9	Cell 10	Cell 11	Cell 12		
Total Tree Guards		**1645**	**140**	**118**	**137**	**226**	**117**	**121**	**127**	**157**	**114**	**152**	**135**	**171**		
Total Tree Guards Infill		**692**	**144**	**142**	**171**	**235**										
	Total	**2337**														

Appendix 2.1 – Main Rehab Seedling List 2020 - Nuts About Natives

	plants supplied May 2020	Numbers to be supplied Aug 2020
Acacia stenoptera		24
Adenanthos barbiger		22
Adenanthos meisneri	80	26
Agrostocrinum hirsutum		0
Amphipogon amphipogonoides		1
Banksia dallanneyi subsp. sylvestris	2	0
Billardiera floribunda	88	77
Billardiera variifolia	168	362
Boronia crenulata subsp. pubescens	42	259
Boronia defoliata		681
Bossiaea ornata		76
Burchardia congesta		36
Chamaescilla corymbosa		232
Chorizema glycinifolium		29
Comesperma virgatum		105
Cyathochaeta equiens		120
Dampiera linearis		28
Dasypogon bromeliifolius		641
Daviesia physodes		51
Gompholobium knightianum		335
Gompholobium marginatum		235
Gompholobium polymorphum		219
Grevillea quercifolia	335	363
Grevillea trifida	170	252
Hakea amplexicaulis	210	137
Hakea ruscifolia	2	629
Hibbertia amplexicaulis		117
Hibbertia glomerata subsp. glomerata	124	321
Hibbertia hypericoides		8
Hibbertia pilosa		77
Hibbertia quadricolor		4
Hibbertia vaginata	42	72
Hovea chorizemifolia		98
Hovea trisperma		93
Hypocalymma robustum		108
Hypolaena exsulca		672
Isopogon sphaerocephalus	2	71
Labichea punctata		29
Lechenaultia biloba	378	330
Leucopogon conostephioides		9
Logania serpyllifolia		37
Lomandra sp. large fruit		0
Mesomelaena tetragona		6
Nuytsia floribunda	14	14
Opercularia apiciflora	168	195
Pattersonia occidentalis		38
Patersonia umbrosa var. xanthina		97
Pericalymma ellipticum var. ellipticum		505
Persoonia elliptica		3
Persoonia longifolia	40	29
Petrophile linearis		3
Petrophile serruriae	136	2
Philotheca spicata	82	278
Platysace		6
Podocarpus drouynianus		365
Pultenaea reticulata		246
Sphaerolobium medium		186
Stackhousia monogyna		60
Synaphea whicherensis		340
Xanthorrhoea brunonis		291
Xanthorrhoea gracilis		605
Xanthorrhoea preissii		121
	2083	10376

Appendix 2.2 – Goulden Rd Seedling List 2020 – Geographe Community Nursery

Goulden Rd Reserve 2020 Seedling Order -

	Quantity	Per Section (5 Sections)
Acacia extensa	240	**48**
Calothamnus sanguineus	240	**48**
Grevillea trifida	148	**30**
Hakea amplexicaulis	144	**29**
Hakea ruscifolia	100	**20**
Kunzea rostrata	348	**70**
Melaleuca thymoides	260	**52**
Patersonia occidentalis	520	**104**
Total	**2000**	**400**

Appendix 2.3 – Main Rehab Seedling List 2021 - Nuts About Natives

Adenanthos meisneri	69
Agrostocrinum hirsutum	4
Amphipogon amphipogonoides	3
Billardiera floribunda	20
Billardiera variifolia	166
Boronia crenulata subsp. pubescens	46
Chamaescilla corymbosa	42
Comesperma virgatum	236
Dampiera linearis	84
Dasypogon bromeliifolius	376
Gompholobium knightianum	237
Gompholobium marginatum	157
Gompholobium polymorphum	50
Gompholobium venustum	41
Grevillea quercifolia	16
Grevillea trifida	87
Haemodorum laxum	23
Hibbertia amplexicaulis	91
Hibbertia glomerata subsp. glomerata	122
Hibbertia pilosa	6
Hibbertia vaginata	86
Hovea chorizemifolia	37
Hovea trisperma	358
Hypocalymma robustum	224
Hypolaena exsulca	420
Isopogon sphaerocephalus	7
Labichea punctata	16
Lechenaultia biloba	152
Opercularia apiciflora	53
Patersonia umbrosa var. xanthina	19
Persoonia longifolia	80
Philotheca spicata	252
Podocarpus drouynianus	129
Pultenaea reticulata	168
Sphaerolobium medium	34
Stackhousia monogyna	19
Tetraria sp Jarrah Forest	1288
Total	**5218**

Appendix 2.4 – Main Rehab Seedling List 2022 - Nuts About Natives

Yoongarillup Seedling Supply 2022

Nuts About Natives Species	Amount	Notes
Amphipogon sp.	25	
Grass from seed supplied with amphipogon (from Yoongarillup)	12	
Billardiera floribunda	24	
Billardiera variifolia	48	
Boronia defoliata	46	
Comesperma virgatum	53	
Corymbia calophylla	720	Keystone
Dampiera linearis	100	Keystone
Dasypogon bromeliifolius	126	
Eucalyptus marginata	720	Keystone
Grevillea trifida	41	Keystone
Hibertia amplexicaulis	42	Keystone
Hibertia glomerata	84	
Hibertia vaginata	42	Keystone
Hovea chorizemifolia	12	Keystone
Hovea trisperma	72	Keystone
Lechenaultia biloba	114	
Opercularia apiciflora	22	
Philotheca spicata	168	
Stirlingia latifolia	34	Keystone
Tetraria sp "Jarrah Forest"	48	Keystone
	2553	

