



## Appendix 5

### Rehabilitation Monitoring Report



# Native Vegetation Rehabilitation Monitoring 2017

## Mount Thorley Warkworth and Hunter Valley Operations

Prepared for Coal & Allied

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*Cover photograph: Native rehabilitation at monitoring site*

## Executive summary

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### Context

Niche Environment and Heritage Pty Ltd (Niche) was commissioned by Coal & Allied Operations Pty Ltd (C&A) to undertake the second-round of native rehabilitation post-mining monitoring at the Mt Thorley Warkworth (MTW) and Hunter Valley Operations (HVO) mine sites. The monitoring forms part of the MTW and HVO monitoring program, which aims to assess the recovery of native rehabilitation within the HVO and MTW rehabilitation areas. The monitoring follows on from the first round monitoring undertaken by Niche in February and March 2016 at the same sites (Niche, 2016). The latest round of monitoring re-visited 16 of the 18 HVO sites and 16 of the 17 MTW sites monitored in 2016.

### Methods

This monitoring report provides the results of the progress of the native vegetation rehabilitation and was undertaken largely in accordance with the methodology detailed in AECOM (2012) *Monitoring Methodology - Post-mined Lands MTW and HVO North Mine Sites*. Two notable amendments to the methodology were employed, based on lessons learnt during the 2016 monitoring period. These amendments include:

- Removal of the 1 x 1 metre pasture/groundcover monitoring and replacement with a BioBanking plot (including a nested 20 x 20 metre plot at each site).
- Introduction of stem density counts along two, two metre strips along the length of the 50 metre centre tape.
- Introduction of tree tagging, where endemic trees with a DBH larger than 5 centimetres were marked and numbered, and specific details of each tree was recorded.

### Aims

The aim of the monitoring program is to undertake follow-up monitoring of rehabilitation sites established during 2016 across the rehabilitation areas and at 12 reference sites established at Belford National Park and within biodiversity offset areas owned by Rio Tinto and Peabody Energy. The reference sites have been selected to target Biometric Vegetation Types (BVTs) specified in the respective Mining Operations Plans (MOP) for MTW and HVO, these communities include:

1. HU701 Central Hunter Grey Box-Ironbark Woodland.
2. HU632 Central Hunter Ironbark-Spotted Gum-Grey Box Forest.

The data obtained during the monitoring has been presented in this report and compared with baseline data collected during the 2016 monitoring period.

### Results

Whilst a total of 35 rehabilitation monitoring sites were established across HVO and MTW native vegetation rehabilitation areas during 2016, follow-up monitoring was not undertaken at three of these original sites. It was decided that sites HVORIV201301 and HVOCHE201301 would not be re-visited in this round of monitoring because these sites had not yet had the native seed mixes planted into them. Site MTWNP201401 was planned to be re-visited in this round of monitoring but was mistakenly omitted. This site will be monitored in the next round of monitoring at MTW planned for Q2 2017. This report compares the data from 2016 with the data collected at the 12 reference sites and 32 monitoring sites in 2017.



Key findings include the following:

- There is significant variation in the types and ages of the rehabilitation sites that were part of the monitoring project, and therefore there is a high degree of variability in monitoring results - this includes native plant species richness, exotic cover, percentage cover, and projected cover of all strata.
- Data was collected from each reference site and compared to the NSW Office of Environment and Heritage (OEH) benchmarks for the two target BVTs. Notable differences include low values for native mid-storey, native ground cover (shrubs), and number of trees with hollows within the local reference sites. The low reference site values for these attributes may not provide C&A with a performance indicator suitable to measure rehabilitation progress.
- Generally the rehabilitation sites fell below reference site and benchmark values for both of the target communities. This means that management should aim to increase those attributes for each rehabilitation site in which it is lacking.
- Rehabilitation sites were achieving local benchmark values for some of BioBanking site attribute values including; NOS; NMS; NGCG; NGCS and NGCO .
- Weed abundance was high across all monitoring sites. This is to be expected for some sites given they were still in the early phases of weed clean-up prior to sowing native seed mixes.
- Landscape Function Analysis (LFA) scores (Landscape Organisation Index (LOI) and soil surface indicators) were high for reference sites, and variable for rehabilitation sites.
- Weather conditions varied greatly between the 2016 and 2017 monitoring seasons, the impact of which was conspicuous on the degree of native cover and diversity.
- LOI at the reference and rehabilitation sites was generally high, with an average LOI of .98 (an increase from 2016) for the reference sites and .77 at the rehabilitation sites.
- The variability in the range of scores however was greater at the rehabilitation sites when compared with the reference sites. The variability in values at the rehabilitation sites is likely to be influenced by the seed treatments applied to sites and the age of the rehabilitation.
- Similar to the outcomes observed in 2016, many of the rehabilitation sites with an LOI of 1 achieved this result due to the high density of grass species (whether native or exotic).
- Sites which achieved relatively low LOI indices were sites that had only recently been established and exhibited little grass or plant cover. These were the same sites that achieved the lowest LOI scores in the 2016 monitoring period, highlighting that perhaps that LOI values cannot be expected to change over short time periods.
- Sites where tree species richness met benchmark often had higher densities of trees than the reference sites and will eventually need to be thinned to allow other species of shrubs, herbs, forbs and grasses to establish and meet benchmark.
- No rehabilitation sites reached benchmark for 'other', these include species of herbs and forbs. Possibly due to the area receiving extremely hot weather before monitoring, many of these sites struggled to reach 50 percent of the benchmark required.
- Tree health was not a variable recorded during this year's monitoring program and should be included in future monitoring.
- Flowers and buds were recorded within the rehabilitation area, showing some of the rehabilitation sites are maturing and beginning to become capable of recruitment.
- Improving the MOP Performance Criteria table by combining and refining duplicate performance criteria and creating a numbering system so that specific performance criteria can be referenced should assist in streamlining assessment against the performance criteria.
- Sites are at various stages of rehabilitation when compared against performance criteria outlined in the MOP.
- Many of the sites meet most the performance criteria for growth medium development. MTWNPN200901 met all of the criteria for growth medium development.

- While only 8 sites out of the 32 rehabilitation sites had trees greater than five centimetres DBH, the species diversity of maturing trees was relatively high. Three sites exceeded benchmark, three sites fell between 50-100 percent and only two fell between 10-50 percent. This places sites on a positive trajectory, to meet other performance criteria around canopy development with extra time.
- MTWMT0200503 was the only site to meet benchmark for the abundance of native understory species per square meter. Overall rehabilitation sites averages fall between 10-50 percent of the benchmark value.

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## Abbreviations

Acronym	Term/Definition
BBAM	BioBanking Assessment Methodology
BVT	Biometric Vegetation Type
C&A	Coal & Allied Operations
Dbh	Diameter at breast height
EEC	Endangered Ecological Community
EPC	Exotic Plant Cover
FL	Fallen logs
ha	Hectare/s
HVO	Hunter Valley Operations
Km	Kilometre
LFA	Landscape Function Analysis
LFI	Landscape Function Index
LOI	Land Organisation Index
MOP	Mining Operations Plan
MTW	Mount Thorley Warkworth
NGCG	Native ground cover grasses
NGCO	Native ground cover other
NGCS	Native ground cover shrubs
NMS	Native midstorey
NOS	Native overstorey
NPS	Native plant species
NTH	Number of trees with hollows
NPWS	National Parks and Wildlife Service
OEH	NSW Office of Environment and Heritage (formerly DECCW, DECC, DEC)
OR	Overstorey regeneration
PCT	Plant Community Type
SSCI	Soil Surface Condition Indicators
TSC Act	Threatened Species Conservation Act 1995 (NSW)

## 1. Introduction

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### 1.1 Overview

Niche Environment and Heritage Pty Ltd (Niche) was commissioned by Coal & Allied Operations Pty Ltd (C&A) to undertake the second year of native rehabilitation post-mining monitoring sites at the Mt Thorley Warkworth (MTW) and Hunter Valley Operations (HVO) mine sites (Figure 1Figure 12). The monitoring forms part of the MTW and HVO monitoring program, which aims to assess the recovery of native rehabilitation across 16 individual HVO rehabilitation areas, and 16 individual MTW rehabilitation areas. This document outlines this year's results in isolation, but also compares these with the data collected during the baseline surveys undertaken during 2016 (Niche 2016).

This monitoring report provides the results of the progress of the native vegetation rehabilitation. Monitoring methods implemented were largely consistent with the methodology detailed in Monitoring Methodology - Post-mined Lands MTW and HVO North Mine Sites (AECOM 2012).

Information available from the relevant Biobanking benchmark sites and monitoring data from the reference sites have been used to inform the performance criteria targets for native vegetation rehabilitation in the Mining Operations Plan (MOP) for MTW, HVO North and HVO South. The results of monitoring in rehabilitation areas have been assessed against the MOP performance criteria in this report.

### 1.2 Background to the rehabilitation monitoring

Rehabilitation monitoring at MTW and HVO is undertaken to satisfy the following regulatory obligations:

- Schedule 4 – Condition 70(h) of Development Consent DA-300-9-2002i (Warkworth Mine)
- Schedule 3 – Condition 42(g) of Development Consent DA 34/95 (Mount Thorley Mine)
- Schedule 4 – Condition 62C(j) of Development Consent DA 450-10-2003 (HVO North)
- Schedule 3 – Condition 36(e) of Project Application PA 06\_0261 (HVO South)
- Commitments made in respective Mining Operations Plans (MOPs) for MTW, HVO North and HVO South.

Rehabilitation activities at MTW and HVO involve areas of post-mined lands being returned to either a native ecosystem or a grazing pasture (or grassland). C&A has committed to recreating Endangered Ecological Communities (EEC) to a standard comparable to similar reference EECs. The EECs include Central Hunter Grey Box-Ironbark Woodland and Central Hunter Ironbark-Spotted Gum-Grey Box Forest, which are both listed as EECs under the NSW *Threatened Species Conservation Act 1995* (TSC Act). The area of rehabilitation that is proposed to be returned to EEC communities is 2,114 ha at MTW and 4 ha at HVO. Other native ecosystem rehabilitation undertaken at MTW and HVO will produce trees over grassland areas, but not necessarily conform to any particular recognised vegetation type.

### 1.3 Project scope and objectives

This rehabilitation monitoring report documents the 2017 survey results and subsequent data analysis.

The monitoring program has been undertaken largely in accordance with the methodology detailed in AECOM (2012).

The monitoring involved the following key objectives:

- Establish permanent monitoring sites within each of the rehabilitation area (16 at HVO and 16 at MTW).
- Establish permanent reference sites within target EECs (Central Hunter Grey Box-Ironbark Woodland and Central Hunter Ironbark-Spotted Gum-Grey Box Forest) to assist with target setting for MOP performance criteria.
- Complete BioBanking plots at all reference sites, and older (> 4 years) rehabilitation sites with sufficient native vegetation establishment (four sites at HVO North and five sites at MTW).
- Complete Landscape Function Analysis (LFA) at all monitoring sites.
- Complete visual monitoring at all monitoring sites.
- Complete soil analysis at all monitoring sites.
- Complete photographic monitoring at all monitoring sites.
- Complete tree health characteristic at all monitoring sites.
- Provide an analysis of results against reference sites.
- Provide recommendations to assist with the improvement of future monitoring and performance indicators.

Based on the experience of the 2016 monitoring period, the methodology outlined in AECOM 2012 was amended in the following ways:

- Removal of the 1 x 1 metre pasture/groundcover monitoring and replacement with a BioBanking plot (including a nested 20 x 20 metre plot at each site).
- Introduction of stem density counts along two, two metre strips along the length of the 50 metre centre tape. The data from these would be compared separately to gauge consistency and determine if this level of collection is required in the future. Once this data is collected, sensitivity analysis would be undertaken to determine if this is level of data collection is adequate for this purpose.
- The methodology for the collection of information pertaining to endemic canopy was made a little more prescriptive, where each canopy tree (endemic) with a DBH larger than five centimetres, was marked with a metal tree tag or similar. Each tree was given a unique number and the details including canopy health, reproductive status was recorded (flowers/fruit).

### 1.4 Monitoring team

Data collection for the first monitoring period was undertaken on 6<sup>st</sup> to 10<sup>th</sup> and 13<sup>th</sup> to 16<sup>th</sup> of February 2017. Ecologists involved with the completion of field monitoring tasks and reporting are listed as follows:

Vivien Howard	Senior Ecologist (Field survey and reporting)
Alex Christie	Ecologist (Field survey and reporting)
Dr Ross Jenkins	GIS

## 2. Rehabilitation areas

### 2.1 HVO rehabilitation areas

HVO rehabilitation consists of 16 individual areas (Figure 2/Figure 6) comprised of different rehabilitation establishment conditions. The desired outcome of the rehabilitation is to achieve a native woodland community. Details regarding the establishment and treatment for each site, including the target domain type are provided in Table 1. It is worthwhile to note that two monitoring sites established during the 2016 monitoring period were not revisited due to the native seed mixes not yet being sown; HVORIV201301 and HVOCHE201301.

Table 1. HVO rehabilitation areas, establishment conditions and target domain type

Rehabilitation area name	Area (ha)	Establishment date	Soil and seeding information <sup>1</sup>	Target domain type
HVO WES200801	3.4	2008	Topsoil, native seed broadcasted in 2008	Woodland - other
HVO WES201101	4.4	2011	Compost (with spoil), native seed hydroseeded in 2011	Woodland - other
HVO WES201301	3.7	2013	Compost (with spoil), native seed drilled in 2013	Woodland - other
HVO WES201302	12.7	2013	Compost (with topsoil), natives not sown	Woodland - other
HVO CAR200901	14.2	2009	Topsoil, native seed broadcast in 2009	Woodland - other
HVO CAR200902	7.7	2009	Topsoil, native seed broadcast in 2009	Woodland - other
HVO CAR201401	25.6	2014	Compost (with topsoil), natives not sown	Woodland - other
HVO RIV201406	3.1	2014	Compost (with topsoil), natives not sown	Woodland - other
HVO RIV201405	14.3	2014	Compost (with subsoil), native seed drilled in 2014	Woodland - other
HVO RIV201404	8.4	2014	Compost (with subsoil), native seed drilled in 2014	Woodland - other
HVO RIV201403	4.8	2014	Compost (with subsoil), native seed drilled in 2015	Woodland - other
HVO RIV201402	10	2014	Compost (with subsoil), native seed drilled in 2014	Woodland - other
HVO RIV201401	5.8	2014	Compost (with spoil), native seed drilled in 2014	Woodland - other
HVO CHE201201	20.8	2012	Compost (with topsoil), native seed drilled in 2013	Woodland - other
HVO CHE201301	12.6	2013	Compost (with topsoil), natives not sown	Woodland - other
HVO CHE201401	9.8	2014	Compost (with topsoil), natives not sown	Woodland - other

<sup>1</sup> Soil and seeding information provided by Bill Baxter (C&A)



## 2.2 MTW rehabilitation areas

The MTW rehabilitation area consists of 16 individual areas (Figure 7Figure 12) comprised of different rehabilitation establishment conditions listed in Table 2.

The desired outcome of the rehabilitation is to achieve a native woodland community.

Monitoring site MTWNPN201401 was mistakenly omitted from this round of monitoring but will be included in the next monitoring program planned for the second quarter of 2017.

Table 2. MTW rehabilitation areas, establishment and target domain type

Rehabilitation area name	Area (ha)	Establishment date	Soil and seeding information <sup>2</sup>	Target domain type
MTWNPN201301	23.1	2013	Compost (with topsoil), natives drilled Winter 2015	Woodland -EEC
MTWNPN201402	1.9	2014	Compost (with fresh sand topsoil), natives drilled 2014	Woodland -EEC
MTWNPN201403	5.5	2014	Compost (with subsoil), natives drilled 2014	Woodland -EEC
MTWNPN201101	43.3	2011	Topsoil, natives hydroseeded 2011	Woodland -EEC
MTWNPN200901	21.8	2009	Topsoil, native seed broadcasted in 2009	Woodland -EEC
MTWCDD201101	8.1	2011	Topsoil, native seed hydroseeded	Woodland -EEC
MTWCDD201301	9.1	2013	Compost (with topsoil), natives not sown	Woodland -EEC
MTWCDD201501	6.4	2015	Compost (with spoil), natives drilled	Woodland -EEC
MTWSPN201401	37.7	2014	Compost (with topsoil), natives not sown	Woodland -EEC
MTWWDL201401	4.7	2014	Compost (with topsoil), natives drilled 2015	Woodland -EEC
MTWWDL201402	8.9	2014	Compost (with topsoil), natives not sown	Woodland -EEC
MTWMT0200001	6.3	2000	Topsoil, native seed broadcasted in 2000	Woodland - other
MTWTD1201501	20.6	2015	Compost (with spoil), native seed drilled 2015	Woodland -EEC
MTWNPN200501	13.2	2005	Topsoil, native seed broadcasted in 2005	Woodland - other
MTWNPN200502	4.8	2005	Topsoil, native seed broadcasted in 2005	Woodland - other
MTWMT0200503	11.7	2005	Topsoil, native seed broadcasted in 2005	Woodland -EEC

<sup>2</sup> Soil and seeding information provided by Bill Baxter (C&A)

## **2.3 Native rehabilitation performance criteria, measures and associated indicators**

As previously discussed in Section 1.2, performance criteria for the native rehabilitation areas have been detailed in the MOP's (Coal & Allied 2015, 2016a and 2016b), and target values for the criteria have been developed based on reference site monitoring data and information available from Biobanking benchmark sites. This monitoring report provides a comparison of results for rehabilitation sites against reference sites, BioBanking benchmark values (where available) and the relevant performance criteria.

## 3. Monitoring methodology

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### 3.1 Monitoring dates

Monitoring was undertaken on 6<sup>st</sup> to 10<sup>th</sup> and 13<sup>th</sup> to 16<sup>th</sup> of February 2017. These dates are consistent with the fieldwork undertaken during 2016 which occurred essentially during the corresponding weeks of February 2016.

Details regarding the dates, personnel and sites completed for each day during the monitoring is provided in Appendix 1.

### 3.2 Design

Monitoring was undertaken in accordance with AECOM (2012) Monitoring Methodology. Niche has summarised the techniques used from AECOM's Monitoring Methodology below.

#### 3.2.1 Rehabilitation monitoring sites

A total of 32 rehabilitation monitoring sites were established:

- 16 monitoring sites at HVO North (Figure 2, and Figures 3 to 6)
- 16 monitoring sites within rehabilitation sites at MTW (Figure 7, and Figure 8 to Figure 12).

For each monitoring site, a marker post was placed at the start and end point, with the end point established downslope. Waypoints were taken at the start and end point for each monitoring site location (Appendix 2).

Monitoring at each rehabilitation site included the collection of the following data: photo points, visual assessment, Landscape Function Analysis (LFA) and soil analysis. Those sites with native vegetation established also required the collection of BioBanking data.

The locations of the monitoring sites, along with their associated descriptions and coordinates have been provided in Appendix 2.

#### 3.2.2 Reference monitoring sites

The project resulted in the establishment of 12 reference monitoring sites, aimed at capturing the two BVTs specified in the MOP:

1. HU701 Central Hunter Grey Box-Ironbark Woodland.
2. HU632 Central Hunter Ironbark-Spotted Gum-Grey Box Forest.

The selection of the reference sites for the monitoring program was undertaken with consideration of the following:

- The rehabilitation objectives and commitments – to ensure that the reference sites are representative of the vegetation types being re-established on post-mined rehabilitated lands.
- To ensure that the suite of reference sites making up the monitoring program appropriately capture the range of environmental and biophysical conditions occurring in the region.

A preliminary assessment of potential reference sites was undertaken based on regional vegetation mapping and based on discussions with staff from OEHL, and environmental staff from C&A and other mine sites. A larger (based on range and number) list of potential sites was developed and then reduced based largely on access limitations.

Three of the Central Hunter Ironbark-Spotted Gum-Grey Box Forest sites were established at Belford National Park (Figure 13) and another three established within land managed by Wambo Coal Mine (Figure 14).

Two of the Central Hunter Grey Box-Ironbark Woodland reference sites were established within land managed by Wambo Coal Mine (Figure 14), with another four established in land managed by C&A (Figure 15).

The coordinates for the location of each reference site is provided in Appendix 2.

BioBanking data collected at each of the reference sites was input into the OEH BioBanking Benchmark Calculator to provide the lower and upper benchmark ranges for each attribute. The reference site ranges were then compared to the OEH benchmarks for both BVTs.

### 3.3 Sampling techniques

#### 3.3.3 Landscape Function Analysis (LFA)

LFA is a monitoring procedure developed by the CSIRO (Tongway and Hindley, 1997, last revised in 2004) that uses rapidly acquired field-assessed indicators to assess the biogeochemical functioning of landscapes at the hillslope scale. It provides a rapid, reliable, and easily applied method for assessing and monitoring landscape restoration or rehabilitation projects. LFA examines the way physical and biological resources are acquired, used, cycled and lost from a landscape.

