FLORA AND FAUNA MANAGEMENT PLAN

ANNUAL MONITORING SUMMER 2019

CONSULTING & ENVIRONMENTAL SERVICES

ENVIRONMENTAL SCIENCE AND SOIL SCIENCE SERVICES FOR THE BLUE MOUNTAINS/ CENTRAL WEST DISTRICTS

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Cover Letter

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12th March 2019

Ron Goldbery,
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Newnes Kaolin & Sand Mine Annual Flora and Fauna Monitoring Study 2019

Dear Dr Goldbery,

Consulting and Environmental Services Pty Ltd in collaboration with Woodlands & Wetlands Pty Ltd report the results of our field assessment for flora and fauna undertaken within an annual monitoring program for the year ending February 2019.

The field assessment conducted over 22nd and 23rd February 2019 has established a fourth annual monitoring event to support the Flora and Fauna management plan for the Newnes Kaolin mine. The survey of flora and fauna on the project site and the adjacent National Park is part of the project management strategy to undertake a series of 'easily repeatable surveys that will gather a comprehensive set of data each time" (RPS, 2012, PR103669, Revised Final p 34).

This letter is Consulting & Environmental Services Ref: C&ES-005-1902 Monitoring Report FF_Dated 12/03/19. Our review specifically addresses the development of impact assessment criteria as noted by condition 30b of the project conditions of consent as outlined within the Flora and Fauna Management Plan PR103669; Revised Final / September 2012.

Further detail of methodology and the results summary are provided as Attachment A to this letter.

Yours faithfully,

Jane T. Aiken.

Dr Jane T. Aiken, PhD, BSc (Hons 1), BSc, MSusAgr, CPSS.

SUMMARY METHODOLOGY AND RESULTS

ANNUAL MONITORING

FLORA AND FAUNA

ATTACHMENT A

1.0 Introduction

Annual monitoring of flora and fauna is a review to specifically address the development of impact assessment criteria as noted by condition 30b of the project conditions of consent as outlined within the Flora and Fauna Management Plan PR103669; Revised Final / September 2012.

2.0 Methodology

Data collection to record the flora and fauna at each of the ten sites has inspected all of the 400 m^2 monitoring plots over the 22nd and 23rd February 2019. Records include using the standard set of environmental management proforma developed for the flora and fauna management plan.

An evaluation of flora species presence was undertaken using the modified Braun-Blanquet methodology closely inspected using the original survey (RPS Australia, 2012) as a guide to likely species. In addition to recording presence/ absence [per the initial survey (RPA Australia, 2012)], each species identified as being present in the original pre-bush fire survey was 'scored' on abundance in February 2019 using the following criteria. NE-not evident, R- rare (one or two specimens), O- occasional (a few isolated specimens), C- common (occurs throughout the plot), A-Abundant (numerous individuals throughout the plot), and D-the major species present at the time of the survey.

At each site, a photograph was taken viewing N, S, E, and W from the plot centre geo-reference location. Additional photographs record typical ground cover and canopy cover.

Faunal habitat was recorded by topographic position, plot quality, ecological resources, species diversity, ground-cover by trees and shrubs, canopy, geology and soils. The presence of birds, invertebrates, and vertebrate species was noted.

The ground cover at each site was recorded using a toe-point transect traversed diagonally from corner to corner of the 20 m x 20 m monitoring quadrat. Along the toe-point transect at every two-metre interval, the data collected included the type of ground cover and its proportion within a 50 cm x 50 cm quadrat area. Through this process, a model is being developed to quantify the ground cover for all the monitoring sites over the now four years monitoring since baseline in 2016.

Our method for quantifying and characterising the site habitat is called the Ground Cover Value (GCV) and is developed for this project. The GCV model computes a Ground Cover Value that will initially identify the re-establishment of a fire damaged understorey. The premise of the calculation is that vegetation is layered and therefore a percentage cover value can total more than 100. When the GCV is 1 or greater, then the site has a full cover on the fire-damaged soil.

The attributes in the measurement include the amount of bare soil, the ground with the exposed rock of < 100 mm size and bedrock; the organic matter comprising charcoal, leaf litter, the timber and bark and the various herbs, forbs and shrubs or trees encountered in the monitoring along the transect. All these except the organic matter of the leaf litter is the emergent vegetation layer. Consequently, the successional attributes of a monitoring site are being captured within four categories. 1) A1 as exposed surface soil; 2) R as inorganic as the regolith; 3) O as organic cover and

4) E as emergent cover, where emergent cover is any plant growing from the regolith, soil or litter surface.