Appendix 3.1 – Field Monitoring Report Summary – Species Monitoring

Cape to Life

Total Species List - Quadrat Summary

Early Spring 2022 (To be compiled twice yearly)

Quadrat Averages	
Mean Species Richness	43.93
Mean Overstorey Species Richness	5.20
Mean Keystone Species Richness	22.33
Mean Stems/ha of Cockatoo Habitat	733
Mean Weed Cover %	< 1%
Total 'Area A' Species Richness	113

Table Key: Present in 'Area A' | Black Cockatoo Habitat Species - Mean | *Keystone | ^Overstory

Species	Present?	*Keystone Species	^Overstory Present?
*Acacia extensa	3.13	*Persoonia elliptica	0.00
Acacia stenoptera	0.33	*Persoonia longifolia	0.27
*Acacia pulchella var. glab	32.93	Petrophile linearis	0.07
Adenanthos barbiger	0.07	*Petrophile serruriae (RS)	1.27
*Adenanthos meisneri	0.80	Philotheca spicata	1.27
Agonis flexuosa	0.00	Platysace tenuissima	0.00
Agrostocrinum hirsutum	0.00	Podocarpus drouynianus	0.33
*^Allocasuarina fraseriana	1.67	Pultenaea reticulata	0.73
Amphipogon amphipogonoides	0.00	Quinetia urvillei	0.00
*Anarthria prolifera	0.00	Sphaerolobium medium	1.73
Andersonia micrantha	0.00	Stackhousia monogyna	0.33
*^Banksia attenuata	0.40	*Stirlingia latifolia	0.47
Banksia dallanneyi subsp. sylvestris	0.00	Synaphea whicherensis	0.67
*^Banksia grandis	1.47	*Netrostylis sp. Jarrah Forest	0.53
Banksia sessilis var. sessilis	0.07	Trachymene pilosa	0.00
Billardiera floribunda	0.33	Xanthorrhoea brunonis	0.00
Billardiera variifolia	0.53	*Xanthorrhoea gracilis	0.00
*Boronia crenulata subsp. pubescens	0.00	*Xanthorrhoea preissii	0.00
Boronia defoliata	0.47	*^Xylomelum occidentale	0.07
*Bossiaea ornata	2.60	Other Species / Natural Recruitment	
Calothamnus sanguineus	3.67	??	0.00
Chamaescilla corymbosa	0.00	Acacia celastrifolia	0.00
Chorizema glycinifolium	0.00	Acacia flagelliformis (P4)	0.07
Comesperma virgatum	0.73	Acacia ? mooreana	0.00
*^Corymbia calophylla	0.73	Acacia ?	0.00
*^Corymbia haemotoxylon	0.53	Amphipogon ? sp.	0.27
Cyathochaeta equitans	0.00	Anigozanthos manglesii	0.00
*Dampiera linearis	0.67	Austrostipa flavescens	0.00
*Dasypogon bromeliifolius	1.40	Conostylis aculeata ? Subsp.	0.07
Daviesia cordata	0.07	? Cyathochaeta	0.00
*Daviesia physodes	0.13	Daviesia elongata subsp. elongata (T)	0.00
*^Eucalyptus marginata ssp. marginata	0.87	Daviesia rhombifolia	0.00
*Gompholobium knightianum	0.73	Dillwyna ? sp.	0.00
*Gompholobium marginatum	0.93	Drosera erythrorhiza	0.00
Gompholobium polymorphum	0.00	Drosera pallida	0.00
Gompholobium venustum	0.40	Drosera pulchella	0.00
Grevillea quercifolia	0.80	Drosera stolonifera	0.00
*Grevillea trifida	2.47	Gompholobium capitatum	0.20
Haemodorum spicatum	0.40	Gompholobium ? confertum	0.27
*Hakea amplexicaulis	0.53	Gompholobium ovatum	0.13
*Hakea ruscifolia	0.67	Gompholobium ? sp.	0.00
Hardenbergia comptoniana	0.00	Hibbertia racemosa	0.00
*Hibbertia amplexicaulis	0.53	Hovea eliptica	0.00
*Hibbertia commutata	0.00	Jacksonia ? horrida	0.13
Hibbertia glomerata subsp. glomerata	2.13	Jacksonia preisii	0.07
*Hibbertia hypericoides	0.13	Juncus pallidus	0.07
Hibbertia pilosa	0.07	kunzea glabrescens	0.00
Hibbertia quadricolor	0.00	Lepidosperma ? squamatum	0.20
*Hibbertia vaginata	1.07	Lepidosperma ? sp.	0.00
*Hovea chorizemifolia	0.20	Lobelia rhombifolia	0.00
*Hovea trisperma	0.60	Microtis media	0.07
Hypocalymma robustum	0.40	Monocot ?	0.07
Hypolaena exsulca	1.53	Pimelia rosea	0.00
*Isopogon sphaerocephalus	0.00	Rhodanthe citrina	0.00
Kennedia carinata	0.00	Stylidium ? sp.	0.00
*Kennedia coccinea	0.27	Synaphea floribunda	0.07
*Kennedia prostrata	0.00	Synaphea petiolaris	0.33
Kunzea rostrata	45.07	Thyanotus multiflorus	0.73
*Labichea punctata	0.00	Viminaria juncea	0.00
Lechenaultia biloba	1.60	Xanthorrhoea ? sp.	0.20
Leucopogon conostephioides	0.00	Morelotia octandra	0.00
*Leucopogon propinquis	0.00	Pentapeltis peltigera	0.00
Logania serpyllifolia	0.13	Levenhookia pusilla	0.00
Lomandra sp. large fruit	0.00		
Loxocarya cinerea	0.07		
Loxocarya striata	0.00		
*Macrozamia reidlii	0.00		
*Melaleuca thymoides	10.93		
Mesomelaena tetragona	0.47		
Neurachne alopecuroidea	0.00		
^Nuytsia floribunda	0.13		
Opercularia apiciflora	0.53		
Patersonia occidentalis	0.27		
*Patersonia umbrosa var. xanthina	0.07		
Patersonia ? sp.	0.20		
Pericalymma ellipticum var. ellipticum	3.00		