Eleven Soil Surface Condition Indicators (SSCIs) (Table 3), each focusing on the measurement of specific biological and/or physical processes, are used to calculate three LFA indices: soil stability, soil infiltration and nutrient cycling. The three indices have scores of 0 to 100, which represent the ecosystem function of the area. These scores provide quantitative measures that may be used to compare rehabilitated areas with reference sites throughout the course of a monitoring program.

An LFA plot and transect was completed at each rehabilitation and reference site.

Table 3. Soil Surface Condition Indicators (SSCI) used to assess the effect of biological and physical processes on ecosystem function

Indicator	Related process
Rainsplash Protection	Rainsplash erosion
Perennial Vegetation Cover	Below ground biomass
Litter	Nutrient cycling of organic matter
Cryptogam Cover	Indication of soil stability and presence of nutrients
Crust Brokenness	Potential for wind and water erosion
Soil Erosion Type and Severity	Type and severity of existing soil erosion
Deposited Materials	Soil stability upslope
Soil Surface Roughness	Water infiltration and retention
Surface Resistance to Disturbance	Effect of mechanical disturbance
Slake Test	Soil stability when wet
Texture	Soil permeability and water storage

### 3.3.4 BioBanking – site value scores

The NSW Biodiversity Banking and Offsets Scheme – known as ‘BioBanking’, was introduced by the NSW government in 2008. The BioBanking Assessment Methodology (BBAM) assesses biodiversity values as defined by the TSC Act. These values include the composition, structure and function of ecosystems. They also include (but are not limited to): threatened species, threatened populations and threatened ecological communities, and their habitats.

AECOM (2012) refers to the use of ‘site value’ to provide a quantitative measure of the condition of the vegetation within each rehabilitation area. The site value for a particular zone is calculated based on quantitative measures of ten site attributes which are measured along a transect and within a survey plot, and assessed against benchmarks values (Table 4). A minimum number of plots are required based on the area of the site being assessed. It was thought to be more valuable to present results for each of the BioBanking criteria rather than just the site value score. The results for the rehabilitation areas have been compared to the reference site benchmarks.

BioBanking plots were undertaken at all reference sites as identified in Appendix 1.

Table 4. The ten site value scores recorded as part the BioBanking assessment

Attribute	Explanation
Native plant species richness (NPS)	Number of native species recorded within a nested 20 x 20 m quadrat.
Native over-storey % cover (NOS)	Recorded at 5 m intervals along a 50 m tape
Native mid-storey % cover (NMS)	Recorded at 5 m intervals along a 50 m tape
Native ground cover (grass) % cover (NGCG)	Recorded at 1 m intervals along a 50 m tape
Native ground cover (other) % cover (NGCO)	Recorded at 1 m intervals along a 50 m tape
Native ground cover (shrubs) % cover (NGCS)	Recorded at 1 m intervals along a 50 m tape
Exotic plant cover % cover (EPC)	Recorded at 1 m intervals along a 50 m tap
Overstorey regeneration	Regeneration is measured as the proportion of over-storey species present in the zone that are regenerating (i.e. with diameter at breast height < 5 cm). For example, if there are three tree species present in the zone but only one of these species is regenerating, then the value is 0.33. The maximum value for this measure is 1.
Fallen logs (m) Length of logs (m) (FL)	Total length of logs recorded within the 20 x 50 m quadrat. To be eligible for inclusion, logs must be >10 cm diameter and longer than 50 cm.
Number of trees with hollows (NTH)	Number of trees with hollows within the 20 x 50 m quadrat.

### 3.3.5 Visual monitoring

#### Species composition

The dominant species present in the monitoring area were identified to obtain a ‘picture’ of the species composition for a specific vegetation community. In rehabilitation areas, this allowed confirmation that the species establishing conformed to the vegetation types being re-established.



Additionally, notes were made on the general health and sustainability of vegetation as indicated by presence/absence of flowering/fruiting adult plants. The presence of plants at reproductive stage is an indication that the ecosystem is recruiting and, as such, capable of self-regeneration.

### Habitat and fauna monitoring

Artificial habitat features installed throughout the site as part of the rehabilitation activities (e.g. stag trees) were recorded.

Notes were also made on the presence and extent of habitat features such as free standing water, coarse woody debris, rocks, mistletoes and weather plants were flowering or fruiting.

### Disturbance monitoring

Disturbance monitoring was undertaken using the visual monitoring tool developed by AECOM (2012). This technique is a field-based, rapid assessment tool to visually assess and award a score to various contributors. The objective of this monitoring is to identify factors and processes that occur at the landscape/catchment scale and have the potential to impact on the monitoring site. The disturbance monitoring aims to cover those aspects that are not adequately covered in the BioBanking and LFA monitoring tools. The following disturbance categories (and associated disturbance factors) were monitored and assessed at each site:

- Disturbance related to mining activities, including:
  - Evidence of wheeled vehicles, tracked vehicles and foot disturbance
  - Excavation
  - Presence of mine rubbish
- Disturbance related to non-mining activities, including:
  - Evidence of grazing
  - Presence of animal pads
- Presence of exotic weeds and feral animal species
- Presence of domestic litter / rubbish
- Fire disturbance
- Evidence of nearby maintenance activities (i.e. chemical treatments, fencing, earthworks)
- Surface stability and erosion issues, including:
  - Eroding factor (i.e. wind, water).
  - Erosion type (i.e. sheet, rill/gully, pedestal, terracette, scalding (Tongway & Hindley 2004)).

### 3.3.6 Canopy development over-storey and regeneration

In order to understand the adequacy of canopy development at rehabilitation sites in terms of species diversity, stem density, size and habitat values, two additional assessment techniques were introduced. One captures the adequacy of canopy recruitment, whilst the other captures canopy development and maturity. These include;

- Introduction of stem density counts along two, two metre strips along the length of the 50 metre centre tape. The number and species of each individual canopy tree was counted. Where individuals could not be identified to species level, they were identified to genus.
- Information pertaining to canopy development; diversity and density, average trunk diameter, condition of the tree population, and percent of the endemic canopy with reproductive structures. This was undertaken in the nested 20 x 20 metre plot and each tree labelled with a metal tree tag or

flagging tape with an ID number to allow for follow-up monitoring. Trees with a DBH less than five centimetres were not included in the count.

### 3.3.7 Soil analyses

Soil characterisation and analyses are performed to determine the physical and chemical properties of the growing media. Soil samples were collected from all monitoring sites (rehabilitation and reference sites). A composite sample consisting of a minimum of nine sub-samples collected 10 to 15 metres apart was collected within a 20 metre radius. The radius was based on a central point five metres in from the 20 metre quadrat tape. All samples were placed in a bucket, and were mixed. The sample was then placed in a plastic bag, labelled, and sent to the Environmental Analysis Laboratory (EAL) for analysis.

The following soil parameters were determined:

- pH
- Electrical conductivity (EC)
- Cation balance
- Sodicity
- Soil organic matter content
- Soil texture including clay content

Soil analysis was undertaken by Environmental Analysis Laboratory (EAL), results were analysed and tabulated by them and included comparisons of soil parameters based on soil treatment and the rehabilitation outcome trying to be achieved at each site. Replicating soil analysis undertaken during 2016, allows for comparison of results year to year, and to understand the reasons for variability in these results.

### 3.3.8 Photographic monitoring

Photographic monitoring is a simple and useful tool that allows for direct visual comparison of a specific site between monitoring events. Digital photographs were taken at the start and finish transect points at each monitoring site. Photographs were taken to allow a panorama of each end of the transects to be established. This included:

- A photograph to the left of the tape (with the tape just in the frame in the far right)
- A photograph with the tape (and star picket) in the centre of the frame
- A photograph to the right of the tape (with the tape just in the frame in the far left).

### 3.3.9 Rill survey

In accordance with the LFA methodology (Tongway and Hindley, 2004), rill surveys are to be carried out where rills are observed at less than 30 metre spacing across the slope.

None of the monitoring sites were impacted by rill erosion at the time of the survey, and therefore no rill surveys were undertaken.

### 3.3.10 Weather

Temperatures and rainfall in the four months preceding the field monitoring period during both 2017 and 2016 are listed below in Table 5 Table 6.

Conditions during the field surveys were dry and hot, with low rainfall recorded. Of note for comparison between this year's preceding weather and weather preceding the 2016 surveys was that average high

temperatures were considerably higher than historical temperatures, rainfall was less than historical averages, and was considerably less than the rainfall which preceded last year’s surveys. Daily temperatures ranged from 29°C to 45°C.

These poor conditions were reflected in the growth phases and general health of the plants present. A large portion of plants were sufferings heat stress, and had little to no flowering/fruited structures present. At younger, less mature rehabilitation sites, some annual and perennial plants appeared to be dead.

**Table 5. Weather conditions preceding and during the 2017 monitoring period (BoM Station # 061397)**

Month	Monthly mean			Historical average (2002-2016)		
	Min Temp (°C)	Max Temp (°C)	Rainfall (mm)	Min Temp (°C)	Max Temp (°C)	Rainfall (mm)
October 2016	10.4	25.1	52.2	14.1	26.4	44.7
November 2016	12.7	30.7	52.2	17.8	28.8	83.6
December 2016	17.2	33.0	75	19.4	29.9	70.5
January 2017	19.1	34.4	48.4	20.2	31.5	69.9
February 2017	19.4	36.2	8.1	18.6	32.7	91.9

**Table 6. Weather conditions preceding and during the 2016 monitoring period (BOM Station #061397)**

Month	Monthly mean			Historical average (2002-2016)		
	Min Temp (°C)	Max Temp (°C)	Rainfall (mm)	Min Temp (°C)	Max Temp (°C)	Rainfall (mm)
October 2015	10.0	26.8	42.6	14.1	26.4	44.7
November 2015	14.0	28.8	839	17.8	28.8	83.6
December 2015	15.8	29.9	73.9	19.4	29.9	70.5
January 2016	17.7	29.3	208.8	20.2	31.5	69.9
February 2016	17.6	29.0	10.0	18.6	32.7	91.9

### 3.4 Limitations

Many of the flora recorded in the rehabilitation monitoring sites were in a juvenile or seedling state and could not always be identified confidently. As such, identification may need to be updated in later monitoring years and analyses corrected.

Whilst the reference sites were located within BVTs that were in good condition and within the general region of the study, they had been impacted by historic clearing, and thus old growth forms of these BVTs were not able to be sampled as reference sites. Considering this disturbance history, the reference sites represent recovering vegetation communities and therefore are useful to compare with the rehabilitation sites during the establishment phase.

Data analysis was limited to a comparison of rehabilitation sites and reference/benchmark sites, and to areas of different soil treatment. Details regarding weed management history and seeding rates were not available so data analysis based on these parameters was not undertaken. It was evident during the field visits that weather had created sub-optimal conditions for plant growth with the hot dry conditions resulting in stress to many individual plants, including individuals within mature rehabilitation areas and at reference sites in remnant vegetation. This was particularly evident for groundcovers species.

As some of the assessment methods between the 2016 baseline and 2017 monitoring periods have changed, not all the key parameters are directly comparable. The ground-cover assessment was not replicated during 2017, therefore this data is not available for comparison. Similarly, new data collected, including details around canopy maturity and over-storey regeneration cannot be compared as baseline data is not available.

## 4. Results

### 4.1 Reference sites

#### 4.1.1 OEH Benchmark values

The OEH Benchmark Values for both Central Hunter Grey Box-Ironbark Woodland and Central Hunter Ironbark-Spotted Gum-Grey Box Forest are provided in the Table 7.

Based on a comparison of the OEH benchmark values for the two communities the following can be concluded:

- Grey-Box Ironbark Woodland has higher NPS compared to Ironbark Spotted Gum-Grey Box Forest.
- NOS cover differed slightly between the two communities.
- Grey-Box Ironbark Woodland has a greater NMS range compared to Spotted Gum – Grey Box Forest.
- Ironbark Spotted Gum-Grey Box Forest has a greater NGCG and a greater range compared to Grey-Box Ironbark Woodland.
- Grey-Box Ironbark Woodland had greater NGCS range than Spotted Gum – Grey Box Forest.
- Grey-Box Ironbark Woodland has a greater NGCO compared to Ironbark Spotted Gum-Grey Box Forest.
- NTH is greater in Grey-Box Ironbark Woodland.
- FL is far greater within Grey-Box Ironbark Woodland.

Table 7. OEH Benchmark values for Central Hunter Grey Box-Ironbark Woodland and Central Hunter Ironbark-Spotted Gum-Grey Box Forest

Plot name	NPS	NOS		NMS		NGCG		NGCS		NGCO		EPC	NTH	OR	FL
Grey-Box Ironbark Woodland OEH Benchmark Upper and Lower Limits	≥41	15	40	5	20	30	50	5	10	20	40	0	3	1	≥5
Spotted Gum – Grey Box Forest OEH Benchmark Upper and Lower Limits	≥25	20	50	10	60	5	16	5	10	5	15	0	1	1	≥66
Average	≥33	17.5	45	7.5	40	17.5	33	5	10	12.5	27.5	0	2	1	≥35.5

NPS: Native Plant Species, NOS: Native overstorey, NMS: Native midstorey, NGCG: Native ground cover grasses, NGCS: Native ground cover shrubs, NGCO: Native ground cover other, EPC: Exotic Plant Cover, NTH: Number trees with hollows, OR: Overstorey Regeneration, FL: Fallen Logs.



#### 4.1.2 Reference site against OEH Benchmark values

The OEH Benchmarks values have been compared to the reference values below.

Central Hunter Grey Box-Ironbark Woodland - based on a comparison of the reference site benchmarks to the OEH benchmarks, the following conclusions can be made:

- Reference sites have a lower limit for most attributes, except NGCG.
- NPS for the reference site benchmark had a total of 10 species less than OEH benchmark.
- NOS for reference site benchmark has a smaller range than the OEH benchmark. This may be attributed to the historic clearing of the reference sites.
- NMS for the reference site benchmark has a lower value of zero, whilst the OEH benchmark has a lower value of five percent.
- NGCG for the reference site benchmark is higher compared to the OEH benchmark.
- NGCS for the reference site benchmark has a lower value of zero and a higher upper value compared to OEH benchmark.
- NGCO for the reference site benchmark has a lower value of 14, whilst the OEH benchmark has a lower value of 20 percent.
- FL has a greater reference site benchmark than the OEH benchmark.

Central Hunter Ironbark-Spotted Gum-Grey Box Forest - based on a comparison of the local benchmarks to the OEH benchmark, the following conclusions can be made:

- NPS for the local benchmark had a total of nine species more than OEH benchmark.
- NOS for reference site benchmark has a smaller range than the OEH benchmark. This may be attributed to the historic clearing of the reference sites.
- NMS for the reference site benchmark has a lower benchmark value of zero compared to a lower OEH benchmark of ten. The reference site benchmark also has a significantly lower upper value compared to the OEH benchmark.
- NGCG for the reference site benchmark is significantly higher compared to the OEH benchmark.
- NGCS for the reference site benchmark has a lower low value and high value compared to OEH benchmark.
- NGCO for the reference site benchmark has a higher low value and a significantly higher upper value compared to OEH benchmark.
- FL has a lower reference site benchmark than the OEH benchmark.

Considerable variation can be seen between the 2016 and 2017 local benchmark data (Table 8Table 9).

- NPS, NMS and NGCG has decreased in both vegetation types in 2017 from 2016.
- NOS has increased slightly in Central Hunter Grey Box-Ironbark Woodland, although, has decreased in Central Hunter Ironbark-Spotted Gum-Grey Box Forest in 2017.
- NGCS has decreased for Central Hunter Grey Box-Ironbark Woodland while the range for Central Hunter Ironbark-Spotted Gum-Grey Box Forest in 2017 has increased.
- NGCO has reduced substantially over both vegetation from 2016 to 2017.
- Another hollow was recorded Central Hunter Grey Box-Ironbark Woodland bring the benchmark up to  $\geq 1$  from  $\geq 0$  the previous year.
- FL has decreased substantially for Central Hunter Ironbark-Spotted Gum-Grey Box Forest in 2017, while the range for Central Hunter Grey Box-Ironbark Woodland has increased slightly.

Table 8. OEH Benchmarks and 2016 reference sites

Reference site name	NPS	NOS		NMS		NGCG		NGCS		NGCO		EPC	NTH	OR	FL
<b>Central Hunter Grey Box-Ironbark Woodland</b>															
WamboGB01	34	13		7		50		6		32		0	0	1	7
WamboGB02	35	19		0		62		12		12		0	0	1	23
WARKGB01	28	15		23		38		0		38		2	0	1	4.5
WARKGB02	31	14.5		1		70		0		62		0	0	1	22
WarkGB03	31	18.5		0		54		0		16		0	0	1	27
WarkGB04	29	2		0		64		28		16		4	1	1	3
Reference Site Benchmark Upper and Lower Limits	≥31	7.5	18.8	0	15.0	44.0	67.0	0	20.0	14.0	50.0	0	≥0	1	≥15
OEH Benchmark Upper and Lower Limits	≥41	15	40	5	20	30	50	5	10	20	40	0	3	1	≥5
<b>Central Hunter Ironbark-Spotted Gum-Grey Box Forest</b>															
BEL1	34	10.5		0		56		2		22		0	0	1	60
BEL2	35	38		2		56		6		50		0	0	1	13.5
BEL3	33	26.5		0		36		2		50		0	0	1	64
WamboSpot1	32	27		14		38		4		12		0	4	1	74
WamboSpot2	27	21		7.5		40		6		12		0	0	1	12
WamboSpot3	34	29		15		30		8		16		0	4	1	13
Reference Site Benchmark Upper and Lower Limits	≥34	15.8	33.5	0.0	14.5	33.0	56.0	2.0	7.0	12.0	50.0	0	≥0	1	≥37
OEH Benchmark Upper and Lower Limits	≥25	20	50	10	60	5	16	5	10	5	15	0	1	1	≥66

NPS: Native Plant Species, NOS: Native overstorey, NMS: Native midstorey, NGCG: Native ground cover grasses, NGCS: Native ground cover shrubs, NGCO: Native ground cover other, EPC: Exotic Plant Cover, NTH: Number trees with hollows, OR: Overstorey Regeneration, FL: Fallen Logs.

Table 9. OEH Benchmarks and 2017 reference sites

Reference site name	NPS	NOS		NMS		NGCG		NGCS		NGCO		EPC	NTH	OR	FL
<b>Central Hunter Grey Box-Ironbark Woodland</b>															
WamboGB01	25	9.5		0.5		40		2		2		0	0	1	11
WamboGB02	28	13.5		0		32		6		6		0	0	1	22
WARKGB01	25	11.5		8		20		8		2		2	1	1	26
WARKGB02	37	21.5		1		66		0		8		0	0	1	60
WarkGB03	25	7.5		1		32		0		2		0	0	1	15
WarkGB04	22	6		0		26		10		14		0	1	1	10
Reference Site Benchmark Upper and Lower Limits	≥27	13.3	22.8	0.0	10.0	18.0	33.0	1.0	11.0	3.0	26.0	0	≥1	1	≥21
OEH Benchmark Upper and Lower Limits	≥41	15	40	5	20	30	50	5	10	20	40	0	3	1	≥5
<b>Central Hunter Ironbark-Spotted Gum-Grey Box Forest</b>															
BEL1	25	13		0		38		0		14		0	0	1	17
BEL2	22	19.5		0		22		2		36		6	0	1	24
BEL3	25	17		0		14		4		16		4	0	1	27
WamboSpot1	28	14		14.5		28		8		2		0	4	1	82
WamboSpot2	29	13.5		0		24		12		4		0	1	1	15
WamboSpot3	29	26		5.5		22		10		4		0	2	1	12
Reference Site Benchmark Upper and Lower Limits	≥25	6.8	17.5	0.0	4.5	23.0	53.0	0.0	9.0	2.0	11.0	0	≥0	1	≥19
OEH Benchmark Upper and Lower Limits	≥25	20	50	10	60	5	16	5	10	5	15	0	1	1	≥66

NPS: Native Plant Species, NOS: Native overstorey, NMS: Native midstorey, NGCG: Native ground cover grasses, NGCS: Native ground cover shrubs, NGCO: Native ground cover other, EPC: Exotic Plant Cover, NTH: Number trees with hollows, OR: Overstorey Regeneration, FL: Fallen Logs.