Our record and quantification about groundcover continues. In 2018 we established at each of the ten monitoring sites, four one metre quadrats located at a randomly identified 8 m distance from the centre of each, and these were sampled on the north, east, south, and western aspects. In order to assist with time constraints this year we recorded the total number of plants of each quadrat along the diagonal transect against the total number of species. The ratio between individuals and species is termed the Species Establishment Ratio as a factor of density for a given ground area..

Also for the 2019 assessment we have included a value for average species richness. On its own, species richness is the number of different species represented in a community. Sampling for species richness is now possible because of the increase in diversity of all plant species at all monitoring sites.

The report also has notation of other species being the ecological observations for the flora and fauna assessment.

In summary, the methodology for assessment in 2019 reflects the 2018 monitoring within the scope of:

1. Evaluation of Canopy Tree Health for 2019. Stand health was assessed using the methodology of Grimes, (1978)
2. Quantification of change in ground cover using the Ground Cover Value to account for changing emergent species.
3. Ecological observations including notation of avifauna presence during the assessment time at each of the ten plots.
4. Quantification of average ground cover species richness as a characteristic of an establishing understory after the 2013 bushfire.

3.0 Result Summary

3.1 Ground Cover

Our initial comparison indicates that ground cover value (GCV) for the organic cover (leaf litter) has increased. The differences between the sites in their aspect and position are becoming evident with either a change in species diversity, organic matter turnover, or surface water catchment position. For example site 10 was completely devoid of organic cover now has a full leaf litter layer with a minimal emergent cover. In this case the O cover is 1.0 and the emergent cover is 0.032. Alternatively, the site 8 has and O + E cover of 0.759 comprising and O of 0.533 and E of 0.227 for the 2019 records.

Figure 3-1 presents the GCV for organic cover (leaf litter, micro-terraces, charcoal) in the monitoring year 2019 as an indication of species establishment. For the 2019 monitoring, the site 1 and site 5, with a low GCV of organic leaf litter had higher species establishment ratios of more than 50. All other sites had species establishment ratios of less than 25. At sites 1 and 5 the organic GCV very low compared to all other sites. Site 1 and Site 5 were not burnt in the October State Mine Gully 2013

bushfire. They both have a high Species Establishment Ratio, is represented by the > 1.0 Emergent GCVs.

3.2 Evaluation of canopy tree health

Virtually all the trees had suffered fire damage. Many had fallen over, leaving charred stumps. Fire damage was evident over the entire trunks of most trees. This made species identification difficult. However, it also provided an opportunity to assess strand health some 60 months after the fire.

Stand health was assessed using the methodology of Grimes (1978).

Tree health was scored for:

A- Crown position
B- Crown size
C- Crown density
D- The occurrence of dead branches
E- Epicormic growth

The results of the 2019 evaluation are shown below indicating that the average total stand health score is 18.7 with a maximum rating of 27 (Table 3-1).

3.3 Species Richness

In 2019 the ground cover had increased in both species number and abundance. Records for each monitoring site have noted the total abundance of all species and the number of species. Table 3-2 identify that average species for all sites are more than 3.

3.4 Avian Habitat and Understorey Development

The resultant increase in canopy cover is noted with the corresponding record of avian fauna calls. Together with the variety of bird calls heard but not seen at the sites 2, 3, 5, 6, 7 and 9, the regeneration of the forest canopy cover is also indicated by the diversity present from other ecological groups. The spider (Araneae), fly (Diptera), butterfly (Lepidoptera), ant (Formicidae), termite (Isoptera), and the grasshopper (Orthoptera) were observed while sampling and recording the ground cover observations (Table 3-3). In the 2019 record we included the presence of flowering plants observed.

3.5 Site Damage, Weeds, Erosion

No site damage, no weeds and no erosion were observed at any of the monitoring sites.

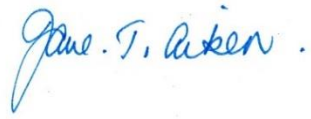
3.6 Grazing and Revegetation

Grazing was noted, but not distinctly evident.