Appendix 3.2 – Field Monitoring Report Summary – Vegetation Monitoring

Cape Life

Vegetation Monitoring - Quadrat Summary

Late Spring 2022 (To be compiled quarterly)

Project Name: P110 Doral Yoongarillup **Date:** 28/11/2022
Quadrat size: 10m x 10m

Score	Cover/abundance of species within quadrat	4.6
1	Rare or of low cover (<2%)	
2	Present but in low numbers (2% - 10%)	
3	Common locally (10% - 30%)	
4	Common over whole area (30% - 70%)	
5	Completely Dominating (>70%)	X

Average height of species (mm)	
Tree species	410.27
Shrub species	512.53

Average health overstorey species		6.6
Score	Crown Extent and Density	Score
0	None (0%)	
1	Minimal (1-10%)	
2	Sparse (11-20%)	
3	Sparse - Medium (21-40%)	
4	Medium (41-60%)	
5	Medium - Major (61-80%)	
6	Major (81-90%)	
7	Maximum (91-100%)	X

Average health understorey species		4.7
Score	Description	Score
0	Dead shrub	
1	<20% canopy	
2	21-40% canopy	
3	41-60% canopy	
4	61-80% canopy	
5	>81% canopy	X

Average health overstorey species - tip growth, epicormic growth & leaf die off					
Score	Description	Definition (regarding assessable crown)	Leaf die-off/yellowing	New tip growth	Epicormic growth
Average			0.60	1.47	0.0000
0	Absent	Not visible			X
1	Scarce	Present but not readily visible	X	X	
2	Common	Clearly visible throughout			
3	Abundant	Dominates the appearance			

Appendix 4 – Field Monitoring Data Sheets

*Please see attached file included

Appendix 5 – Biosoil Inputs Timeline

Bio Soil Solutions
PO Box 37 Vasse WA 6280
T: 08 9755 4189
E: info@biosoilsolutions.com.au
ABN: 59 620 557 673

For: Brook Divine

BIOSOIL PRODUCT APPLICATIONS RECORD
YOONGARILLUP REVEGETATION SITE

Please find below information for the 8Ha Doral Mineral Sands revegetation site at Yoongarillup as requested.

Products supplied by Biosoil Solutions and applied by BioAg Contractors.

Date	Product	Quantity	Application information
24/07/2018	Bio+ BREW	2000L	BioAg sprayed onto timber pile by hand
14/05/2019	Bio+ BREW	2000L	BioAg ute sprayed onto approx 3Ha at Sues Road end of site
23/09/2019	Bio+ BREW	2000L	BioAg ute sprayed onto whole 8Ha site
27/11/2019	Soil biological review		Biosoil Solutions issued Soil Biological Assessment on 3 samples taken from site (labelled TOP, MIDDLE, BOTTOM)
28/04/2020	Bio+ BREW	2000L	BioAg ute sprayed onto whole 8Ha site
23/06/2020	Soil biological review		Biosoil Solutions issued Soil Biological Assessment on 4 samples taken from site by PBS (labelled #1, #2, #3, #4)
*01/09/2020	Custom biostimulant blend		As per recommendations in recent Soil Biological Assessment

Soil chemistry analysis and consulting is conducted through Colin Bosustow, PBS.

Please contact the office for further product or application information regarding this site.

Brent Burns
Director

APPENDIX 7

Yoongarillup Weed Monitoring Report (Ecoedge)

2020 Weed Abundance Survey Adjacent to Area A Yoongarillup Mineral Sands Project

Prepared for Doral
August 2021

PO Box 9179 Picton WA 6229
enquiries@ecoedge.com.au

Executive Summary

In spring or early summer 2017, 2018 and 2020 weed surveys were carried out along transects adjacent to the mining area within State Forest (Area A) at the Yoongarillup Mineral Sands project to determine whether mining or the subsequent rehabilitation caused an increase in weed cover or number of species. These weed surveys were in response to a requirement by the EPA under Section 7.2 of the Flora and Vegetation Monitoring Plan (FVMP) for the project.

Results from the 2017 and 2018 surveys were published in separate reports through the current report uses some of the previous year's data to illustrate changes between years in the cover and number of weed and native herbaceous taxa.

The 2020 data, along with that of the two previous surveys indicates that there has been no increase in weed cover over the three years since monitoring began.

The number of weed taxa (and of native herbaceous taxa) appears to be more related to site conditions than to distance from Area A.

The number of weed taxa appears to be influenced by winter rainfall and by the presence of previous disturbance within the State Forest and not the mining activities.

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1 Introduction

Section 7.2 of the Flora and Vegetation Monitoring Plan (FVMP) for the Yoongarillup Mineral Sands Project specifies that:

> "Quantitative weed cover/abundance assessments and qualitative native species cover/abundance assessments [would be carried out] along transects within the potential impact area"

Monitoring would be carried out to determine whether there was an increased incidence of non-native species within SF33 adjacent to the proposed pit. Thirteen sites along four transects were monitored in 2017 and 2018. However, because an area of *Phytophthora* dieback infestation had spread downhill in the area of transects 3 and four in 2019, these sites (3/3 to 3/6 and 4/3 to 4/5) were not visited in 2020. Only six sites along the two easternmost transects were revisited in December 2020 (**Figure 1**).