### 4.1.3 Landscape Function Analysis

The LFA scores for the Central Hunter Grey Box-Ironbark Woodland and Central Hunter Ironbark-Spotted Gum-Grey Box Forest reference sites were tabulated and are provided in Table 10. It also provides the results and data from the 2016 baseline. Key results include the following:

- Most sites scored a LOI of 1.0.
- Most LOI scores were largely consistent, with only minor variation between 2016 and 2017.
- WAMBOSPOT2 had the lowest LOI (0.95) across all reference sites.
- The average LOI for Ironbark-Spotted Gum-Grey Box Forest was similar to the average for Grey Box-Ironbark Woodland.
- The stability scores achieved at many sites reduced overall between 2016 and 2017.
- Stability ranged from 53.9 to 68.9 for Grey Box-Ironbark Woodland. WAMBOSPOT2 had the highest stability score with 68.9.
- There has been some variation in the LFA scores between 2016 and 2017 at reference sites.

Table 10. LFA for Reference sites

	Landscape Organisation Index		Stability		Infiltration		Nutrient cycling	
	2016	2017	2016	2017	2016	2017	2016	2017
<b>Central Hunter Grey Box-Ironbark Woodland</b>								
WARKGB01	1	1	69.8	53.9	49.7	65.2	43.2	42.9
WARKGB02	1	0.98	70	59.8	57.6	59	52.1	51.6
WARKGB03	0.84	0.99	57.9	55	49.8	55	38.7	38.5
WARKGB04	0.97	0.98	72.5	58.9	48.4	52.1	48.4	60.6
WAMBOGB1	1	1	58.3	63.5	56.2	57.4	46.3	56.9
WAMBOGB2	1	1	72.5	61.1	48.4	55.5	48.4	50.8
<b>Central Hunter Ironbark-Spotted Gum-Grey Box Forest</b>								
BELLSPOT1	1	1	66.7	56.9	51.6	70.4	43.6	41.4
BELLSPOT2	0.94	0.98	81.8	66.7	69.9	61.1	54.2	70.3
BELLSPOT3	1	1	63.9	55.2	65.3	61.8	54.9	64.4
WAMBOSPOT1	1	1	62.5	66.9	74	60.4	65.6	55.6
WAMBOSPOT2	0.96	0.95	72.7	68.9	64.2	58.1	62.1	79.8
WAMBOSPOT3	1	1	69.7	62.2	67.2	73.9	59.7	53.8

### 4.1.4 Visual monitoring, photo monitoring

The results of the visual monitoring, and photo monitoring are provided in Appendix 4.

### 4.1.5 Canopy development over-storey and regeneration

#### Stem density counts

At each rehabilitation and reference sites the stem density of canopy species was recorded within two 50 metre x 2 metre quadrats, running along either side of the 50 metre tape. The number of each different kind of over-storey species was recorded and the results are summarised in Table 11, Full results are provided in Appendix 5.

Table 11. Details of canopy regeneration at reference sites

Site	Number of species	Stems per hectare (ha)
WAMBOGB1	2	950
WAMBOGB2	1	250
WARKGB01	2	3150
WARKGB02	2	1050
WARKGB03	3	2750
WARKGB04	2	500
<b>Average</b>	<b>2</b>	<b>1442</b>
BELLSPOT1	2	300
BELLSPOT2	2	850
BELLSPOT3	4	1000
WAMBOSPOT1	4	1650
WAMBOSPOT2	4	950
WAMBOSPOT3	3	800
<b>Average</b>	<b>3.2</b>	<b>925</b>
<b>Total Average</b>	<b>3</b>	<b>1183</b>

### Canopy maturity and habitat values

At each reference site individual canopy tree species with a DBH greater than five centimetres were marked with a metal tree tag or flagging tape and were numbered. This will allow future monitoring to know exactly which canopy trees were included in counts and DBH measurements. Whether an individual had flowers or fruit was determined by whether there was evidence of these structures on the tree at the time of survey. So this is likely to under-estimate of the maturity of the tree canopy. The results are provided below in Table 12. Full data is provided in Appendix 5.

Table 12. Details of canopy maturity at reference sites

Site name	Average tree width	Native trees >5cm DBH (20x20 plot)	Native trees >5cm DBH per hectare	Native tree species >5cm DBH	Native trees with hollows	Native trees with fruit/flowers
WAMBOGB1	11.5	22	550	4	0	0
WAMBOGB2	22	4	100	2	0	0
WARKGB1	14.8	25	625	2	0	0
WARKGB2	14	24	600	2	0	0
WARKGB3	14.5	28	700	3	0	0
WARKGB4	65	2	50	1	0	0
<b>Average</b>	<b>23.6</b>	<b>17.5</b>	<b>437.5</b>	<b>2.3</b>	<b>0</b>	<b>0</b>
BELLSPOT1	18.7	20	500	2	0	0
BELLSPOT2	19	13	325	2	1	0
BELLSPOT3	15	21	525	3	0	0
WAMBOSPOT1	22.5	8	200	3	3	0

WAMBOSPOT2	10.75	29	725	2	0	2
WAMBOSPOT3	22	9	225	3	0	0
Average	18.0	16.7	416.7	2.5	0.7	0.3
Total Average	20.8	17	427.1	2.4	0.3	0.16

#### 4.1.6 Soil analysis

The results of the soil analyses by EAL Australia for key soil chemistry parameters for the reference sites are detailed in Appendix 6.

## 4.2 Rehabilitation monitoring sites

A total of 16 HVO and 16 MTW rehabilitation monitoring sites were established as described in Section 2.1, with BioBanking plots undertaken at all 32 sites.

### 4.2.1 Vegetation and condition

Descriptions for each site, including structure, dominant species and site photographs have been provided in Appendix 4.

Based on the BioBanking data, a total of 193 flora species across 54 families were recorded (Appendix 3). Of the 193 flora recorded, 53 were introduced species (27%).

Common native species across both MTW and HVO included:

- Trees: *Corymbia maculata*, *Eucalyptus crebra*, *Eucalyptus moluccana*, *Acacia implexa*, *Acacia salicina*
- Shrubs: *Acacia decora*, *Acacia amblygona*, *Acacia cultriformis*, *Acacia falcata*, *Breynia oblongifolia*, *Acacia decurrens* and *Acacia filicifolia*.
- Grasses: *Bothriochloa macra*, *Austrostipa scabra*, *Chloris ventricosa*, *Chloris truncata*, *Cynodon dactylon*, *Panicum effusum* and *Cymbopogon refractus*
- Forbs/herbaceous/other: *Glycine tabacina*, *Commelina cyanea*, *Atriplex semibaccata*, *Eremophila debilis*, *Vittadinia cuneata*, *Einadia nutans*, *Sida corrugata*, *Cheilanthes sieberi*, *Calotis lappulacea*, *Enchylaena tomentosa*, *Chrysocephalum apiculatum*, *Vittadinia sulcata*, *Gahnia aspera*, *Dianella revoluta*, *Wahlenbergia spp.*, *Einadia trigonos*, *Carex inversa*, *Hardenbergia violacea* and *Indigofera australis*.
- Common introduced species include: *Eucalyptus cladocalyx*, *Galenia pubescens*, *Gomphocarpus fruticosus*, *Bidens pilosa*, *Cirsium vulgare*, *Conyza bonariensis*, *Senecio madagascariensis*, *Acacia saligna*, *Sida rhombifolia*, *Plantago lanceolata*, *Chloris gayana*, *Panicum maximum*, *Paspalum dilatatum*, *Pennisetum clandestinum* and *Verbena bonariensis*.

### 4.2.2 BioBanking attribute data

The BioBanking attribute data collected from the rehabilitation sites, along with the average reference site local benchmark data, are summarised in Table 13 Table 14.

Table 13. BioBanking attribute data at HVO rehabilitation sites and average local benchmarks

Plot name	NPS	NOS	NMS	NGCG	NGCS	NGCO	EPC	NTH	OR	FL			
HVOCAR200901	9	0	13	0	4	2	30	0	0	0			
HVOCAR200902	10	8	0	0	0	0	74	0	0	0			
HVOCAR201401	4	0	0	0	0	0	74	0	0	0			
HVOCHE201201	5	0	0	0	0	18	14	0	0	0			
HVOCHE201203	3	0	0	20	0	0	64	0	0	0			
HVOCHE201401	3	0	0	28	0	0	42	0	0	0			
HVORIV201401	18	0	0	4	4	20	50	0	0	0			
HVORIV201402	7	0	0	14	0	4	38	0	0	0			
HVORIV201403	11	0	0	24	0	2	52	0	0	0			
HVORIV201404	10	0	0	16	4	10	10	0	0	0			
HVORIV201405	1	0	0	0	0	0	60	0	0	0			
HVORIV201406	9	0	0	0	2	4	34	0	0	0			
HVOWES200801	16	11	2	16	0	2	10	0	0	0			
HVOWES201101	21	8	0	12	2	24	10	0	0	0			
HVOWES201301	14	0	0	30	0	8	30	0	0	0			
HVOWES201302	0	0	0	50	0	8	30	0	0	0			
<b>Average</b>	8.8	1.7	0.9	13.4	1.0	6.4	38.9	0	0	0			
Grey Box-Ironbark Woodland Lower and Upper Average Local Benchmarks	≥27	13.3	22.8	18.0	33.0	1	11.0	3.0	26.0	0	≥1	1	≥21
Ironbark-Spotted Gum-Grey Box Forest Lower and Upper Average Local Benchmarks	≥25	6.8	17.5	23.0	53.0	0.0	9.0	2.0	11.0	0	≥0	1	≥19

Table 14. BioBanking attribute data at MTW rehabilitation sites and average local benchmarks

Plot name	NPS	NOS	NMS	NGCG	NGCS	NGCO	EPC	NTH	OR	FL			
MTWCDD201101	24	3	6	18	48	12	2	0	0	0			
MTWCDD201301	0	0	0	0	0	0	90	0	0	0			
MTWCDD201501	24	0	5	26	24	10	16	0	0	0			
MTWMT0200001	12	0.5	0	0	0	40	18	0	0	0			
MTWMT0200503	19	0.5	0	10	0	6	78	0	0	0			
MTWNP200501	12	0	3.5	12	0	0	22	0	0	0			
MTWNP200502	11	16.5	12	0	4	0	34	0	0	0			
MTWNP200901	13	17	2.5	2	18	2	2	0	0	0			
MTWNP201101	16	0	5.5	12	26	0	46	0	0	0			
MTWNP201301	16	0	0	12	6	16	28	0	0	0			
MTWNP201402	24	0	8.3	30	22	4	26	0	0	0			
MTWNP201403	10	0	0	6	2	10	66	0	0	0			
MTWSP201401	4	0	0	16	0	0	10	0	0	0			
MTWTDI201501	13	0	0	34	0	50	20	0	0	0			
MTWWDL201401	23	0	1.5	20	26	16	16	0	0	0			
MTWWDL201402	7	0	0	10	0	0	80	0	0	0			
<b>Average</b>	14.3	2.3	2.8	13.0	11.0	10.4	34.6	0	0	0			
Grey Box-Ironbark Woodland Lower and Upper Average Local Benchmarks	≥27	13.3	0	18.0	33.0	1	11.0	3.0	26.0	0	≥1	1	≥21
Ironbark-Spotted Gum-Grey Box Forest Lower and Upper Average Local Benchmarks	≥25	6.8	0.0	23.0	53.0	0.0	9.0	2.0	11.0	0	≥0	1	≥19



### 4.2.3 Species Richness

Table 15 and Table 16 below provide species counts of the reference and rehabilitation sites. Table 16 also highlights the rehabilitation sites that have achieved species richness comparable to the reference sites.

Table 15. Reference site species count

Site Name	Number of Tree Species	Number of Shrub Species	Number of Grass Species	Number of Other Species	Number of Native Understory Species Per BioBanking Plot
<b>Reference Sites</b>					
BEL1	2	6	4	12	16
BEL2	2	4	4	12	16
BEL3	4	4	6	12	18
WAMBOG1	2	4	5	12	17
WAMBOGB2	1	6	9	12	21
WAMBOSPO1	4	9	4	13	17
WAMBOSPO2	4	7	8	12	20
WAMBOSPO3	3	7	6	13	19
WARKGB01	2	5	5	14	19
WARKGB02	2	6	7	20	27
WARKGB03	3	6	6	11	17
WARKGB04	2	5	6	10	16
<b>Average</b>	<b>3</b>	<b>6</b>	<b>6</b>	<b>13</b>	<b>19</b>

Table 16. Rehabilitation sites species count

Site Name	Number of Tree Species	Number of Shrub Species	Number of Grass Species	Number of Other Species	Number of Native Understory Species Per BioBanking Plot
<b>Reference Site Average</b>	<b>3</b>	<b>6</b>	<b>6</b>	<b>13</b>	<b>19</b>
<b>Mount Thorley Warkworth</b>					
MTWCDD201101	4	10	5	6	11
MTWCDD201301*	0	0	0	0	0
MTWCDD201501	3	7	13	3	16
MTWMT0200001	2	2	0	9	9
MTWMT0200503	2	0	6	12	18
MTWNPN200501	1	2	4	6	10
MTWNPN200502	2	4	2	2	4
MTWNPN200901	4	6	2	1	3
MTWNPN201101	2	9	2	3	5
MTWNPN201301	0	7	5	3	8

MTWNP201401	0	12	9	3	12
MTWNP201403	1	3	3	2	5
MTWSPN201401*	0	0	4	0	4
MTWTDI201501	1	2	8	1	9
MTWWDL201401	3	8	6	6	12
MTWWDL201402*	0	0	5	2	7
MTW Average	2	6	5	4	8
<b>Hunter Valley Operations</b>					
HVOCAR200901	3	4	1	0	1
HVOCAR200902	3	3	2	0	2
HVOCAR201401*	0	0	2	2	4
HVOCHE201201	0	0	2	3	5
HVOCHE201203*	0	0	2	1	3
HVOCHE201401*	0	0	3	0	3
HVORIV201401	3	5	6	6	12
HVORIV201402	1	1	4	2	6
HVORIV201403	0	2	5	3	8
HVORIV201404	0	2	3	4	7
HVORIV201405	0	0	1	0	1
HVORIV201406	0	0	5	4	9
HVOWES200801	4	6	7	2	9
HVOWES201101	6	7	5	3	8
HVOWES201301	4	2	6	2	8
HVOWES201302*	0	0	4	2	6
HVO Average	2	3	4	2	6

	0-10% of reference site benchmark
	10-50% of reference site benchmark
	50-100% of reference site benchmark
	within reference site benchmark

Notes: \* = sites that have not yet been sown with native seed mixes and therefore excluded from site averages.

#### 4.2.4 Landscape Function Analysis

The raw data and average LFA scores for all the HVO and MTW sites in 2017 and 2016 is provided in Table 17 and 18.

##### HVO rehabilitation sites

Based on the data, LFA scores across all indices were fairly consistent for all sites, with no conspicuous outliers. The average LOI score was .89 across all sites. High LOI scores, particularly at younger rehabilitation sites, was generally driven by extensive grass cover, rather than development of leaf litter or shrub species.

##### MTW rehabilitation sites

The raw data and average LFA scores for all MTW sites from 2016 and 2017 is provided in Table 17 Table 18. The comparison columns for each of the four indices is based on the average score for each of these indices at the reference sites.

Key results are as follows:

- LOI ranged from 0.14 to 1.0.
- Stability ranged from 47.8 to 85.4.
- Infiltration was highly variable and ranged from 10.3 to 71.4.
- Nutrient cycling was variable and ranged from 10.3 to 77.8.
- MTWCDD201501 had the lowest LFA score. It was an outlier in the dataset. The cause for this low score is likely due to the site being in the early stages of rehabilitation, with foliage cover at the site being extremely low. This is evident from the photo monitoring results provided in Appendix 4.

Table 17. LFA for MTW and HVO Rehabilitation Sites (2017 data)

Site name	LOI	LOI Comparison %	Stability	Stability Comparison %	Infiltration	Infiltration Comparison %	Nutrient cycling	Nutrient cycling Comparison %
Reference Site Average	0.98		60.75		60.75		55.5	
HVOCAR200901	0.59	60	59.4	98	35.8	59	39.7	72
HVOCAR200902	0.93	95	63	104	75	123	61.5	111
HVOCAR201401	0.75	77	50.9	84	59.6	98	49.9	90
HVOCHE201201	0.84	86	56.1	92	54	89	47.7	86
HVOCHE201203	0.96	98	62.8	103	58.4	96	47.7	86
HVOCHE201401	0.99	101	51.1	84	47.9	79	36.2	65
HVORIV201401	0.94	96	67.1	110	60.5	100	58.3	105
HVORIV201402	0.84	86	53.5	88	51.6	85	43.4	78
HVORIV201403	0.91	93	53.4	88	33.1	54	36.3	65
HVORIV201404	0.87	89	55.6	92	43.2	71	32.1	58
HVORIV201405	1	102	56.7	93	46.9	77	32.3	58
HVORIV201406	0.95	97	51.6	85	70.5	116	15.3	28
HVOWES200801	0.84	86	69.6	115	43.5	72	72.1	130
HVOWES201101	0.73	74	63.8	105	53.2	88	54.4	98
HVOWES201301	0.67	68	61.9	102	50	82	42.9	77
HVOWES201302	0.96	98	62	102	58	95	47	85
MTWCDD201101	0.71	72	69.3	114	49.6	82	61.5	111
MTWCDD201301	0.97	99	60	99	48	79	49	88
MTWCDD201501	0.28	29	13.3	22	8.2	13	5.7	10
MTWMTO200001	0.96	98	56.1	92	56.4	93	41.5	75
MTWMTO200503	0.35	36	56.1	92	45.3	75	33.5	60
MTWNPN200501	0.58	59	51.3	84	50.1	82	43.1	78
MTWNPN200502	0.67	68	39.5	65	41.1	68	34	61

MTWNP200901	0.89	91	73.2	120	54.1	89	58.5	105
MTWNP201101	0.21	21	69.3	114	49.6	82	61.5	111
MTWNP201301	0.61	62	49.9	82	29.4	48	30.8	55
MTWNP201402	0.55	56	53	87	51.6	85	44.8	81
MTWNP201403	0.95	97	51.5	85	39	64	38.3	69
MTWSP201401	0.94	96	45.2	74	65.4	108	49.5	89
MTWTD1201501	0.64	65	58.9	97	22.8	38	18.6	34
MTWWDL201401	0.68	69	44.2	73	32.5	53	35.9	65
MTWWDL201402	0.94	96	64.5	106	43.7	72	46.4	84
<b>HVO Average</b>	<b>0.9</b>		<b>58.7</b>		<b>52.6</b>		<b>44.8</b>	
<b>MTW Average</b>	<b>0.7</b>		<b>53.5</b>		<b>42.9</b>		<b>40.8</b>	

	0-10% of reference site benchmark
	10-50% of reference site benchmark
	50-100% of reference site benchmark
	within reference site benchmark

Table 18. LFA for HVO and MTW Rehabilitation sites (2016 data)

Site name	LOI	Stability	Infiltration	Nutrient Cycling
<b>Hunter Valley Operations</b>				
HVO CAR200901	0.83	66.5	47.4	44.2
HVO CAR200902	0.99	68	46.2	40.1
HVO CAR201401	0.86	61.4	43.3	50.2
HVO CHE201201	0.98	65.4	56.1	76.5
HVO CHE201203	0.91	64.3	57.3	57.5
HVO CHE201301	1	64.2	46.3	67
HVO CHE201401	0.82	55.6	40.2	34.1
HVO RIV201301	0.94	73.1	48.7	52.4
HVO RIV201401	0.69	49	33.2	22.6
HVO RIV201402	0.77	53.9	22.1	13.5
HVO RIV201403	0.86	50.8	22	16
HVO RIV201404	0.96	56	21.3	15.9
HVO RIV201405	1	73.1	64.1	77.8
HVO RIV201406	1	74.4	63.3	75.6
HVO WES200801	0.61	58.8	47.1	46
HVO WES201101	0.95	61.4	35.9	25.7
HVO WES201301	0.88	50.4	27	18.8
HVO WES201302	0.93	55	33.8	25.5
<b>Mount Thorley Warkworth</b>				
MTWCDD201101	0.98	85.4	65.2	72.1
MTWCDD201301	1	78.7	77.8	64.6

Site name	LOI	Stability	Infiltration	Nutrient Cycling
MTWCDD201501	0.14	47.8	10.3	10.3
MTWMT0200001	0.89	58.2	31.8	33.9
MTWMT0200503	0.54	54	28.5	21.4
MTWNPN200501	0.92	63.3	43.3	39.9
MTWNPN200502	0.95	61.3	37	32.4
MTWNPN200901	0.93	66.2	40.5	45.8
MTWNPN201101	1	58.7	57.1	53.5
MTWNPN201301	1	63.5	57.1	53.3
MTWNPN201401	0.67	61.9	32.8	21.4
MTWNPN201402	0.96	59.8	39.5	47
MTWNPN201403	0.98	74.6	66.8	65.5
MTWSPN201401	1	73.7	40.7	37.2
MTWTD1201501	0.61	54.4	24	22
MTWWDL201401	0.97	63.7	40.6	36.8
MTWWDL201401	0.97	63.7	40.6	36.8
MTWWDL201402	0.98	66.5	71.4	67.2
MTWWDL201402	0.98	66.5	71.4	67.2
HVO Average	0.9	62.2	43.4	44.7
MTW Average	0.8	64.1	43.3	41.1

#### 4.2.5 Visual monitoring, photo monitoring

The results of the visual monitoring and photo monitoring for the HVO North sites are provided in Appendix 4.