Close

Our 2019 monitoring provides the record of the forest vegetation and its re-establishment after bushfire and before the Newnes Kaolin mine commencing operations. This year in 2019, the understory development had further advanced to the stage that plant species and abundance were quantifiable as a species establishment ratio. With this calculation we observe that when the leaf litter is low and the plant species and their abundance of known unburnt sites are high in comparison to the burnt sites. We also identify that succession on burnt sites is characterised by increasing species richness and therefore changes in the dynamics of the species ecology will be expected. Similarly, the total stand health score has reached an average of 18.75, which is an increase from the value at 15.6 we reported in the baseline dataset of March 2016.

Yours faithfully,



Dr Jane T. Aiken PhD, BSc(Hons), BSc, MSusAgr, CPSS.

12st March 2019.

Tables and Figures

Figure 3-1 Species Establishment Ratio and Organic Ground Cover

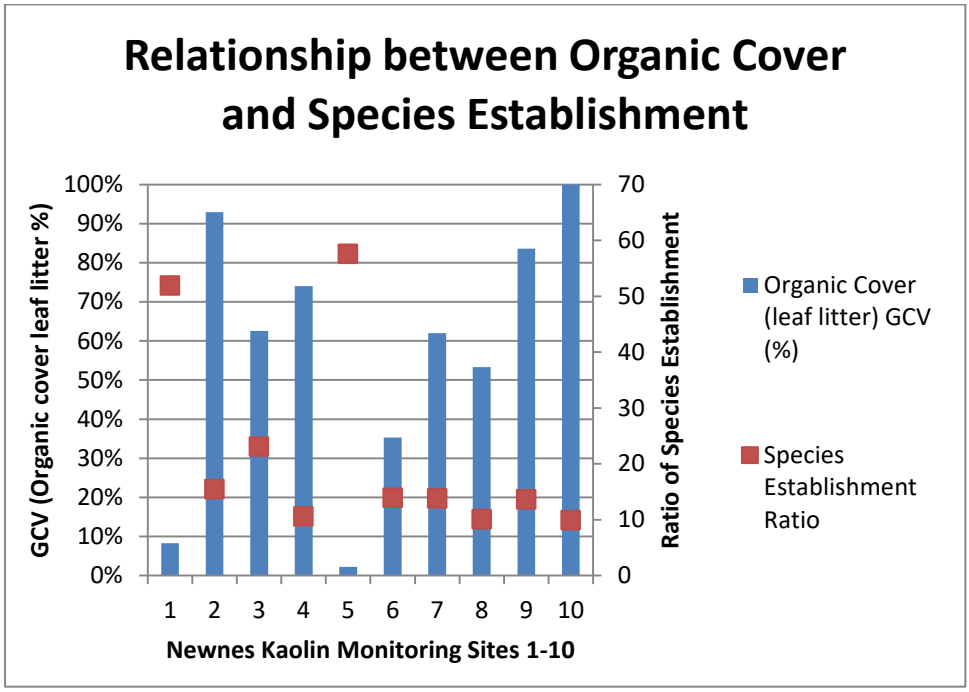


Table 3-1 Tree health Scores 2019

Plot number		Crown position	Crown size	Crown density	Occurrence of dead branches	Occurrence of epicormic growth	Total stand health score
		Score of 1 to 5	Score of 1 to 5	Score of 1 to 9	Score of 1 to 5	Score of 1 to 3	Max score is 27
1		4	2	7	3	1.5	17.5
2		4	3	7	3	2	19
3		4	3	7	2	2	18
4		4	3	7	3	2	19
5		4	3	7	3	3	20
6		4	3.5	6	2.5	1.5	17.5
7		4	3	7	3	2	19
8		4	3.5	7	3	2.5	20
9		3	3	6	2.5	2	16.5
10		4	4	6	4	2.5	18.5
Average		3.9	3.1	6.7	2.9	2.1	18.7

Table 3-2 Average Groundcover Plant Species in monitoring sites

Newnes Kaolin Monitoring Site – Feb 2019	Average # Species
1*	3.5
2	5.9
3	3.9
4	3.4
5**	6.7
6	5.9
7	4.7
8	3.1
9	3.5
10	3.2
* watercourse unburnt	-
*riparian unburnt	-

Table 3-3 Common notation of other species [ecological observations] for flora and fauna

Monitoring Site	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	
Wombat					•				•		
Spider								•			
Flies				•	•		•	•	•		
Bird Calls		2	6		5	5	6				
		S & P			S	S	S				Parrot [C]
Bird Sighted									•		Brown Thornbill
Ants / Termites		•					•	•		•	
Beetle								•			
Flowering Plants [Present]	•	•		•	•		•	•			[White flowers only]
Insects				•	• cricket		• golden brown butterfly				