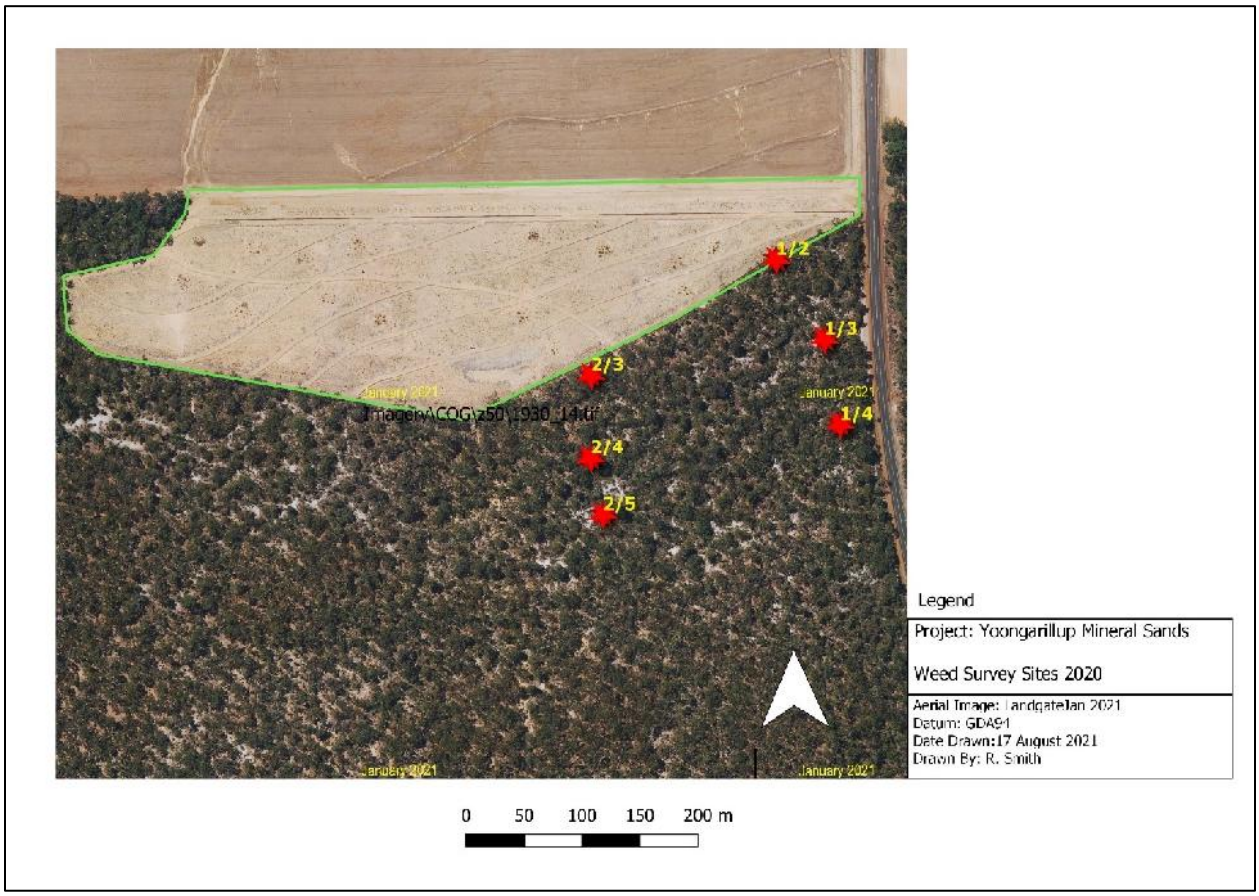

Figure 1. The survey area showing Area A cleared for mining and the sites surveyed for weeds in 2020.

2 Methods

The main purpose of the survey described here is to document the variety, frequency and abundance of exotic plants in the forest adjacent to "Area A" as described in the FVMP. There is a concern that the incursion of mining into the State Forest will create an "edge effect" and through changes in variables like micro-climate will result in an increase of the abundance of weeds in the State Forest adjacent to the mining area.

As per Figure 5 of the FVMP four transects were laid out in spring 2017 (16 Sep – 12 Oct) running from the northern boundary of "Area A" of the Yoongarillup Mineral Sands mine area into the State Forest south of Area A (**Figure 1**, **Table 1**). Along the transects at 40m to 70m intervals four 5m x 5m quadrats were laid out at right angles to the transect and marked at each corner by metal pegs. The sites situated within Area A were not able after 2017 because it was cleared prior to mining.

An area of *Phytophthora* dieback infestation had spread downhill in the area of transects three and four in 2019, so these sites (3/3 to 3/6 and 4/3 to 4/5) were not visited in 2020.

The distance of sites from the southern boundary of the mining area (Area A) visited in 2020 is shown below in **Table 1**.

Table 1. Assessments at each site, showing distance of the site from the minesite boundary.

SITE	DIST. (m)
1/2	5
2/3	12
2/4	75
1/3	85
2/5	125
1/4	152

2.1 Weed density per site

Weed presence and density within the quadrats was assessed using the point intercept method. The method involved using a 1m long steel ruler laid on the ground, with intercepts being recorded each 10 cm starting from"0". The ruler was placed in each quadrant of a quadrat with one end of the ruler touching the corner peg and the ruler orientated towards the centre of the quadrat. Using this method 160 point intercepts were recorded for each site[1]. At these sites the species name for all intercepts, including native shrubs, was recorded.