#### 4.2.6 Canopy development over-storey and regeneration

##### *Stem density counts*

At each rehabilitation and reference sites stem density of canopy species was recorded along two 50 metre x 2 metre quadrats running along either side of the centre 50 metre tape. Within this space, the number of each different kind of over-storey species was recorded. The results of this are provided below in Table 19.

Table 19. Details of canopy regeneration at rehabilitation sites 2017

Site	Number of species	Stems per hectare (ha)	Natives sown (Y/N)
Reference Site Average	3	1183	
HVOCAR200901	3	1900	Y
HVOCAR200902	3	2400	Y
HVOCAR201401*	0	0	N
HVOCHE201201	0	0	Y
HVOCHE201203*	0	0	N
HVOCHE201401*	0	0	N
HVORIV201401	3	350	Y

HVORIV201402	1	50	Y
HVORIV201403	0	0	Y
HVORIV201404	0	0	Y
HVORIV201405	0	0	Y
HVORIV201406	0	0	Y
HVOWES200801	4	4250	Y
HVOWES201101	6	4650	Y
HVOWES201301	4	600	Y
HVOWES201302*	0	0	N
MTWCDD201101	4	1750	Y
MTWCDD201301*	0	0	N
MTWCDD201501	3	4850	Y
MTWMT0200001	2	850	Y
MTWMT0200503	2	1150	Y
MTWNP200501	1	100	Y
MTWNP200502	2	1500	Y
MTWNP200901	4	3500	Y
MTWNP201101	2	600	Y
MTWNP201301	0	0	Y
MTWNP201402	0	0	Y
MTWNP201403	1	100	Y
MTWSP201401*	0	0	N
MTWTDI201501	1	50	Y
MTWWDL201401	3	750	Y
MTWWDL201402*	0	0	N
<b>HVO Average</b>	<b>2</b>	<b>1183.3</b>	
<b>MTW Average</b>	<b>1.9</b>	<b>1169.2</b>	

0-10% of reference site benchmark
10-50% of reference site benchmark
50-100% of reference site benchmark
within reference site benchmark

Notes: Sites which have not yet been sown with native seed mixes have been excluded from site averages.

## Canopy maturity and habitat values

At each rehabilitation site individual canopy tree species with a DBH greater than five centimetres were marked with a metal tree tag or flagging tape and numbered. This will allow future monitoring to know exactly which canopy trees were included in counts and DBH measurements. Only a limited number of rehabilitation sites had canopy trees with a DBH greater than five centimetres. Whether an individual had flowers or fruit was determined by whether there was evidence of these structures on the tree at the time of survey. The results of this are provided below in Table 23. Full data is provided in Appendix 5.

Table 20. Details of canopy maturity at rehabilitation sites

Site name	Average tree width	Native trees >5cm DBH (20x20 plot)	Native trees >5cm DBH per hectare	Native tree species >5cm DBH	Native trees with hollows	Native trees with fruit/flowers
Reference Site Average	20.8	17	427.1	2.4	0.3	0.16
<b>Hunter Valley Operations</b>						
HVOCAR200901	10.5	25	625	3	0	0
HVOCAR200902	6.5	4	100	3	0	0
HVOWES200801	6.1	38	950	2	0	0
HVOWES201101	6.2	17	425	2	0	0
<b>Mount Thorley Warkworth</b>						
MTWCDD201101	5.8	17	425	2	0	2
MTWMT0200001	7.1	6	150	1	0	0
MTWNPN200501	15	2	50	1	0	0
MTWNPN200502	9.1	30	750	3	0	0
HVO Average	7.3	21	525	2.5	0	0
MTW Average	9.3	13.8	343.8	1.75	0	0.5
Average	8.2	17.37	434.4	2.13	0	0.16

	0-10% of reference site benchmark
	10-50% of reference site benchmark
	50-100% of reference site benchmark
	within reference site benchmark

#### 4.2.7 Soil analysis

The results of the soil analyses by EAL Australia for key soil chemistry parameters for the HVO site MTW sites are detailed in Appendix 6. Some of the results for soil properties outlined in the MOP Performance criteria have been compared with data from the reference sites. These can be seen in the Table 21Table 22.

Table 21. Reference site soil results 2017

Site Name	pH >5.5 and <8.5	EC (dS/m) <2 dS/m	Phosphorus - Exchangeable (Mg/Kg)	Organic Carbon (% OM)	CEC (cmol+/Kg)	Sodium - ESP (%)	Calcium / Magnesium Ratio
WamboSpot1	6.28	0.06	4.73	5.02	8.26	1.16	2.14
WamboSpot2	6.41	0.05	5.94	6.23	14.88	1.53	1.94
WamboSpot3	6.19	0.06	5.28	4.74	8.59	2.17	1.87
WamboGB01	5.76	0.06	9.01	5.87	12.07	3.64	0.80
WamboGB02	6.69	0.10	7.73	7.67	20.44	1.74	2.02
WARKGB01	5.42	0.05	3.36	3.43	7.97	3.27	1.56
WARKGB02	6.03	0.06	5.41	4.97	8.16	2.63	1.99
WARKGB04	5.71	0.09	9.44	8.72	8.25	5.54	1.00
BEL1	5.44	0.05	5.19	7.05	7.44	4.18	0.65
BEL2	5.93	0.05	3.20	3.69	7.66	2.84	1.66
BEL3	5.69	0.10	5.19	8.17	11.26	4.43	1.28
Range	5.42-6.69	0.05-0.10	3.19-9.44	3.43-8.72	7.44-20.44	1.16-5.54	0.65-2.14
Average	5.96	0.07	5.86	5.96	10.45	3.01	1.54



Table 22. Rehabilitation site soil results compared to reference site average

Site Name	pH >5.5 and <8.5	Electrical Conductivity (EC) (dS/m) <2 dS/m	Phosphorus - Exchangeable (Mg/Kg)	Organic Carbon (% OM)	Cation Exchange Capacity (CEC) (cmol+/Kg)	Sodium - ESP (%)	Calcium / Magnesium Ratio
Reference Site Average	5.96	0.07	5.86	5.96	10.45	3.01	1.54
Reference Site Range	5.42-6.69	0.05-0.10	3.19-9.44	3.43-8.72	7.44-20.44	1.16-5.54	0.65-2.14
HVO WES200801	7.24	0.11	17.17	4.43	13.76	2.02	1.10
HVO WES201101	8.44	0.16	87.55	5.64	20.09	2.05	1.48
HVO WES201301	8.37	0.18	146.20	4.36	18.96	1.27	2.24
HVO WES201302	7.81	0.54	186.15	8.84	23.81	1.65	2.74
HVO CAR200901	7.60	0.12	14.96	4.06	17.46	5.53	0.75
HVO CAR200902	7.70	0.08	11.65	2.73	23.27	3.01	1.16
HVO CAR201401	8.03	0.15	48.37	4.80	23.68	3.03	1.85
HVO RIV201406	7.78	0.17	55.85	6.41	22.01	4.98	1.20
HVO RIV201405	8.46	0.12	149.60	3.48	13.50	3.65	2.67
HVO RIV201404	8.80	0.20	101.15	5.29	20.66	6.02	2.30
HVO RIV201403	8.51	0.17	64.77	3.82	21.87	5.43	0.91
HVO RIV201402	8.72	0.48	215.05	8.28	30.22	9.32	1.58
HVO RIV201401	8.80	0.45	243.95	7.67	30.27	9.96	1.07
HVO CHE201201	8.13	0.16	249.90	9.57	23.32	4.04	2.69
HVO CHE201401 - A	7.69	0.13	77.18	4.97	18.25	2.53	1.71
HVO CHE201401 - B	8.14	0.17	244.80	6.27	16.47	3.44	3.95
HVO CHE201203	5.53	0.05	9.52	2.84	4.32	7.06	1.25
MTWNP201301	6.87	0.08	24.57	2.64	8.04	1.37	2.43
MTWNP201401	6.84	0.10	36.30	5.32	13.33	3.61	1.43
MTWNP201403	8.28	0.20	121.55	4.94	17.27	6.10	1.54
MTWNP201101	8.14	0.07	25.67	3.40	14.09	0.84	1.92

Site Name	pH >5.5 and <8.5	Electrical Conductivity (EC) (dS/m) <2 dS/m	Phosphorus - Exchangeable (Mg/Kg)	Organic Carbon (% OM)	Cation Exchange Capacity (CEC) (cmol+/Kg)	Sodium - ESP (%)	Calcium / Magnesium Ratio
MTWNP200901 - A	6.41	0.15	7.89	4.87	14.24	1.85	1.15
MTWNP200901- B	8.02	0.16	81.43	5.20	18.25	1.23	2.40
MTWCDD201101	6.95	0.10	8.84	3.82	13.86	6.31	1.27
MTWCDD201301	8.31	0.14	133.45	5.99	16.31	4.44	2.64
MTWCDD201501	8.81	0.19	147.05	5.25	13.02	6.13	1.82
MTWWDL201401	7.41	0.17	86.70	6.74	15.17	8.68	1.53
MTWWDL201402	8.11	0.35	119.85	5.81	20.08	7.59	1.56
MTWMT0200001	7.55	0.15	15.64	2.47	12.43	13.55	0.73
MTWTDI201501	9.19	0.80	89.25	10.94	19.61	36.74	1.14
MTWNP200501	7.48	0.09	19.98	3.89	11.66	2.83	1.08
MTWNP200502	7.31	0.09	22.44	5.97	13.07	1.43	1.00
MTWMT0200503	7.71	0.19	11.14	4.94	13.69	4.78	1.11
MTWSPN201401	8.32	0.16	38.42	5.29	15.49	4.04	2.04

outside reference site benchmark range

within reference site benchmark range

## 5. Discussion

### 5.1 Rehabilitation sites compared to Central Hunter Grey Box – Ironbark Woodland Reference Site Benchmarks

Rehabilitation sites have been compared to reference site benchmarks for Central Hunter Grey Box – Ironbark Woodland in Table 23.

The following conclusions can be made when comparing the reference site benchmarks for Central Hunter Grey Box-Ironbark Woodland against the rehabilitation sites:

- All sites have lower than benchmark for NPS.
- Sites HVOCAR200902, HVOWES200801, HVOWES201101, MTWNP200502 and MTWNP200901 are within benchmark for NOS.
- All other sites have less than ten percent NOS. This is likely due to juvenile trees not occurring in the canopy stratum. While MTWMTO200001 and MTWMTO200503 support established tree canopies of *Eucalyptus cladocalyx*, this species does not contribute to the NOS cover percentage as it is not endemic to the region.
- HVOCAR200901, HVOWES200801, MTWCDD201101, MTWCDD201501, MTWNP200501, MTWNP200502, MTWNP200901, MTWNP201101, MTWNP201402 and MTWWDL201401 are within benchmark for NMS. It should be noted that the lower benchmark value for NMS is zero.
- HVOWES201302 is within benchmark for NGCG.
- HVOCAR200901, HVORIV201401, HVORIV201404, HVORIV201406, HVOWES201101, MTWCDD201101, MTWCDD201501, MTWNP200502, MTWNP200901, MTWNP201101, MTWNP201301, MTWNP201402, MTWNP201403 and MTWWDL201401 are within benchmark for NGCS. It should be noted that the lower benchmark value for NGCS is zero, and thus any low shrub cover will put the site into benchmark for this attribute.
- MTWCDD201101, MTWCDD201501, MTWNP201101, MTWNP201402 and MTWWDL201401 exceed the upper benchmark for NGCS. This is likely a result of the combination of exceptional germination and juvenile canopy and mid-story species contributing towards NGCS.
- HVOCH201201, HVORIV201401, HVOWES201101, MTWCDD201501, MTWMTO200001, MTWNP201301, MTWTDI201501 and MTWWDL201401 are within benchmark for NGCO.
- All sites have a high percentage of weed cover. However, MTWCDD201101 and MTWNP200901 received scores of two which are close to the benchmark of zero.
- None of the sites contain evidence of native regeneration (e.g. young eucalypts regenerating naturally).
- All sites meet benchmark for NTH, although this is due to the benchmark value being zero.
- Sites did not contain any FL, although this is to be expected given the young age of the canopy.
- It cannot be concluded that the older sites are trending closer to benchmark compared with younger sites, as there is a range of results for each of the attributes when comparing establishment years. For example, MTWNP200901 has a high NOS compared to older sites. This would largely be attributed to variation between site conditions, and the management that has occurred at each rehabilitation area, including the seeding mix and seeding methods used.

Table 23. Rehabilitation sites compared to Central Hunter Grey Box – Ironbark Woodland benchmarks

Plot name	NPS	NOS		NMS		NGCG		NGCS		NGCO		EPC	NTH	OR	FL
		7.5	18.8	0	15.0	44.0	67.0	0	20.0	14.0	50.0				
Central Hunter Grey Box-Ironbark Woodland benchmark	≥31	7.5	18.8	0	15.0	44.0	67.0	0	20.0	14.0	50.0	0	≥0	1	≥15
HVOCAR200901	9	0		13		0		4		2		30	0	0	0
HVOCAR200902	10	8		0		0		0		0		74	0	0	0
HVOCAR201401*	4	0		0		0		0		0		74	0	0	0
HVOCHE201201	5	0		0		0		0		18		14	0	0	0
HVOCHE201203*	3	0		0		20		0		0		64	0	0	0
HVOCHE201401*	3	0		0		28		0		0		42	0	0	0
HVORIV201401	18	0		0		4		4		20		50	0	0	0
HVORIV201402	7	0		0		14		0		4		38	0	0	0
HVORIV201403	11	0		0		24		0		2		52	0	0	0
HVORIV201404	10	0		0		16		4		10		10	0	0	0
HVORIV201405	1	0		0		0		0		0		60	0	0	0
HVORIV201406	9	0		0		0		2		4		34	0	0	0
HVOWES200801	16	11		2		16		0		2		10	0	0	0
HVOWES201101	21	8		0		12		2		24		10	0	0	0
HVOWES201301	14	0		0		30		0		8		30	0	0	0
HVOWES201302*	0	0		0		50		0		8		30	0	0	0
MTWCDD201101	24	3		6		18		48		12		2	0	0	0
MTWCDD201301*	0	0		0		0		0		0		90	0	0	0
MTWCDD201501	24	0		5		26		24		10		16	0	0	0
MTWMT0200001	12	0.5		0		0		0		40		18	0	0	0
MTWMT0200503	19	0.5		0		10		0		6		78	0	0	0
MTWNP200501	12	0		3.5		12		0		0		22	0	0	0
MTWNP200502	11	16.5		12		0		4		0		34	0	0	0
MTWNP200901	13	17		2.5		2		18		2		2	0	0	0
MTWNP201101	16	0		5.5		12		26		0		46	0	0	0
MTWNP201301	16	0		0		12		6		16		28	0	0	0
MTWNP201402	24	0		8.3		30		22		4		26	0	0	0
MTWNP201403	10	0				6		2		10		66	0	0	0
MTWSPN201401*	4	0		0		16		0		0		10	0	0	0
MTWTDI201501	13	0		0		34		0		50		20	0	0	0
MTWWDL201401	23	0		1.5		20		26		16		16	0	0	0
MTWWDL201402*	7	0		0		10		0		0		80	0	0	0

0-10% of reference site benchmark

10-50% of reference site benchmark

50-100% of reference site benchmark

within reference site benchmark

NPS: Native Plant Species, NOS: Native overstorey, NMS: Native midstorey, NGCG: Native ground cover grasses, NGCS: Native ground cover shrubs, NGCO: Native ground cover other, EPC: Exotic Plant Cover, NTH: Number trees with hollows, OR: Overstorey Regeneration, FL: Fallen Logs.

Notes: \* = Sites which have not yet been sown with native seed mixes.

## 5.2 Rehabilitation sites compared to Central Hunter Ironbark-Spotted Gum-Grey Box Forest Reference Site Benchmarks

Rehabilitation sites have been compared to reference site benchmarks for Central Hunter Ironbark-Spotted Gum-Grey Box Forest in Table 24.

The following conclusions can be made from comparing the reference site benchmarks for Central Hunter Ironbark-Spotted Gum-Grey Box against the rehabilitation sites:

- All sites are lower than benchmark for NPS.
- Sites MTWNP200502 and MTWNP200901 are within benchmark for NOS.
- Many of the sites did not have any NOS. This is likely due to juvenile trees not occurring in the canopy stratum. While MTWMT0200001 and MTWMT0200503 support established tree canopies of *Eucalyptus cladocalyx*, this species does not contribute to the NOS cover percentage as this species is not endemic to the region.
- HVOCAR200901, HVOWES200801, MTWCDD201101, MTWCDD201501, MTWNP200501, MTWNP200502, MTWNP200901, MTWNP201101, MTWNP201402 and MTWWDL201401 are within benchmark for NMS. It should be noted that the lower benchmark value for NMS is zero.
- HVOWES201302 and MTWTDI201501 are within benchmark for NGCG.
- HVOCAR20090, HVORIV201401, HVORIV201404, HVORIV201406, HVOWES201101, MTWCDD201101, MTWCDD201501, MTWNP200502, MTWNP200901, MTWNP201101, MTWNP201301, MTWNP201402, MTWNP201403, MTWWDL201401 are above benchmark for NGCS.
- Sites MTWCDD201101, MTWNP200901, MTWCDD201501, MTWNP201101, MTWNP201402 and MTWWDL201401 exceed the upper benchmark for NGCS. This is likely a result of the combination of exceptional germination, and juvenile canopy and mid-story species contributing towards NGCS.
- HVOCHE201201, HVORIV20140, HVOWES201101, MTWCDD201101, MTWMT0200001, MTWNP201301, MTWTDI201501 and MTWWDL201401 are within benchmark for NGCO.
- All sites have a high percentage of weed cover. However, MTWCDD201101 and MTWNP200901 received scores of two which are close to the benchmark of zero.
- None of the sites contain evidence of native regeneration (e.g. young eucalypts regenerating naturally).
- All sites meet benchmark for NTH, although this is attributed to the benchmark value being zero.
- All sites are below benchmark for FL. Most sites did not contain any FL, although this is to be expected given the young age of the canopy.
- It cannot be concluded that the older sites are trending closer to benchmark compared to younger sites, as there is a range of results for each attribute when comparing establishment years. For example, MTWNP200901 has a high NOS compared to older years. This would largely be attributed to the management that has occurred at each rehabilitation area, including the seeding mix and seeding methods used.

Table 24. Rehabilitation sites compared to Central Hunter Ironbark-Spotted Gum-Grey Box Forest benchmarks

Plot name	NPS	NOS		NMS		NGCG		NGCS		NGCO		EPC	NTH	OR	FL
Central Hunter Ironbark-Spotted Gum-Grey Box Forest reference site benchmark	≥34	15.8	33.5	0.0	14.5	33.0	56.0	2.0	7.0	12.0	50.0	0	≥0	1	≥37
HVOCAR200901	9	0		13		0		4		2		30	0	0	0
HVOCAR200902	10	8		0		0		0		0		74	0	0	0
HVOCAR201401*	4	0		0		0		0		0		74	0	0	0
HVOCHE201201	5	0		0		0		0		18		14	0	0	0
HVOCHE201203*	3	0		0		20		0		0		64	0	0	0
HVOCHE201401*	3	0		0		28		0		0		42	0	0	0
HVORIV201401	18	0		0		4		4		20		50	0	0	0
HVORIV201402	7	0		0		14		0		4		38	0	0	0
HVORIV201403	11	0		0		24		0		2		52	0	0	0
HVORIV201404	10	0		0		16		4		10		10	0	0	0
HVORIV201405	1	0		0		0		0		0		60	0	0	0
HVORIV201406	9	0		0		0		2		4		34	0	0	0
HVOWES200801	16	11		2		16		0		2		10	0	0	0
HVOWES201101	21	8		0		12		2		24		10	0	0	0
HVOWES201301	14	0		0		30		0		8		30	0	0	0
HVOWES201302*	0	0		0		50		0		8		30	0	0	0
MTWCDD201101	24	3		6		18		48		12		2	0	0	0
MTWCDD201301*	0	0		0		0		0		0		90	0	0	0
MTWCDD201501	24	0		5		26		24		10		16	0	0	0
MTWMT0200001	12	0.5		0		0		0		40		18	0	0	0
MTWMT0200503	19	0.5		0		10		0		6		78	0	0	0
MTWNPN200501	12	0		3.5		12		0		0		22	0	0	0
MTWNPN200502	11	16.5		12		0		4		0		34	0	0	0
MTWNPN200901	13	17		2.5		2		18		2		2	0	0	0
MTWNPN201101	16	0		5.5		12		26		0		46	0	0	0
MTWNPN201301	16	0		0		12		6		16		28	0	0	0
MTWNPN201402	24	0		8.3		30		22		4		26	0	0	0
MTWNPN201403	10	0				6		2		10		66	0	0	0
MTWSPN201401*	4	0		0		16		0		0		10	0	0	0
MTWTDI201501	13	0		0		34		0		50		20	0	0	0
MTWDDL201401	23	0		1.5		20		26		16		16	0	0	0
MTWDDL201402*	7	0		0		10		0		0		80	0	0	0

0-10% of reference site benchmark  
 10-50% of reference site benchmark  
 50-100% of reference site benchmark  
 within reference site benchmark

NPS: Native Plant Species, NOS: Native overstorey, NMS: Native midstorey, NGCG: Native ground cover grasses, NGCS: Native ground cover shrubs, NGCO: Native ground cover other, EPC: Exotic Plant Cover, NTH: Number trees with hollows, OR: Overstorey Regeneration, FL: Fallen Logs.  
 Notes: \* = Sites which have not yet been sown with native seed mixes.

## 5.3 Landscape Function Analysis comparison to reference sites

### 5.3.1 Landscape Organisation Index (LOI)

In general the LOI at the reference and rehabilitation sites was high, with an average LOI of 0.98 for the reference sites and 0.86 and 0.68 for the rehabilitation sites (see Table 25). The variability in the range of scores however was greater at the rehabilitation sites than at the reference sites. The variability in values at the rehabilitation sites is likely to be influenced by the seed treatments applied to those sites and the age of the rehabilitation. For example, many of the rehabilitation sites with a LOI of 1 achieved this result due to the high density of grass species (whether native or exotic). An example of one of these sites with a high density of exotic grasses is HVORIV201405, which is similar to that observed in 2016. This result highlights that LOI does not determine native cover per se, rather it's a determination of site stability. Conversely, sites that achieved relatively low LOI indices were typically spoil/compost sites that had only recently been established and exhibited little grass or plant cover (i.e. MTW CDD201501 and MTW TD1201501). Changes in the LOI between 2016 and 2017 can be seen in Chart 1Chart 3.

Table 25. LOI and Soil Surface Indicators for all sites (Reference and Rehabilitation)

Site name	LOA 2017	Stability 2017	Infiltration 2017	Nutrient cycling 2017
<b>Reference sites</b>				
BELLSPOT1	1	56.9	70.4	41.4
BELLSPOT2	0.98	66.7	61.1	70.3
BELLSPOT3	1	55.2	61.8	64.4
WAMBOGB1	1	63.5	57.4	56.9
WAMBOGB2	1	61.1	55.5	50.8
WAMBOSPOT1	1	66.9	60.4	55.6
WAMBOSPOT2	0.95	68.9	58.1	79.8
WAMBOSPOT3	1	62.2	73.9	53.8
WARKGB01	1	53.9	65.2	42.9
WARKGB02	0.98	59.8	59	51.6
WARKGB03	0.99	55	55	38.5
WARKGB04	0.98	58.9	52.1	60.6
<b>Average</b>	<b>0.98</b>	<b>60.75</b>	<b>60.75</b>	<b>55.5</b>
<b>Hunter Valley Operations</b>				
HVOCAR200901	0.59	59.4	35.8	39.7
HVOCAR200902	0.93	63	75	61.5
HVOCAR201401	0.75	50.9	59.6	49.9
HVOCHE201201	0.84	56.1	54	47.7
HVOCHE201203	0.96	62.8	58.4	47.7
HVOCHE201401	0.99	51.1	47.9	36.2
HVORIV201401	0.94	67.1	60.5	58.3
HVORIV201402	0.84	53.5	51.6	43.4
HVORIV201403	0.91	53.4	33.1	36.3

HVORIV201404	0.87	55.6	43.2	32.1
HVORIV201405	1	56.7	46.9	32.3
HVORIV201406	0.95	51.6	70.5	15.3
HVOWES200801	0.84	69.6	43.5	72.1
HVOWES201101	0.73	63.8	53.2	54.4
HVOWES201301	0.67	61.9	50	42.9
HVOWES201302	0.96	62	58	47
<b>Average</b>	<b>0.86</b>	<b>58</b>	<b>52.56</b>	<b>44.75</b>
<b>Mount Thorley Warkworth</b>				
MTWCDD201101	0.71	69.3	49.6	61.5
MTWCDD201301	0.97	60	48	49
MTWCDD201501	0.28	13.3	8.2	5.7
MTWMTO200001	0.96	56.1	56.4	41.5
MTWMTO200503	0.35	56.1	45.3	33.5
MTWNP200501	0.58	51.3	50.1	43.1
MTWNP200502	0.67	39.5	41.1	34
MTWNP200901	0.89	73.2	54.1	58.5
MTWNP201101	0.21	69.3	49.6	61.5
MTWNP201301	0.61	49.9	29.4	30.8
MTWNP201402	0.55	53	51.6	44.8
MTWNP201403	0.95	51.5	39	38.3
MTWSP201401	0.94	45.2	65.4	49.5
MTWTD1201501	0.64	58.9	22.8	18.6
MTWWDL201401	0.68	44.2	32.5	35.9
MTWWDL201402	0.94	64.5	43.7	46.4
<b>Average</b>	<b>0.68</b>	<b>53.4</b>	<b>42.9</b>	<b>40.75</b>

### 5.3.2 Soil surface condition

#### *Stability*

There's some level of consistency between the average stability index for reference and rehabilitation sites, with the reference sites obtaining an average index of 60.75 and the rehabilitation sites obtaining an average score of 55.0. As with the results from the LOI (above), stability indicators across the reference sites show greater consistency than the stability indicators for the rehabilitation sites. Of note also is the reduction in the average stability score for both the reference sites and rehabilitation sites. One of the indicators of stability is vegetation cover which due to the dry conditions and treatment (herbicide spray) at some sites had reduced. This may have resulted in a reduction in the average score at the rehabilitation and reference sites. Changes in scores for stability between 2016 and 2017 for reference sites at HVO and MTW can be found in Chart 4Chart 6.

#### *Infiltration*

The average infiltration scores for both reference and rehabilitation sites has increased from 58.32 and 43.42 to 60.75 and 47.73 respectively. The range of scores was greater for the rehabilitation scores than



the reference sites. This may be due to an increase in the litter component at most sites. Under the methodology, dead and decaying vegetation forms litter and this probably contributed to the higher infiltration scores. Changes in scores for infiltration between 2016 and 2017 for reference sites at HVO and MTW can be found in Chart 7Chart 9.

### Nutrient cycling

Nutrient enrichment values between 2016 and 2017 showed no obvious trend with average difference for the reference sites increasing from 51.43 to 55.5 and the average for the rehabilitation sites being 42.75. Chart 10Chart 12 below show the difference in these scores achieved at each site between 2016 and 2017.