2.2 Total number of native and exotic herbaceous species per site

As well as the point intercept method of estimating weed density, a count of all native and exotic herbaceous taxa[2] in each quadrat was carried out. As with the weed density survey the data for each quadrat was summed to give a total for each site. The distance of each site from the edge of the paddock on the northern boundary of the State Forest was employed as a variable and the total number of native and exotic taxa was graphed in relation to distance.

[1] Except for Site 3/6, where there were only 3 quadrats.

[2] This included both "perennial" and "annual" native and introduced herbaceous taxa.

3 Results

3.1 Weed density

As can be seen from **Figure 2,** the cover of exotic herbaceous taxa was low and it is noticeable that at Site 1/3 (85 m away) and Site 2/5 (125 m away) from the boundary of Area A the cover was substantially less than at the previous two surveys.

It can also be seen from **Figure 2** that the cover of exotic herbaceous taxa (EHT) is very low (or effectively zero) near the minesite boundary.

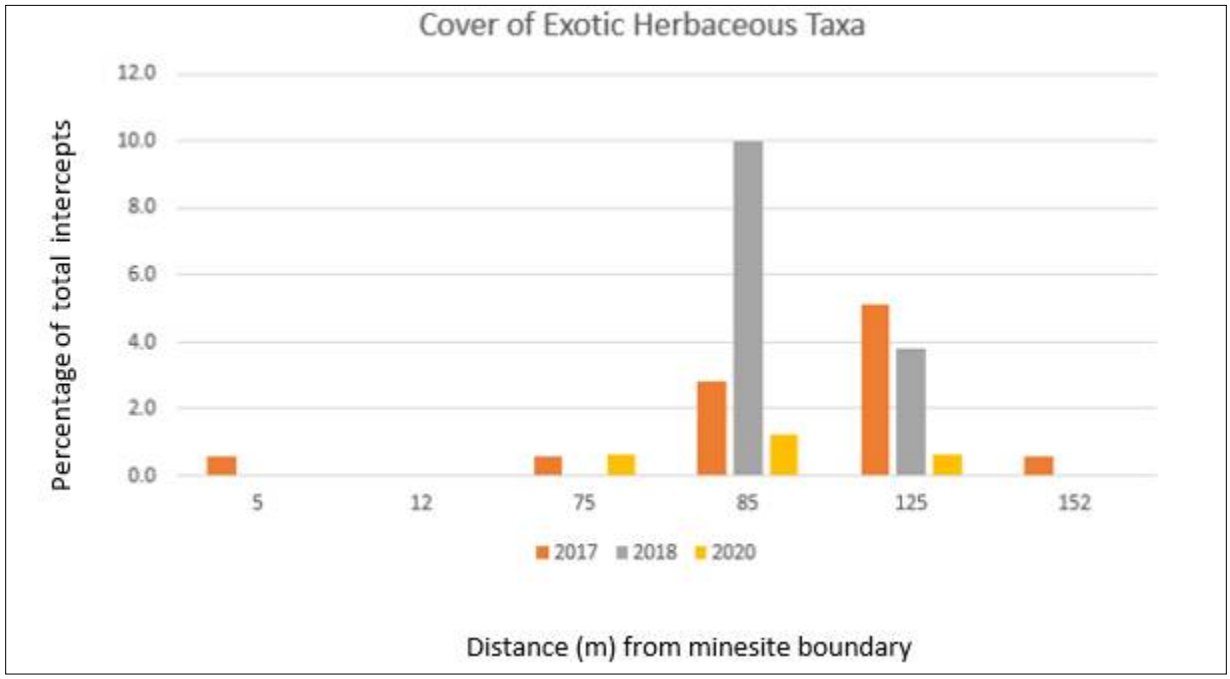

Figure 2. Percentage of total intercepts that were exotic herb species with increasing distance from the minesite boundary (Area A) win 2017, 2018 and 2020.

The cover of native herbaceous taxa[3] (NHT) for the three years of survey is shown in **Figure 3**. It is evident from **Figure 3** that the cover of NHT has varied considerably from year to year at a particular site. It is also apparent that the cover of NHT is much higher than that of EHT at all sites.