Chart 1. Changes in LOI at Reference Sites

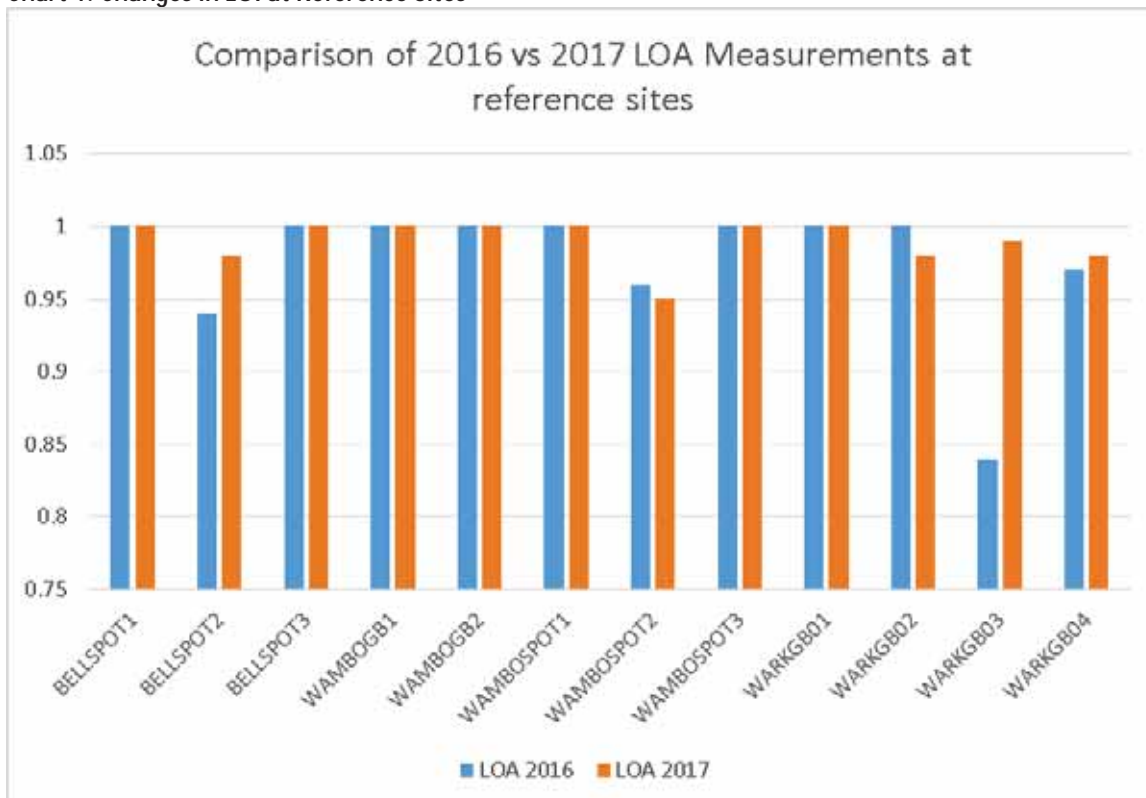


Chart 2. Changes in LOI at HVO rehabilitation sites

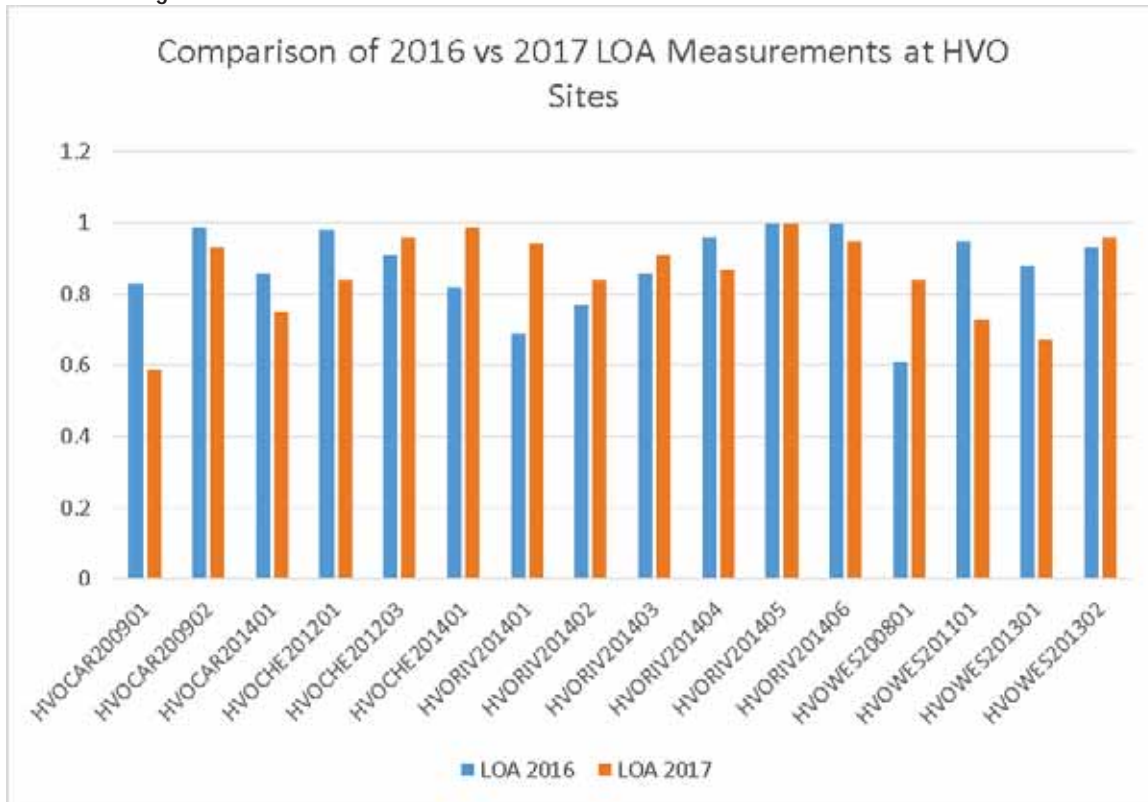


Chart 3. Changes in LOI at MTW rehabilitation sites

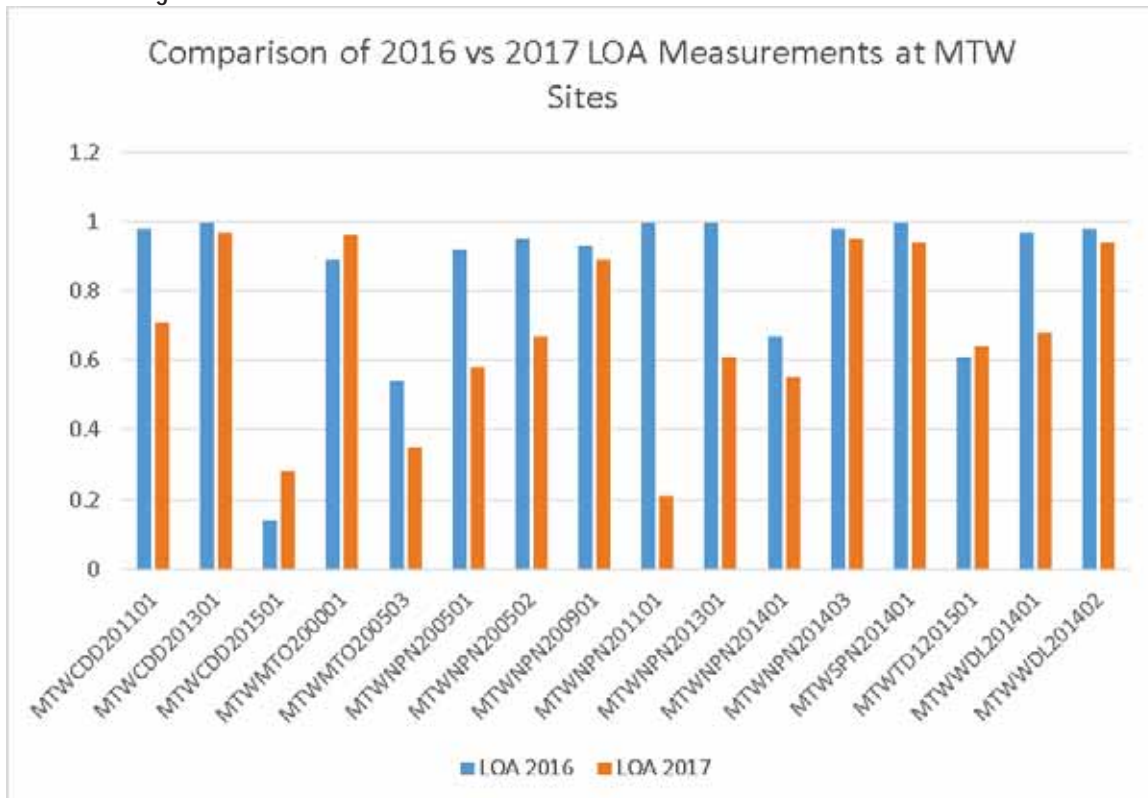


Chart 4. Changes in the stability score at reference sites

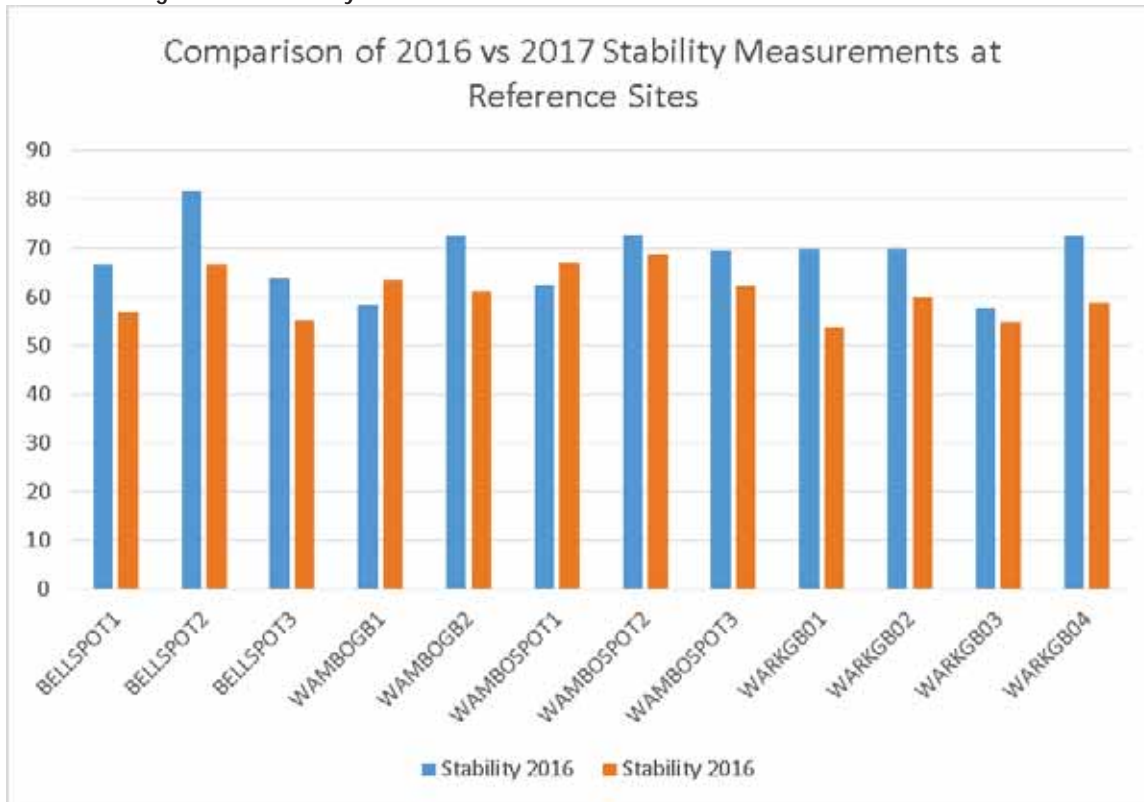


Chart 5. Changes in the stability score at HVO rehabilitation sites

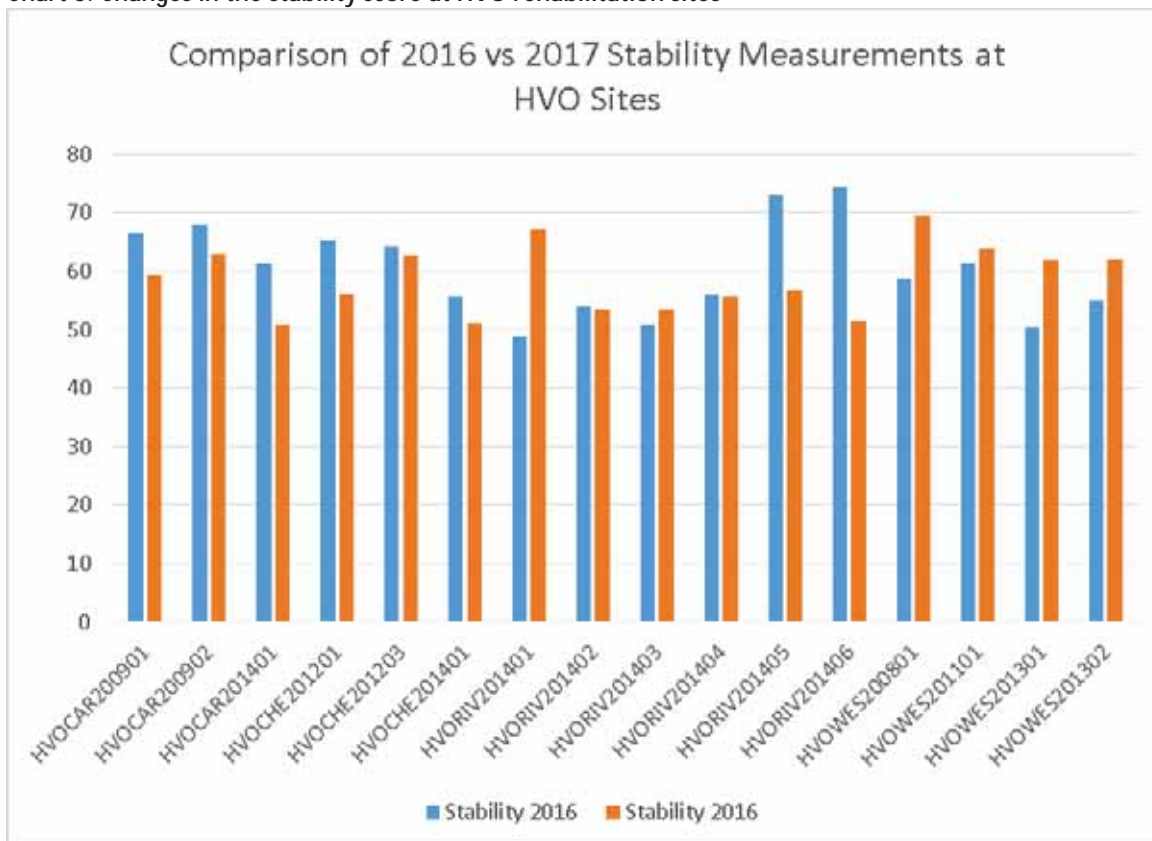


Chart 6. Changes in the stability score at MTW rehabilitation sites

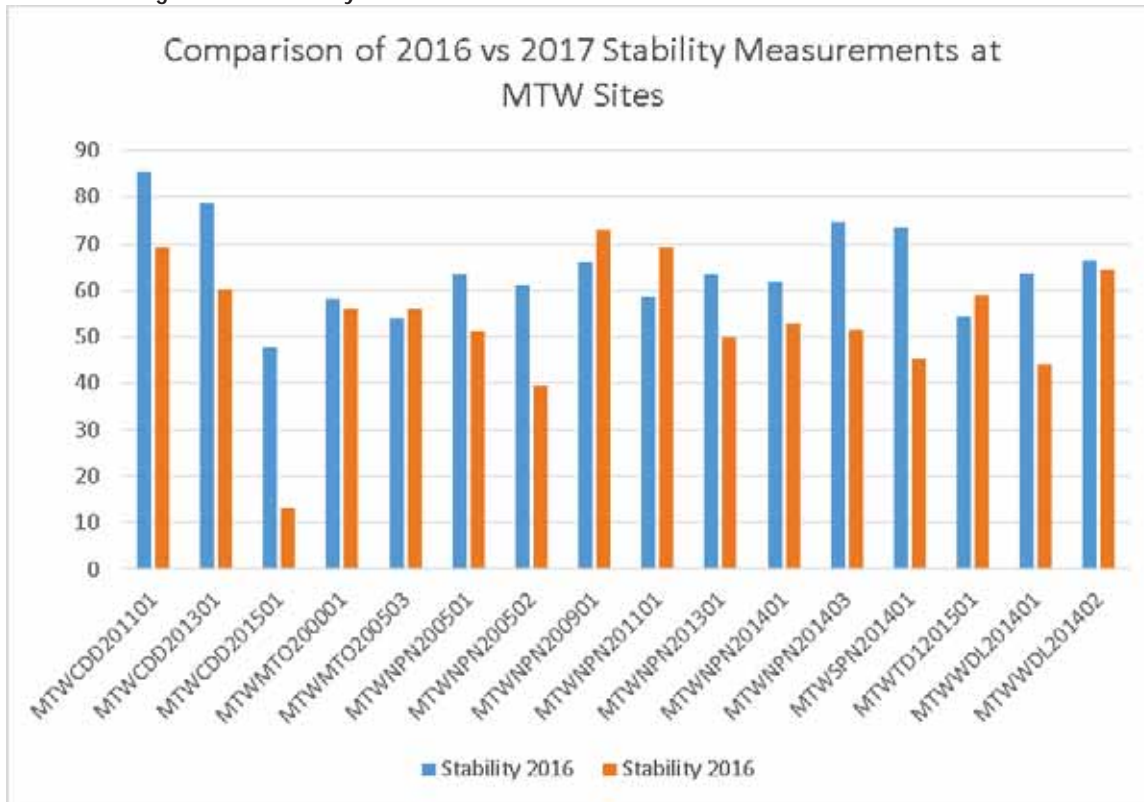


Chart 7. Changes in infiltration scores at reference sites

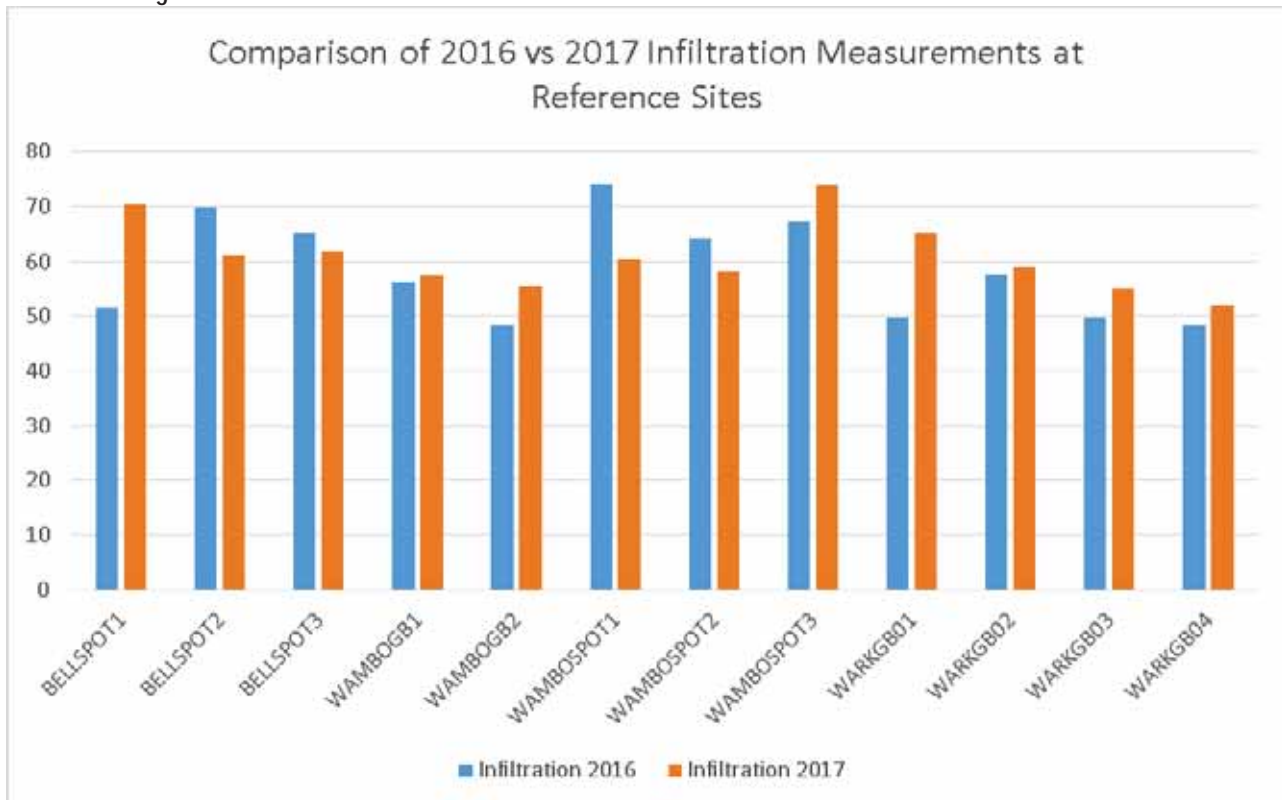


Chart 8. Changes in the infiltration scores at HVO rehabilitation sites

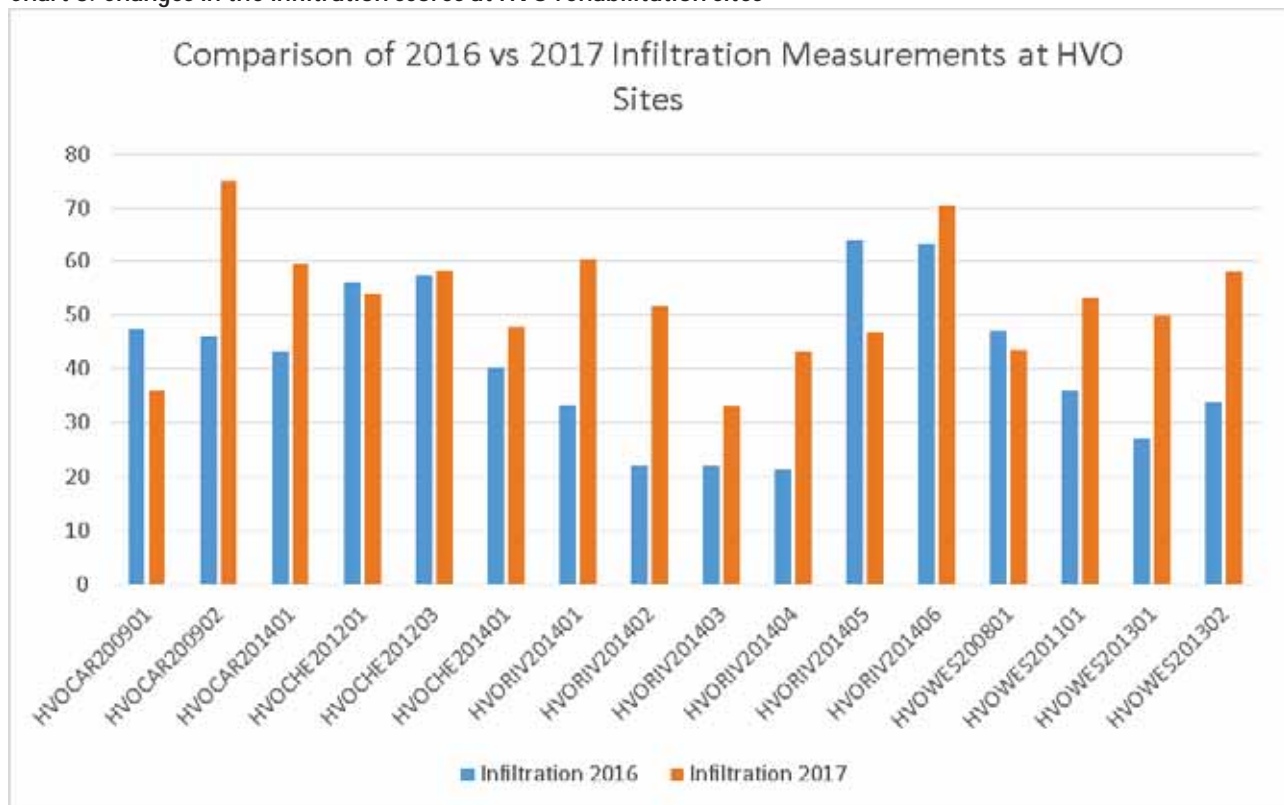


Chart 9. Changes in the infiltration scores at MTW rehabilitation sites

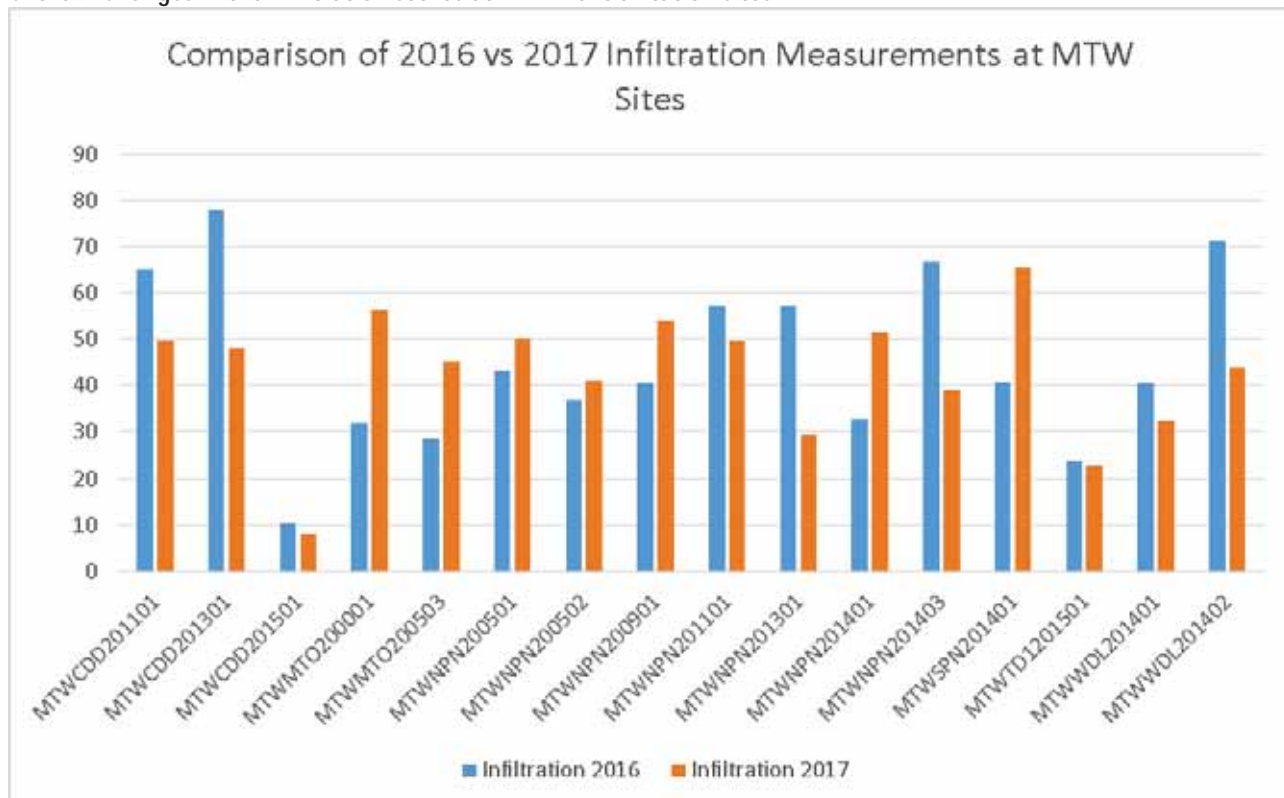




Chart 10. Changes in the nutrient cycling scores at reference sites

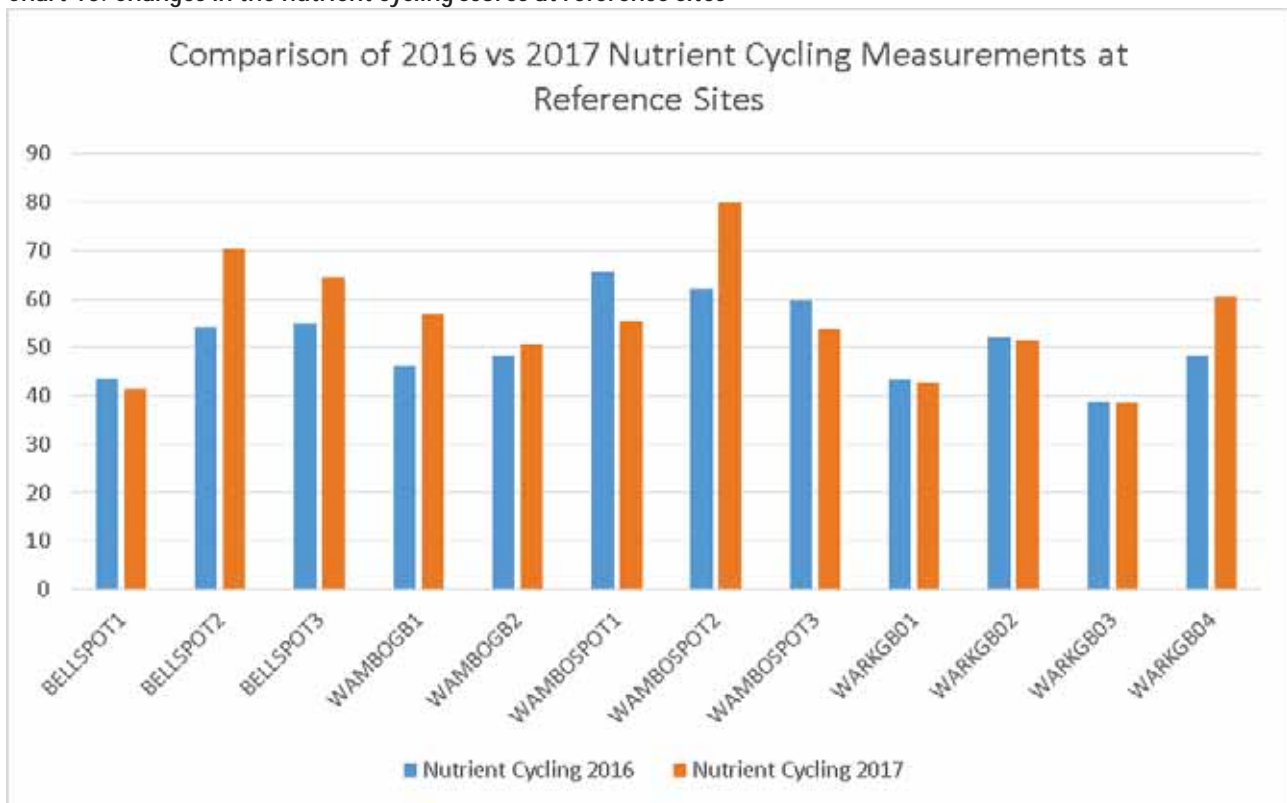


Chart 11. Changes in the nutrient cycling scores at HVO rehabilitation sites

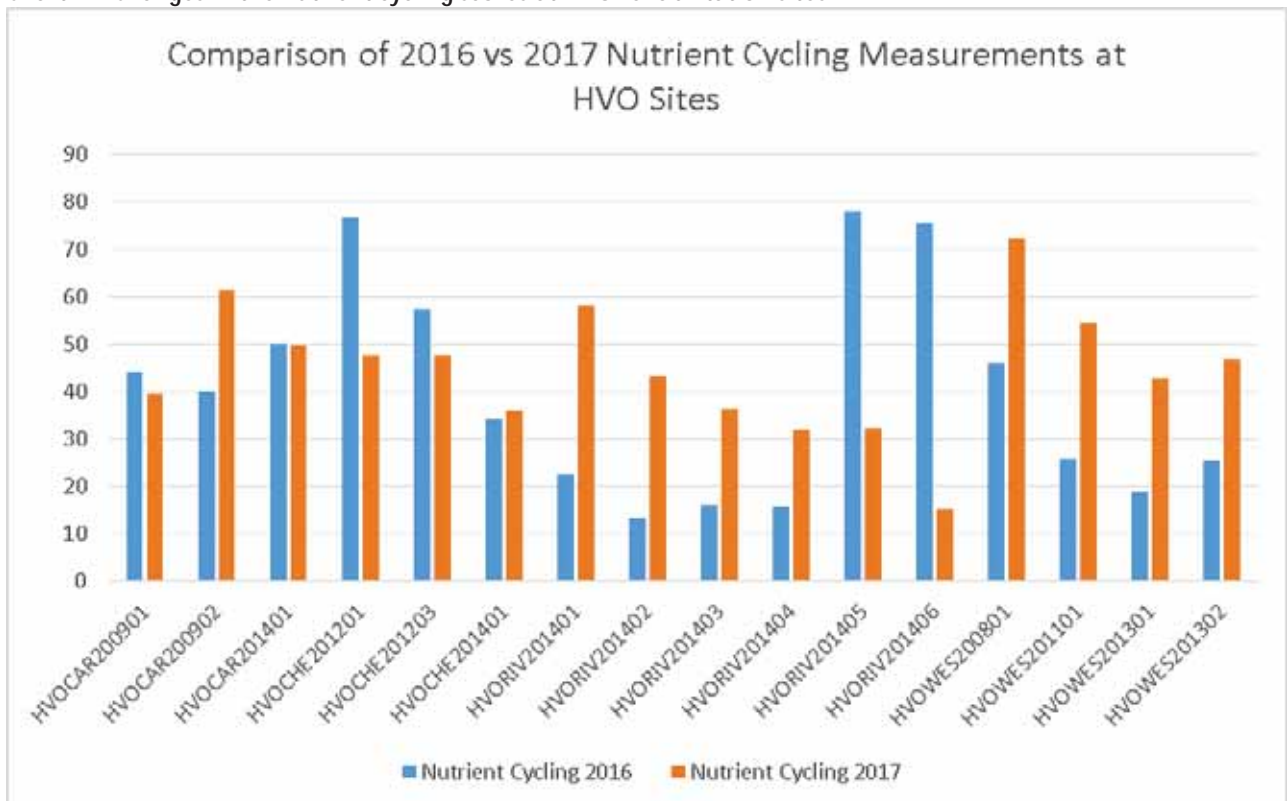
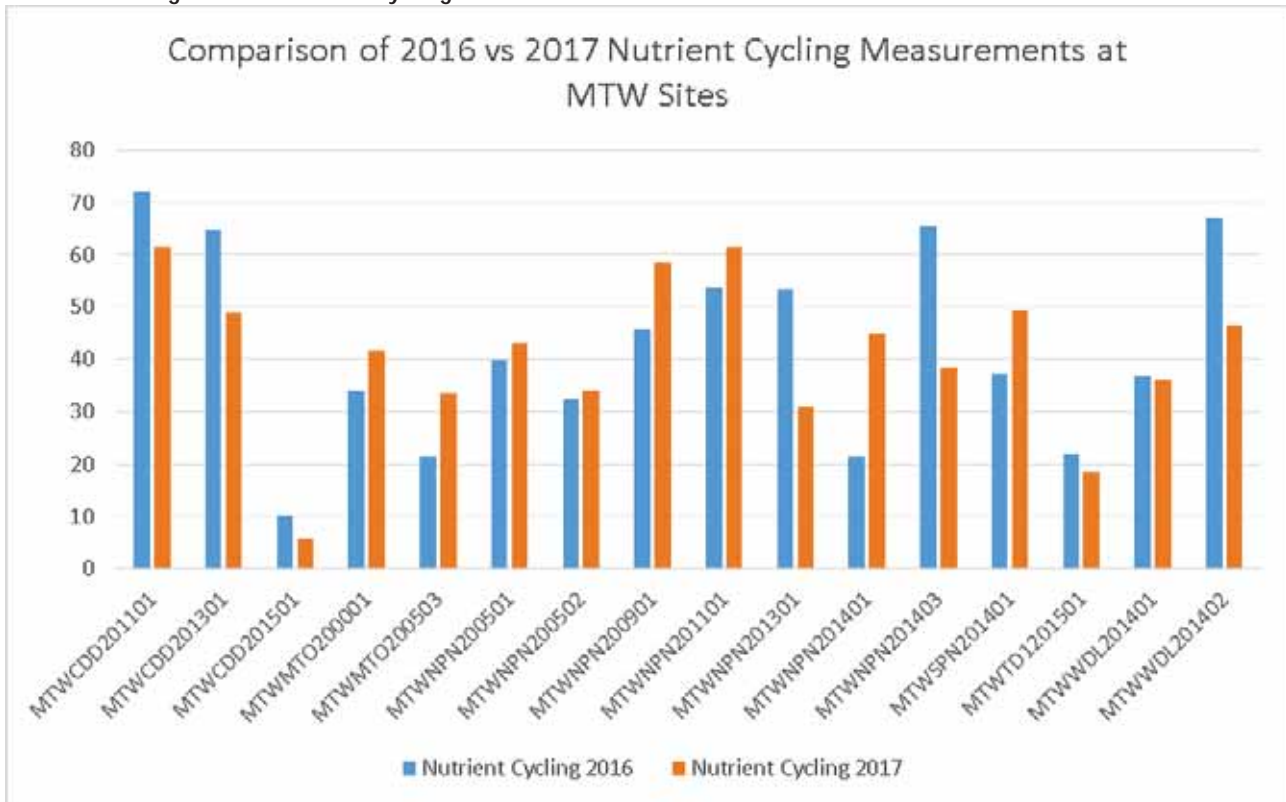


Chart 12. Changes in the nutrient cycling scores at MTW rehabilitation sites.



## 5.4 Compliance with the performance criteria outlined in the Mining Operations Plan.

The Mining Operations Plan provides a range of performance criteria to assess the native rehabilitation, in terms of establishment and sustainability. Due to the number of sites and the breadth and number of performance criteria it is difficult to assess the performance of sites against the criteria in one Table. Table 1 Table 26 below provide a list of each of the criteria and provides the table number where it's addressed for each of the sites.

Table 26. MOP Performance Criteria – MTW and HVO rehabilitation sites

Performance Criteria – Growth Medium Development		Domain Type	Table Number
1	pH >5.5 and <8.5	All Woodland	Table 21 & 22
2	Electrical Conductivity <2 dS/m	All Woodland	Table 21 & 22
3	Phosphorous within levels in analogue sites by Year 5	All Woodland	Table 21 & 22
4	Organic Carbon within levels in analogue sites by Year 5	All Woodland	Table 21 & 22
5	Cation Exchange Capacity within levels in analogue sites by Year 2	All Woodland	Table 21 & 22
6	Exchangeable Sodium Percentage within levels in analogue sites by Year 2	All Woodland	Table 21 & 22
7	Calcium/magnesium ratio within levels in analogue sites by Year 2	All Woodland	Table 21 & 22
Performance Criteria – Ecosystem and Landuse Establishment		Domain Type	Table Number
1	Based on key physical, biological and chemical characteristics the LFA Stability Index provides an indication of the site's stability and that it is comparable to or trending towards that of analogue sites (%)	All Woodland	Table 17
2	Based on key physical, biological and chemical characteristics the LFA Infiltration Index provides an indication of the site's infiltration capacity and that it is comparable to or trending towards that of analogue sites (%)	All Woodland	Table 17
3	Based on key physical, biological and chemical characteristics the LFA Nutrient Recycling Index provides an indication of the site's ability to recycle nutrients and that it is comparable to or trending towards that of analogue sites (%)	All Woodland	Table 17
4	The Landscape Organisation Index provides a measure of the ability of the site to retain resources and that it is comparable to or trending towards that of analogue sites (%)	All Woodland	Table 17
5	The number of tree species comprising the vegetation community is comparable to that of analogue sites (no. species/area)	Woodland - Other	Table 19
6	The number of grass species comprising the vegetation community is comparable to that of analogue sites (no. species/area)	Woodland - Other	Table 16
7	The density of trees is comparable to that of analogue sites (no./area)	Woodland - Other	Table 19
8	The number of tree species comprising the vegetation community is comparable to that of analogue sites (no. species/area)	Woodland EEC	Table 19
9	The number of shrub species comprising the vegetation community is comparable to that of analogue sites (no. species/area)	Woodland EEC	Table 16
10	The number of grass species comprising the vegetation community is comparable to that of analogue sites (no. species/area)	Woodland EEC	Table 16
11	The number of subshrub species and understorey species (other than grasses) comprising the vegetation community is comparable to that of analogue sites (no. species/area).	Woodland EEC	Table 16



12	The native plant species richness is within 50-100% or exceeds that of analogue sites (no. species/area). (Use benchmark values)	Woodland EEC	Table 23 & 24
13	The density of trees is comparable to that of analogue sites (no./area)	Woodland EEC	Table 19
<b>Performance Criteria – Ecosystem and Landuse Sustainability</b>		<b>Domain Type</b>	<b>Table Number</b>
1	Weed plant cover (calculated as a percentage of total ground cover) is comparable to that of analogue sites. (% Cover)	Woodland - Other	Table 13 & 14
2	Total groundcover is the sum of protective ground cover components (dead and live plant material, rocks and logs) and is comparable to that of analogue sites (% Cover)	Woodland - Other	Table 17
3	The diversity of maturing trees and shrubs with a stem diameter greater than 5cm is comparable to that of analogue sites (no./area).	Woodland - Other	Table 20
4	The percentage of maturing trees and shrubs with a stem diameter greater than 5cm that are local endemic species is comparable to analogue sites.	Woodland - Other	Table 20
5	The density of maturing trees and shrubs with a stem diameter greater than 5cm is comparable to analogue sites (no./area).	Woodland - Other	Table 20
6	Average trunk diameter (dbh) of the tree population provides a measure of age and growth rate and that it is trending towards that of analogue sites (cm).	Woodland - Other	Table 20
7	The percentage of the tree population which are in healthy condition and that the percentage is comparable to analogue sites.	Woodland - Other	N/A
8	The percentage of the tree population which are in a medium health condition and that the percentage is comparable to analogue sites.	Woodland - Other	N/A
9	The percentage of the tree population which are in a state of advance dieback and that the percentage is comparable to analogue sites.	Woodland - Other	N/A
10	The presence of reproductive structures such as buds, flowers or fruit on trees and shrubs provides evidence that the ecosystem is maturing, capable of recruitment and can provide habitat resources and that the % population is comparable to that of analogue sites.	Woodland - Other	Table 20
11	The proportion of over-storey species occurring as regeneration is within 50-100% or exceeds that of analogue sites.	Woodland - Other	Table 13 & 14
12	The percentage of native over storey cover is within 50-100% or exceeds that of analogue sites(Use benchmark values)	Woodland - EEC	Table 23 & 24
13	The percentage of native mid storey cover is within 50-100% or exceeds that of analogue sites. (Use benchmark values)	Woodland - EEC	Table 23 & 24
14	The percentage of native ground cover (grasses) is within 50-100% or exceeds that of analogue sites. (Use benchmark values)	Woodland - EEC	Table 23 & 24
15	The percentage of native ground cover (shrubs) is within 50-100% or exceeds that of analogue sites. (Use benchmark values)	Woodland - EEC	Table 23 & 24
16	The percentage of native ground cover (other) is within 50-100% or exceeds that of analogue sites. (Use benchmark values)	Woodland - EEC	Table 23 & 24
17	Exotic plant cover (calculated as a percentage of total ground cover and mid storey cover) is within 5-33% or less than that of analogue sites. (Use benchmark values)	Woodland - EEC	Table 23 & 24
18	Total groundcover is the sum of protective ground cover components (dead and live plant material, rocks and logs) and is comparable to that of analogue sites (% Cover).	Woodland - EEC	N/A
19	The abundance of native understorey species per square metre, averaged across the site, provides an indication of the heterogeneity of the site and that the number of native species is comparable to analogue sites (no. species/m2).	Woodland - EEC	Table 16

20	The diversity of maturing trees and shrubs with a stem diameter greater than 5cm is comparable to that of analogue sites (no./area).	Woodland - EEC	Table 20
21	The percentage of maturing trees and shrubs with a stem diameter greater than 5cm that are local endemic species is comparable to analogue sites.	Woodland - EEC	Table 20
22	The density of maturing trees and shrubs with a stem diameter greater than 5cm is comparable to analogue sites (no./area).	Woodland - EEC	Table 20
23	Average trunk diameter (dbh) of the tree population provides a measure of age and growth rate and that it is trending towards that of analogue sites (cm).	Woodland - EEC	Table 20
24	The percentage of the tree population which are in healthy condition and that the percentage is comparable to analogue sites.	Woodland - EEC	Table 20
25	The percentage of the tree population which are in a medium health condition and that the percentage is comparable to analogue sites.	Woodland - EEC	Table 20
26	The percentage of the tree population which are in a state of advance dieback and that the percentage is comparable to analogue sites.	Woodland - EEC	Table 20
27	The presence of reproductive structures such as buds, flowers or fruit on trees and shrubs provides evidence that the ecosystem is maturing, capable of recruitment and can provide habitat resources and that the % population is comparable to that of analogue sites.	Woodland - EEC	Table 20
28	The proportion of over-storey species occurring as regeneration is within 50-100% or exceeds that of analogue sites. (Use benchmark values)	Woodland - EEC	Table 23 & 24
29	The total length of fallen logs is within 50- <100% or exceeds that of analogue sites. (Use benchmark values)	Woodland - EEC	Table 23 & 24
30	The number of hollows / nesting sites is within 50- <100% or exceeds that of analogue sites. (Use benchmark values)	Woodland - EEC	Table 23 & 24

### 5.4.1 Growth Medium Development

Overall, many of the rehabilitation sites fall within the reference site soil property ranges and therefore meet the MOP performance criteria. Reference site ranges have also been used as a performance indicator to compare the reference site data with that of the rehabilitation sites (Table 21 Table 22). The following conclusions can be made when comparing rehabilitation sites against reference sites (where applicable) and the target specified in the performance criteria:

- pH falls between the compliance values specified in the MOP at all sites excluding HVO RIV201404, HVO RIV201403, HVO RIV201402, HVO RIV201401, MTWCDD201501 and MTWTD1201501. These sites have only recently been established and may take some time for the pH to reduce and become closer to neutral, as can be seen in older sites.
- Electrical Conductivity (EC) falls below the required target of 2dS/m as outlined in the MOP for all sites, however the rehabilitation sites are generally higher than the reference site range.
- Phosphorous levels only meet benchmark for two sites MTWNPN200901 and MTWCDD201101. Levels of phosphorus levels at rehabilitation sites was markedly higher than those recorded at reference sites.
- Organic Carbon has meet benchmark for all sites. This is likely due to compost being added and the organic matter from short lived annuals. Sites with higher number of exotic cover tended to have higher Organic Carbon. These higher organic carbon levels may also make it difficult for native species to compete on sites with a high densities of exotic species.
- Cation Exchange Capacity (CEC) falls between benchmark for all sites with the exception of HVOWES201302, HVOCAR200902, HVOCAR201401, HVORIV201406, HVORIV201404, HVORIV201403, HVORIV201402, HVORIV201401, and HVOCHE201201.

- Sites HVORIV201404, HVORIV201402, HVORIV201401, HVOCHE201203, MTWNPN201403, MTWCDD201101, MTWCDD201501, MTWWDL201401, MTWWDL201402, MTWMTO200001 and MTWTDI201501 did not meet benchmark for sodium levels.
- HVO WES201301, HVO WES201302, HVO RIV201405, HVO RIV201404, HVO CHE201201, HVO CHE201401 – B, MTWNPN201301, MTWNPN200901- B and MTWCDD201301 did not meet the reference site benchmark for Calcium / Magnesium Ratio.

### 5.4.2 Ecosystem and Landuse Development

LFA based performance indicators have been covered in section 5.3 and the results can be viewed in Table 17Table 25.

Species richness at rehabilitation sites were compared to benchmark values calculated from the reference sites. Tree species meet benchmark for four sites at HVO and six sites at MTW. As can be seen in Table 19, these sites tended to have higher densities of trees than reference sites and will eventually need to be thinned to allow other species of shrubs, herbs, forbes and grasses to establish and meet benchmark. This is particularly the case for HVOWES200801, HVOWES201101 and MTWCDD201501 which contains densities of trees in excess of 4000 stems per hectare.

MTW had seven sites meet the benchmark for shrubs; MTWCDD201101, MTWCDD201501, MTWNPN200901, MTWNPN201101, MTWNPN201301, MTWNPN201401 and MTWWDL201401. While HVO only had two sites meet benchmark; HVOWES200801 and HVOWES201101. Grass species on the MTW rehabilitation sites meet benchmark for six sites; MTWCDD201501, MTWMTO200503, MTWNPN201301, MTWNPN201401, MTWTDI201501 and MTWWDL201401. Although only three of the HVO sites meet benchmark, these included HVORIV201401, HVOWES200801 and HVOWES201301. No rehabilitation sites meet benchmark for 'other', these include species of herbs and forbes. This may have been due to the exceptionally hot weather the area received causing these species to die off earlier and may have been exacerbated on rehabilitation sites due to the lack of larger shade trees.

As discussed in Section 5.1 and 5.2 only 30 percent of sites for Central Hunter Grey Box – Ironbark Woodland and 20 percent of sites for Central Hunter Ironbark-Spotted Gum-Grey Box Forest managed to reach the 50-100 percent native plant species richness benchmark. No site managed to exceed 100 percent (Table 23Table 24).

### 5.4.3 Ecosystem and Landuse Sustainability

While only eight of the 32 rehabilitation sites had trees greater than five centimetres DBH, the diversity of maturing trees was relatively high. Three sites exceeded benchmark, three sites fell between 50-100 percent and only two fell between 10-50 percent. These species were all local endemic species as this was what exclusively marked and recorded during the survey.

Density was also calculated in Table 20 for individuals greater than five centimetres DBH. Three of these sites meet the density benchmark, however many of these sites had individuals that were less than five centimetres DBH and were therefore not recorded. For this reason it is likely that these benchmark scores will increase as these smaller trees mature and as mentioned previously may even require thinning. Average DBH did not meet benchmark, although, this is to be expected due to the young age of the rehabilitation site.

Tree health was not a variable expressly recorded during this year's monitoring program and was recorded based on hollows, DBH and maturity. In general, trees on both reference and rehabilitation sites appeared to be healthy and were not suffering from extensive dieback. Table 20 shows one site contained two tree

that had buds or flowering. This has brought the average for both rehabilitation sites up to be comparable to the benchmark achieved by the reference site. This shows that some of the rehabilitation sites are beginning to become capable of recruitment.

The abundance of native understory species per square meter, averaged across a site, provides an indication of the heterogeneity of the site and allows comparison with the reference site. Table 20 provides the number of species per square meter for each site and shows MTWMT0200503 being the only site to meet benchmark. Overall rehabilitation sites average to fall between 10-50 percent of the benchmark value for this attribute.

## 6. Conclusions

### 6.1 Conclusions

There is significant variation in the types and ages of the rehabilitation sites which formed part of this monitoring project and thus there is a high degree of variability in the results, particularly for native plant species richness, exotic cover, percentage cover, LOI and projected cover of all strata. Weather conditions varied greatly between the 2016 and 2017 monitoring seasons, which affected the degree of native cover and diversity. Provided below are some of the core outcomes of the BioBanking assessment, LFA, the assessment of tree canopy and over-storey regeneration and a summary of the performance of rehabilitation areas against the criteria required in the mop.

#### 6.1.1 BioBanking assessment

Aspects of the BioBanking methodology have been used as part of this monitoring program to make comparisons with the target EECs, through the establishment of reference sites. A total of 12 reference sites were established, six representing the Central Hunter Ironbark-Spotted Gum-Grey Box EEC and six representing the Central Hunter Grey Box-Ironbark Woodland EEC. BioBanking plots were undertaken at rehabilitation sites, enabling the comparison of rehabilitation sites against reference sites for the parameters collected. Results were generally positive, with some sites achieving the reference site benchmark for some of the ten attributes. Some of the core outcomes include:

- All rehabilitation sites fall below benchmark in at least one attribute for both of the target communities.
- Only 30 percent of sites for Central Hunter Grey Box – Ironbark Woodland and 20 percent of sites for Central Hunter Ironbark-Spotted Gum-Grey Box Forest managed to reach the 50-100 percent native plant species richness benchmark. No site managed to exceed 100 percent.
- Due to the density of regenerating shrub species, a number of sites exceed the upper benchmark for NGCS. This is likely a result of the combination of exceptional germination, and juvenile canopy and mid-story species contributing towards NGCS.
- Three sites are within benchmark for NOS; HVOCAR200902, HVOWES200801, HVOWES201101, MTWNPN200502 and MTWNPN200901 are within benchmark for NOS for Central Hunter Grey Box-Ironbark Woodland, and MTWNPN200502 and MTWNPN200901 are within benchmark for Central Hunter Ironbark-Spotted Gum-Grey Box.
- All other sites have less than ten percent NOS. This is likely due to juvenile trees not occurring in the canopy stratum. While MTWMTO200001 and MTWMTO200503 support established tree canopies of *Eucalyptus cladocalyx*, this species does not contribute to the NOS cover percentage as it is not endemic to the region.
- This year's reference site benchmarks vary from last year's due to seasonal differences. While field surveys were conducted during the same time of the year as the 2016 surveys, many benchmark values are lower. This is likely a result of extended periods of extremely hot weather, which is likely to have killed sensitive herbs and forbs earlier than the previous year.

This report has noted differences between the published OEH benchmarks and the reference site benchmark data collected.

### 6.1.2 Landscape function analysis

LFA was undertaken at all the sites surveyed, including the reference and rehabilitation sites. Similar to last year, LFA scores (LOI and soil surface indicators) were high for reference sites, and variable for rehabilitation sites. A number of core outcomes of the LFA assessment include:

- LOI at the reference and rehabilitation sites was generally high, with an average LOI of .98 (an increase from 2016) for the reference sites and .77 at the rehabilitation sites.
- The variability in the range of scores however was greater at the rehabilitation sites when compared with the reference sites. The variability in values at the rehabilitation sites is likely to be influenced by the seed treatments applied to sites and the age of the rehabilitation.
- Similar to the outcomes observed last year, many of the rehabilitation sites with a LOI of 1 achieved this result due to the high density of grass species (whether native or exotic), including HVORIV201405.
- Sites which achieved relatively low LOI indices (MTWCDD201501 and MTWTD201501) were sites that had only recently been established and exhibited little grass or plant cover. These were the same sites that achieved the lowest LOI scores in the 2016 monitoring period, highlighting that perhaps that LOI values cannot be expected to change during short intervals.
- It is also valuable to note in this context that LOI is not a measure of native diversity, and in this regard not a measure of successful rehabilitation of native vegetation.