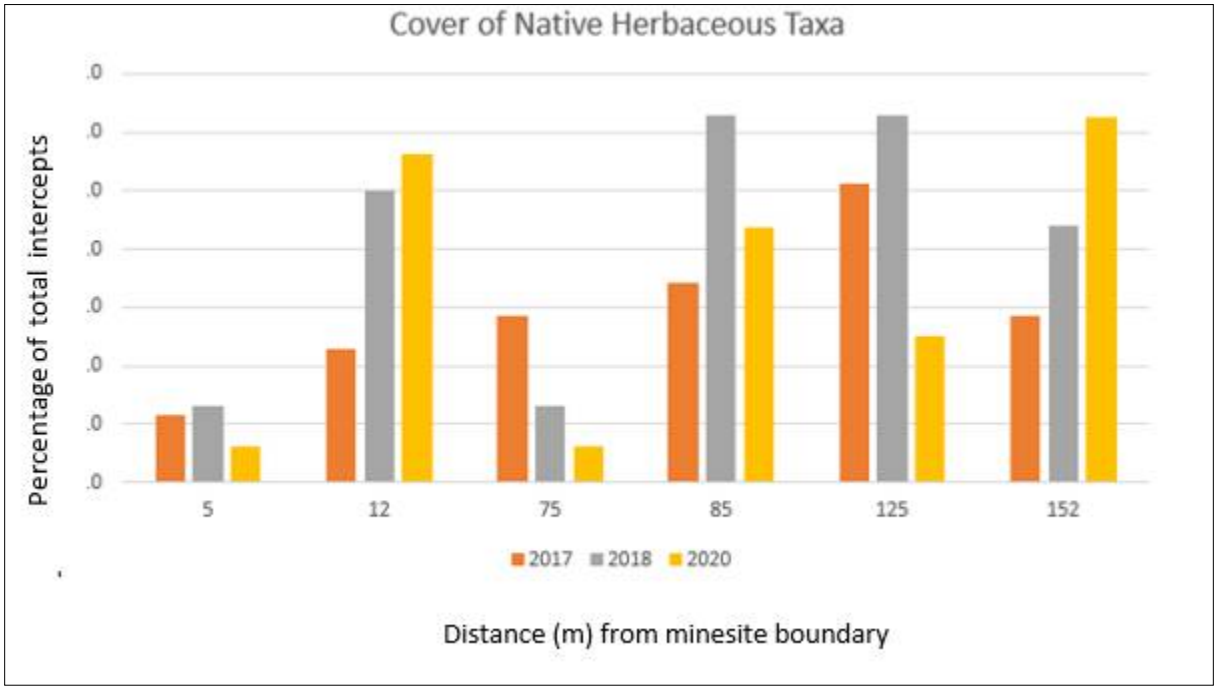

Figure 3. Percentage of total intercepts that were native herbaceous species with increasing distance from the minesite boundary (Area A) win 2017, 2018 and 2020.

There does not appear to be a negative effect of increased cover of EHT on cover of NHT for any of the years, which is not surprising given the very low cover of EHT generally.

[3] Annual and annually-regenerating taxa.

3.2 Weed numbers

The number of NHT and EHT per site for the three years of monitoring is shown in **Figure 4**, below. There was an increase in the number of EHT at all sites in 2020 compared to the previous two years though this was not accompanied by an increase in the cover of EHT in 2020 (**Figure 2**). It is also apparent that the increase in number of EHT was highest at the site furthest from the boundary. This was also the case with the number of NHT.

If the presence of EHT at a site was acting to exclude NHT it would be expected that either the number or the cover of NHT would be less at sites where the cover or number of EHT was highest. However, this is not the case.

Graphing of the numbers of NHT against numbers of EHT for each site (**Figure 5**) shows that there is a positive correlation between the number of NHT and that of EHT, which indicates that the number of taxa is more related to site conditions than competition.

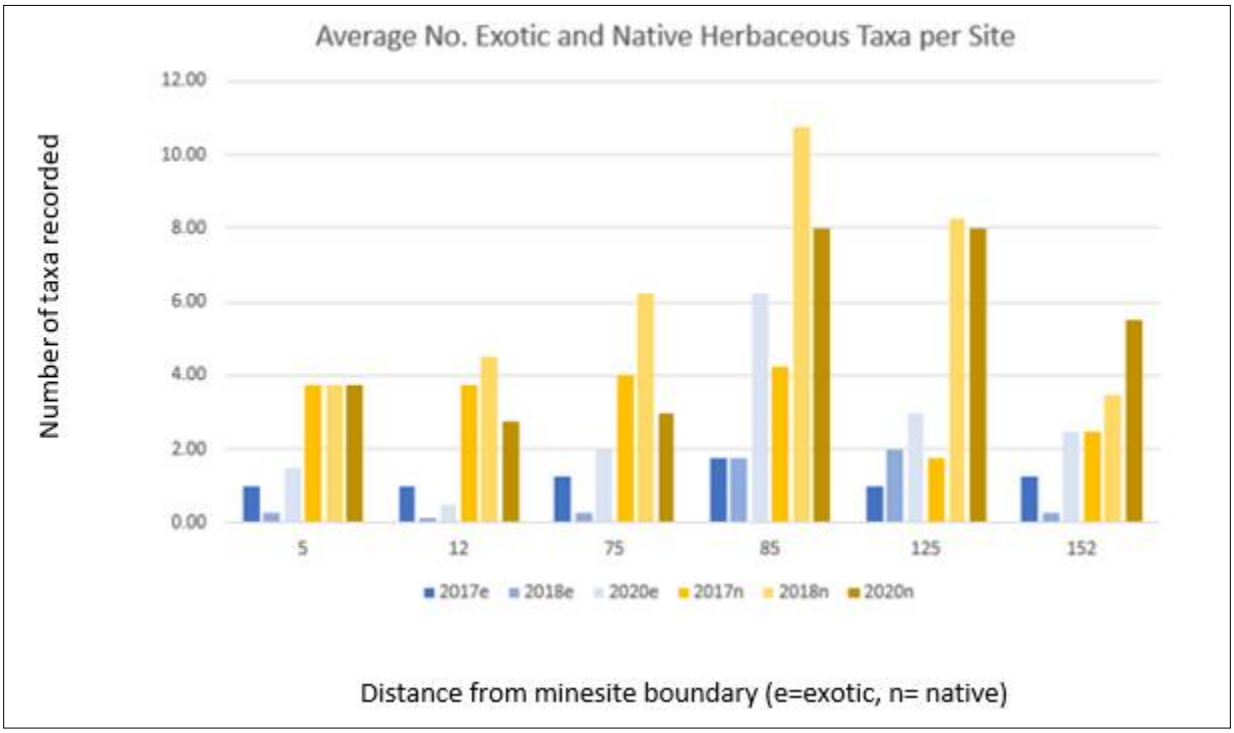

Figure 4. Average number of exotic and native herbaceous taxa per site for the three years of monitoring.

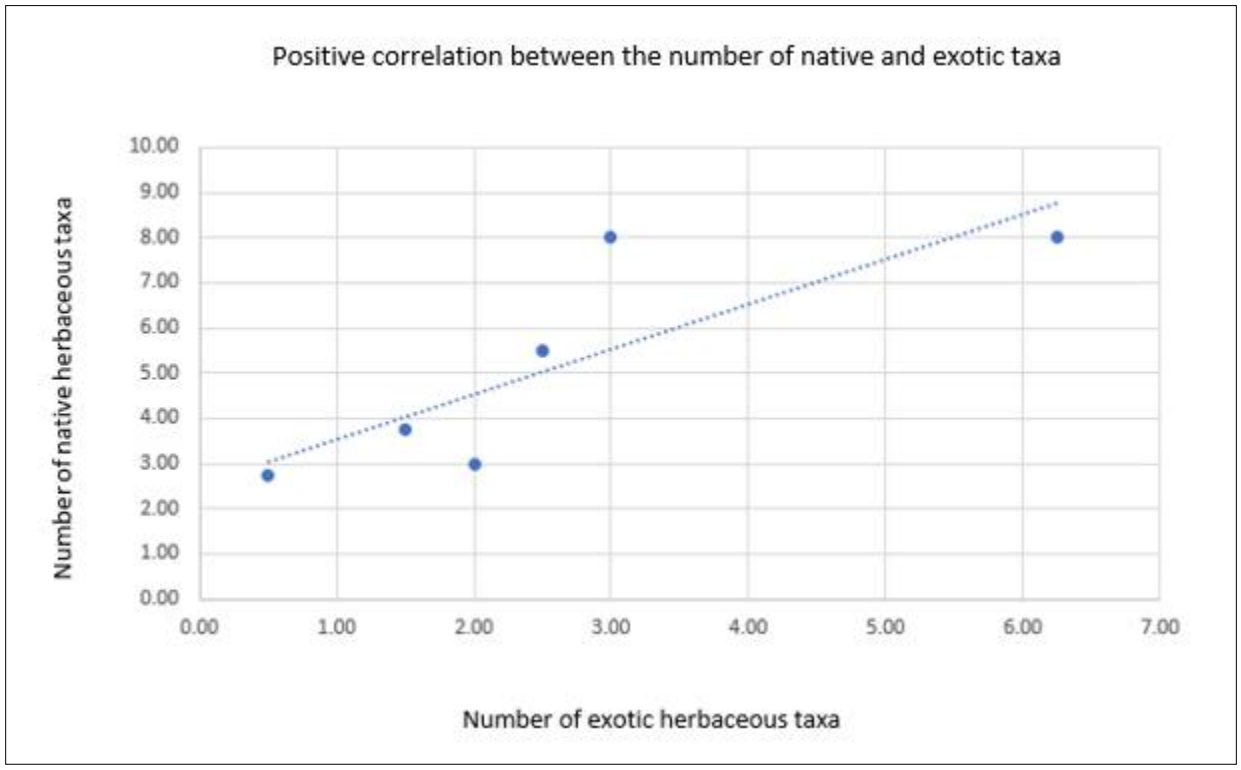

Figure 5. Relationship between number of NHT and number of EHT in 2020.

4 Conclusions

- There was low or very low cover of Exotic Herbaceous Taxa at all sites, and a substantial decrease in cover at two sites compared to 2018 values.
- The cover of Native Herbaceous Taxa appeared to be unrelated to the cover of Exotic Herbaceous Taxa.
- The cover of Native Herbaceous Taxa varied substantially (up to a factor of three) between years at all sites.
- The number of Exotic Herbaceous Taxa was higher in 2020 than at the two previous surveys at five of the six sites.
- The highest number of Exotic Herbaceous Taxa was at the three sites furthest from the boundary of Area A which is not what be expected if the source of the weeds was from within Area A.
- The positive relationship between the number of Native Herbaceous Taxa and Exotic Herbaceous Taxa indicates that the number of taxa is more related to site conditions than competition.
- The cover data does not indicate that there has been an increase in weed invasion associated with mining and rehabilitation within Area A.
- The number of weed species (Exotic Herbaceous Taxa) appears to be influenced by previous disturbance[4] and rainfall during the winter and not the mining activities.

[4] Much of the native forest adjacent to Area A was cleared sixty or seventy years ago and has regrown.

5 References

Ecoedge (2018). Weed abundance survey at Yoongarillup. Unpublished report to Doral Mineral sands.

Ecoedge (2019). Annual Report - Yoongarillup Weed Abundance Survey 2018. Unpublished report to Doral Mineral sands.

Appendix 1. Frequency of native and exotic taxa of various lifeforms within study area.

TYPE	SPECIES	Frequency
Exotic grass	*Aira caryophyllea*	13
Exotic perennial herb	*Hypochaeris glabra*	13
Native herb	*Trachymene pilosa*	13
Native herb	*Levenhookia pusilla*	12
Native perennial herb	*Caladenia flava*	11
Native perennial herb	*Lomandra hermaphrodita*	11
Native grass	*Neurachne alopecuroidea*	11
Native herb	*Quinetia urvillei*	11
Exotic grass	*Vulpia bromoides*	11
Native herb	*Phyllangium paradoxum*	10
Native perennial herb	*Lomandra integra*	9
Native perennial herb	*Lomandra sericea*	9
Native herb	*Rhodanthe citrina*	9
Native perennial herb	*Cassytha racemosa*	8
Native perennial herb	*Conostylis setigera*	8
Native perennial herb	*Drosera stolonifera*	8
Native perennial herb	*Lomandra caespitosa*	8
Native herb	*Millotia tenuifolia*	8
Native perennial herb	*Xanthosia huegelii*	8
Native grass	*Austrostipa compressa*	7
Exotic grass	*Briza maxima*	7
Exotic grass	*Briza minor*	7
Native perennial herb	*Burchardia congesta*	7
Native perennial herb	*Opercularia apiciflora*	7
Native herb	*Siloxerus humifusus*	7
Native perennial herb	*Stackhousia monogyna*	7
Native perennial herb	*Stylidium androsaceum*	7
Native perennial herb	*Stylidium repens*	7
Exotic herb	*Arctotheca calendula*	6
Native perennial herb	*Elythranthera brunonis*	6
Native herb	*Hydrocotyle callicarpa*	6
Native perennial herb	*Lomandra purpurea*	6
Exotic perennial herb	*Romulea rosea*	6
Native grass	*Tetrarrhena laevis*	6
Native perennial herb	*Thelymitra crinita*	6
Native herb	*Centrolepis aristata*	5
Native perennial herb	*Chamaescilla corymbosa*	5
Native perennial herb	*Drosera pallida*	5

Native perennial herb	*Leporella fimbriata*	5
Native perennial herb	*Lobelia tenuior*	5
Native perennial herb	*Monotaxis occidentalis*	5
Native herb	*Podotheca angustifolia*	5
TYPE	SPECIES	FREQ.
Native perennial herb	*Stylidium piliferum*	5
Native perennial herb	*Thysanotus tenellus*	5
Native perennial herb	*Wahlenbergia preissii*	5
Native herb	*Aphelia cyperoides*	4
Exotic herb	*Cotula turbinata*	4
Native herb	*Levenhookia stipitata*	4
Native perennial herb	*Lomandra suaveolens*	4
Native perennial herb	*Stylidium amoenum*	4
Exotic herb	*Ursinia anthemoides*	4
Native perennial herb	*Agrostocrinum hirsutum*	3
Native perennial herb	*Caladenia attingens*	3
Native herb	*Centrolepis drummondiana*	3
Native perennial herb	*Conostylis aculeata*	3
Native perennial herb	*Drosera* (erect)	3
Native perennial herb	*Drosera glanduligera*	3
Native perennial herb	*Patersonia occidentalis*	3
Native perennial herb	*Pentapeltis peltigera*	3
Native perennial herb	*Stylidium schoenoides*	3
Native herb	*Angianthus sp.*	2
Exotic grass	*Avena fatua*	2
Exotic herb	*Cerastium glomeratum*	2
Native herb	*Crassula colorata*	2
Native herb	*Crassula decumbens*	2
Native perennial herb	*Lindsaea linearis*	2
Native perennial herb	*Lomandra nigricans*	2
Exotic herb	*Lotus* sp.	2
Native perennial herb	*Pyrorchis nigricans*	2
Native grass	*Rytidosperma setaceum*	2
Native perennial herb	*Schoenus brevisetus*	2
Native perennial herb	*Thelymitra cornicina*	2
Native perennial herb	*Caladenia marginata*	1
Native perennial herb	*Drosera erythrorhiza*	1
Native herb	*Ficinia marginata*	1
Native perennial herb	*Haemodorum spicatum*	1
Native herb	*Hydrocotyle alata*	1
Native perennial herb	*Johnsonia acaulis*	1
Exotic herb	*Juncus capitatus*	1

Native perennial herb	*Lagenophora huegelii*	1
Native perennial herb	*Lyperanthus serratus*	1
Exotic herb	*Ornithopus pinnatifolius*	1
Native perennial herb	*Poranthera microphylla*	1
Native perennial herb	*Stylidium ?scandens*	1
TYPE	SPECIES	FREQ.
Native perennial herb	*Thelymitra* (yellow)	1
Native perennial herb	*Velleia trinervis*	1
Exotic perennial herb	*Wahlenbergia capensis*	1

APPENDIX 8

Notification of cessation of mining to DMIRS

Doral

20th October 2020

Attn: Peter O'Loughlin

Senior Inspector of Mines
Department of Mines, Industry Regulation and Safety
PO Box 500
COLLIE WA 6225

Dear Peter,

DORAL MINERAL SANDS – NOTIFICATION OF COMPLETION OF MINING OPERATIONS

As per MSI Regulations 3.12 and 3.14, Doral Mineral Sands Pty Ltd wishes to formally notify the Department of Mines, Industry Regulation and Safety of the planned closure of its Yoongarillup Mine commencing from 2nd November 2020.

The Yoongarillup Mine has been operational from January 2017 and, as scheduled, has exhausted all economic mineral sands reserves at the site. Although rehabilitation of the land has been progressive during this time, the site shall now transition into a wholly rehabilitation and closure operation. Access to open pits and site supervision shall be maintained for inspection purposes and to enable surface water management whilst rehabilitation earthworks are conducted. All legislative, reporting and operational approval commitments shall be maintained.

The Picton Plant shall remain in operation to undertake treatment of stockpiled HMC and retreatment of intermediate minerals as required and continue the toll-treatment of HMC from the Keysbrook Operations.

At the present time, employees remaining at the mine include Doral staff in preparation for the deconstruction of the mine infrastructure and transition to the next mine prospect at Yalyalup, approximately 9km to the northeast of Yoongarillup. Piacentini and Son contractors will continue the operation of earthmoving machines to conduct the mine rehabilitation earthworks.

The principal employer of the mine is Doral Mineral Sands Pty Ltd, and the registered address is Alumina Rd, East Rockingham WA 6168. The affected Mining Tenements are M70/458 and M70/459.

Attached is a site layout plan of Yoongarillup Mine as required by Section 88 of the Act.

Please do not hesitate to contact our OSH&E Superintendent Mr Craig Bovell on 0417 951 202 should you require any additional information or clarification.

Yours sincerely

Andrew Templeman
General Manager

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