### 6.1.3 MOP Performance Criteria

Growth medium development performance criteria were largely measured by the comparison of rehabilitation sites with reference sites, forming benchmarks on which they can be compared. The key conclusions which can be drawn from this data include:

- pH falls between the compliance values specified in the MOP at all but six sites. These sites have only recently been established and may take some time for the pH to lower and become more neutral, as can be seen in older sites.
- Electrical Conductivity (EC) falls below the 2dS/m at all sites as specified in the MOP as the benchmark.
- Phosphorous levels only meet benchmark for two sites MTWNPN200901 – A and MTWCDD201101.
- Organic Carbon has meet benchmark for all sites. This is likely due to compost being added and the organic matter from short lived annuals. Sites with higher number of Exotic cover tended to have higher Organic Carbon. These higher organic carbon levels may also make it difficult for native species to compete on sites with a high densities of exotic species.
- Cation Exchange Capacity (CEC) falls between benchmark for all site with the exception of HVOWES201302, HVOCAR200902, HVOCAR201401, HVORIV201406, HVORIV201404, HVORIV201403, HVORIV201402, HVORIV201401, and HVOCHE201201. This means the remaining sites have not met benchmark by year two.
- Sites HVORIV201404, HVORIV201402, HVORIV201401, HVOCHE201203, MTWNPN201403, MTWCDD201101, MTWCDD201501, MTWWDL201401, MTWWDL201402, MTWMT0200001 and MTWTDI201501 did not meet benchmark for sodium levels in year two.
- MTWNPN200901 – was the only site which met benchmark values for all variables for growth medium development

Ecosystem, Landuse Sustainability and Landuse Establishment are covered by very similar MOP Performance Criteria, for this reason and to save duplication they have been discussed as one and combined for the majority of the report. The following conclusions can be drawn:

- Tree species richness meet benchmark for four sites at HVO and six sites at MTW. These sites tended to have higher densities of trees than reference sites and will eventually need to be thinned to allow other species of shrubs, herbs, forbes and grasses to establish and meet. This is particularly the case for

HVOWES200801, HVOWES201101 and MTWCDD201501 which contain densities of trees in excess of 4000 stems per hectare.

- No rehabilitation sites meet benchmark for 'other', these include species of herbs and forbes. This may have been due to the exceptionally hot weather the area received causing these species to die off earlier and may have been exacerbated on rehabilitation sites due to the lack of larger shade trees.
- While only 8 sites out of the 32 rehabilitation sites had trees greater than five centimetres DBH, the species diversity of maturing trees was relatively high. Three sites exceeded benchmark, three sites fell between 50-100 percent and only two fell between 10-50 percent.
- MTWMTO200503 was the only site to meet benchmark for the abundance of native understory species per square meter. Overall rehabilitation sites averages fall between 10-50 percent of the benchmark value.

Many of these Performance Criteria will start to meet benchmark values over time. Some future monitoring and management recommendations that may be useful include:

- The thinning of trees on sites that contain densities of trees greater than reference site benchmarks
- Additional seeding of understory species in areas that lack diversity as compared with benchmark values
- The inclusion of tree health data collection to allow the quantifiable comparison of tree health between reference and rehabilitation sites.
- Improving the MOP Performance Criteria Table by combining and refining duplicate performance criteria and creating a numbering system so that specific performance criteria can be referenced.

## 7. References

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AECOM (2012) Monitoring Methodology - Post-mined Lands MTW and HVO North Mine Sites. Prepared for Coal & Allied.

Coal and Allied (2015) Mining Operations Plan – HVO South.

Coal and Allied (2016a) Mining Operations Plan – HVO North.

Coal and Allied (2016b) Mining Operations Plan - Mount Thorley Warkworth.

Niche (2016) Native Vegetation Rehabilitation Monitoring 2016 - Mount Thorley Warkworth and Hunter Valley Operations. Prepared for Coal & Allied.

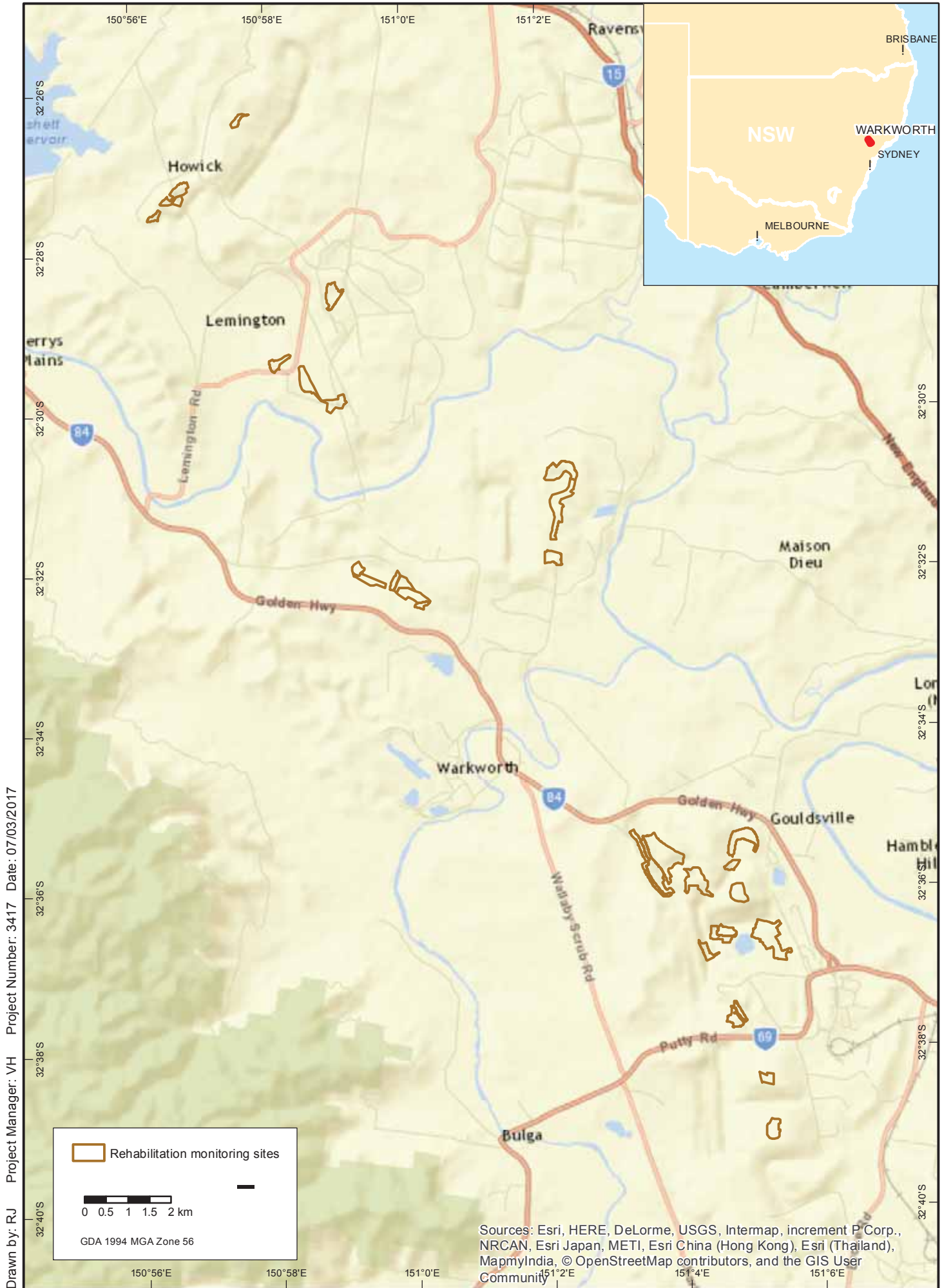
Tongway, D. and Hindley, N. (2004) Landscape Function Analysis: Procedures for Monitoring and Assessing Landscapes with Special References to Mine sites and Rangelands. CSIRO Sustainable Ecosystems, Canberra.

DECCW (2010) Belford National Park: plan of management / NSW National Parks and Wildlife Service, part of the Department of Environment, Climate Change and Water.



## Figures

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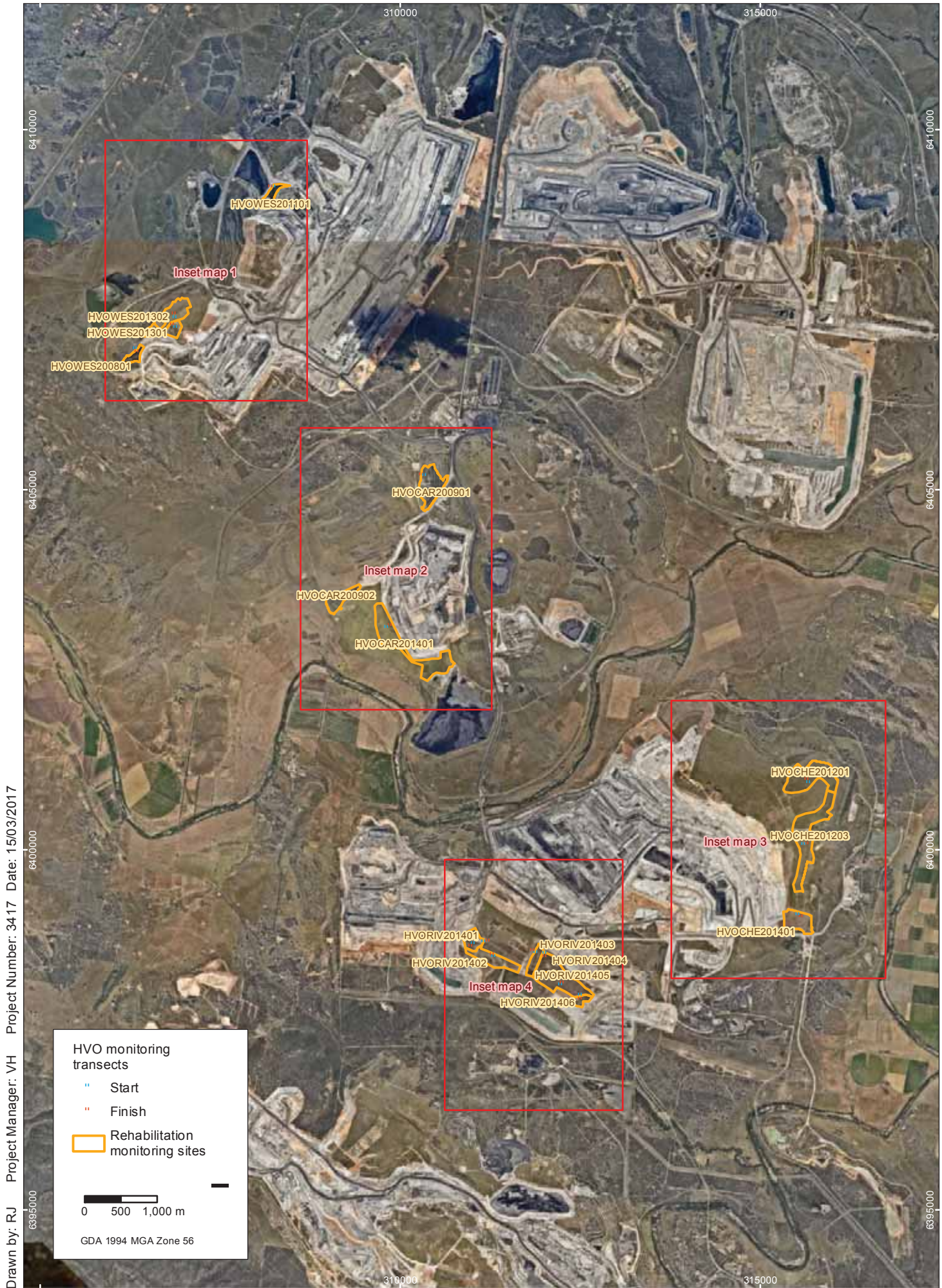


Project location

Coal & Allied Rehabilitation Monitoring

**FIGURE 1**





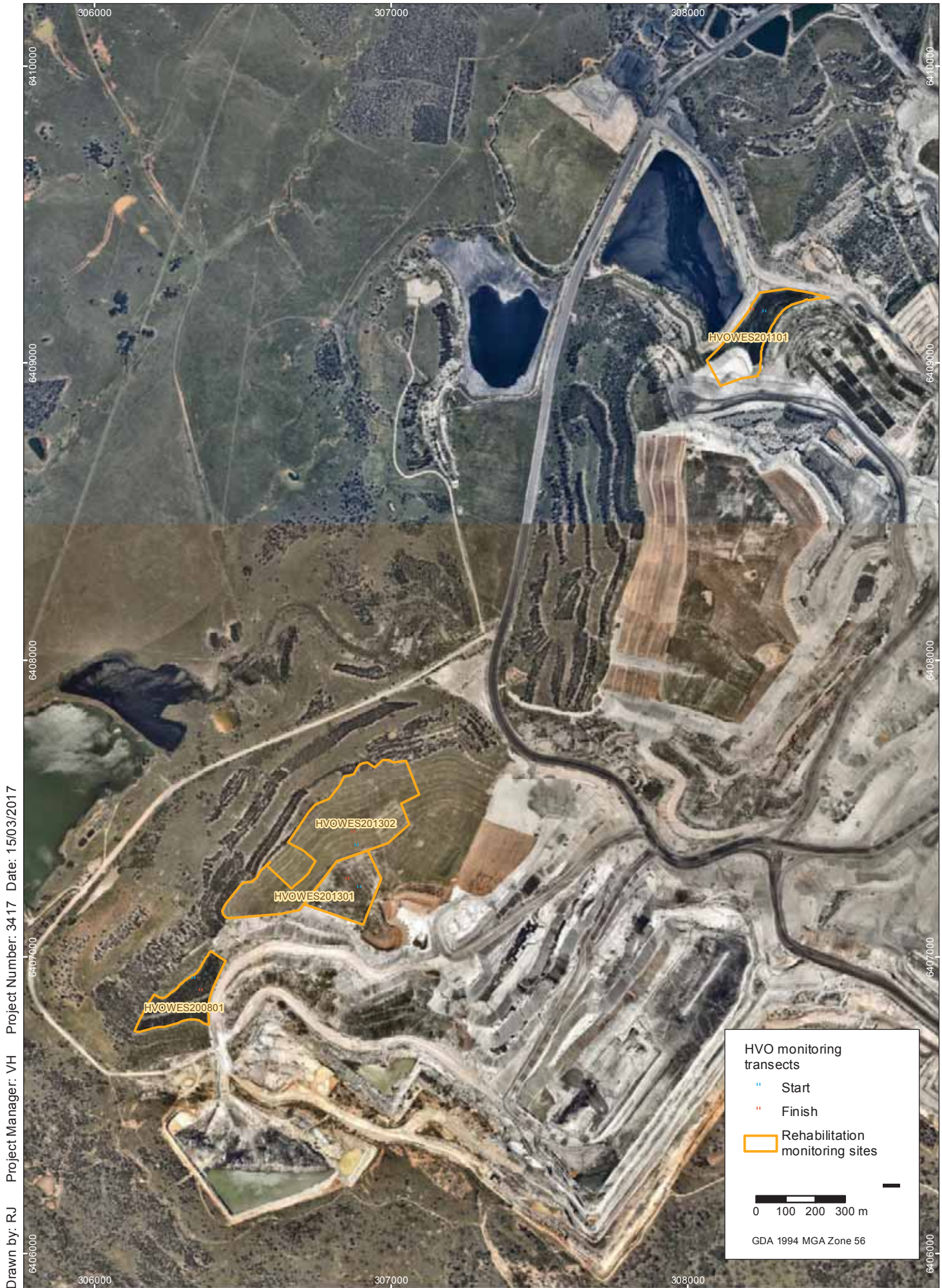
Drawn by: RJ Project Manager: VH Project Number: 3417 Date: 15/03/2017

HVO survey locations overview  
Coal & Allied Rehabilitation Monitoring

**FIGURE 2**

Imagery: (c) Nearmap 2016





Drawn by: RJ Project Manager: VH Project Number: 3417 Date: 15/03/2017

HVO survey locations - Inset map 1  
Coal & Allied Rehabilitation Monitoring

**FIGURE 3**

Imagery: (c) Nearmap 2016





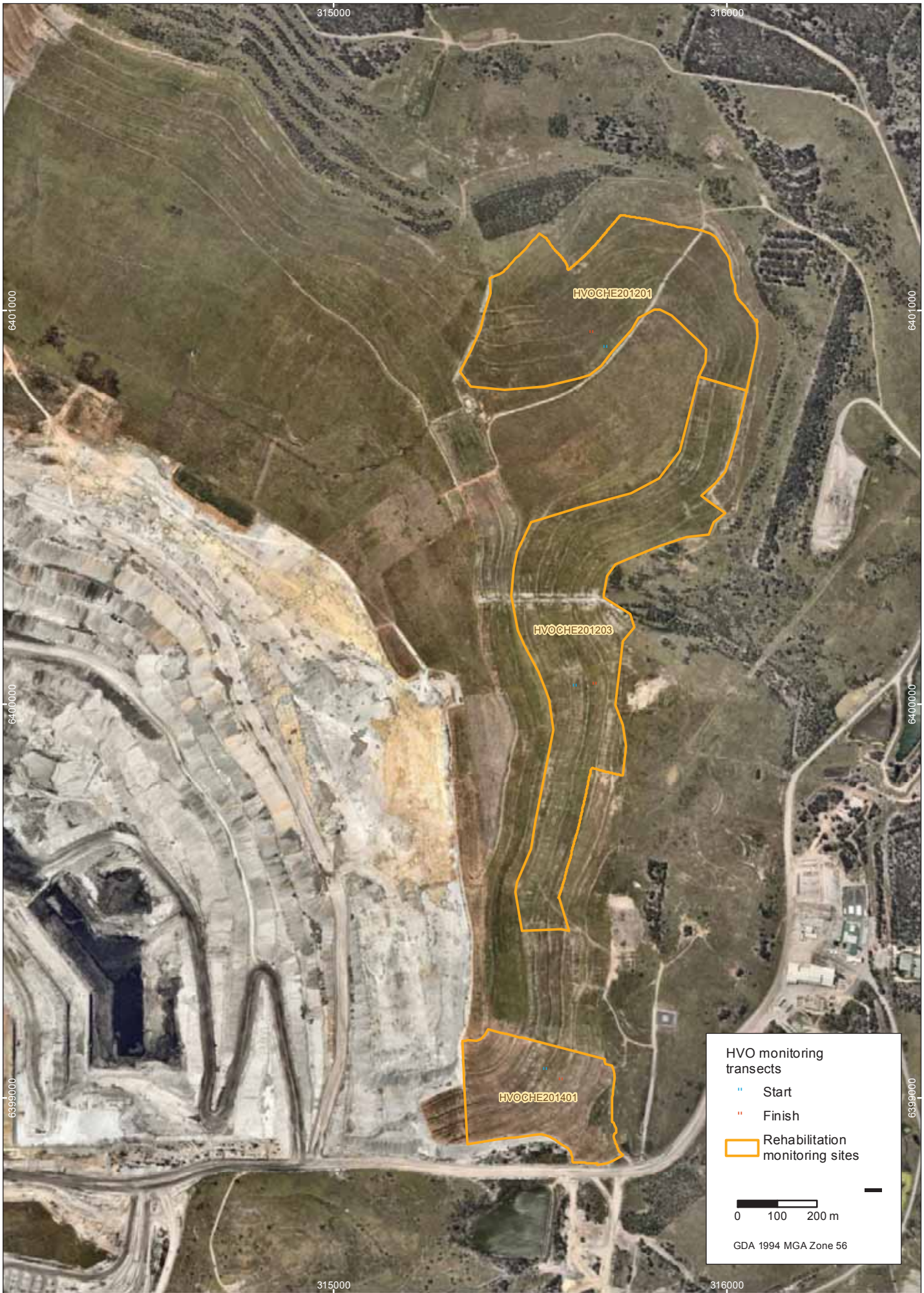
HVO survey locations - Inset map 2  
 Coal & Allied Rehabilitation Monitoring

**FIGURE 4**

Imagery: (c) Nearmap 2016-11-13



Drawn by: RJ Project Manager: VH Project Number: 2766 Date: 15/03/2017



HVO survey locations - Inset map 3  
Coal & Allied Rehabilitation Monitoring

**FIGURE 5**

Imagery: (c) Nearmap 2016-11-13







Drawn by: RJ Project Manager: VH Project Number: 3417 Date: 15/03/2017

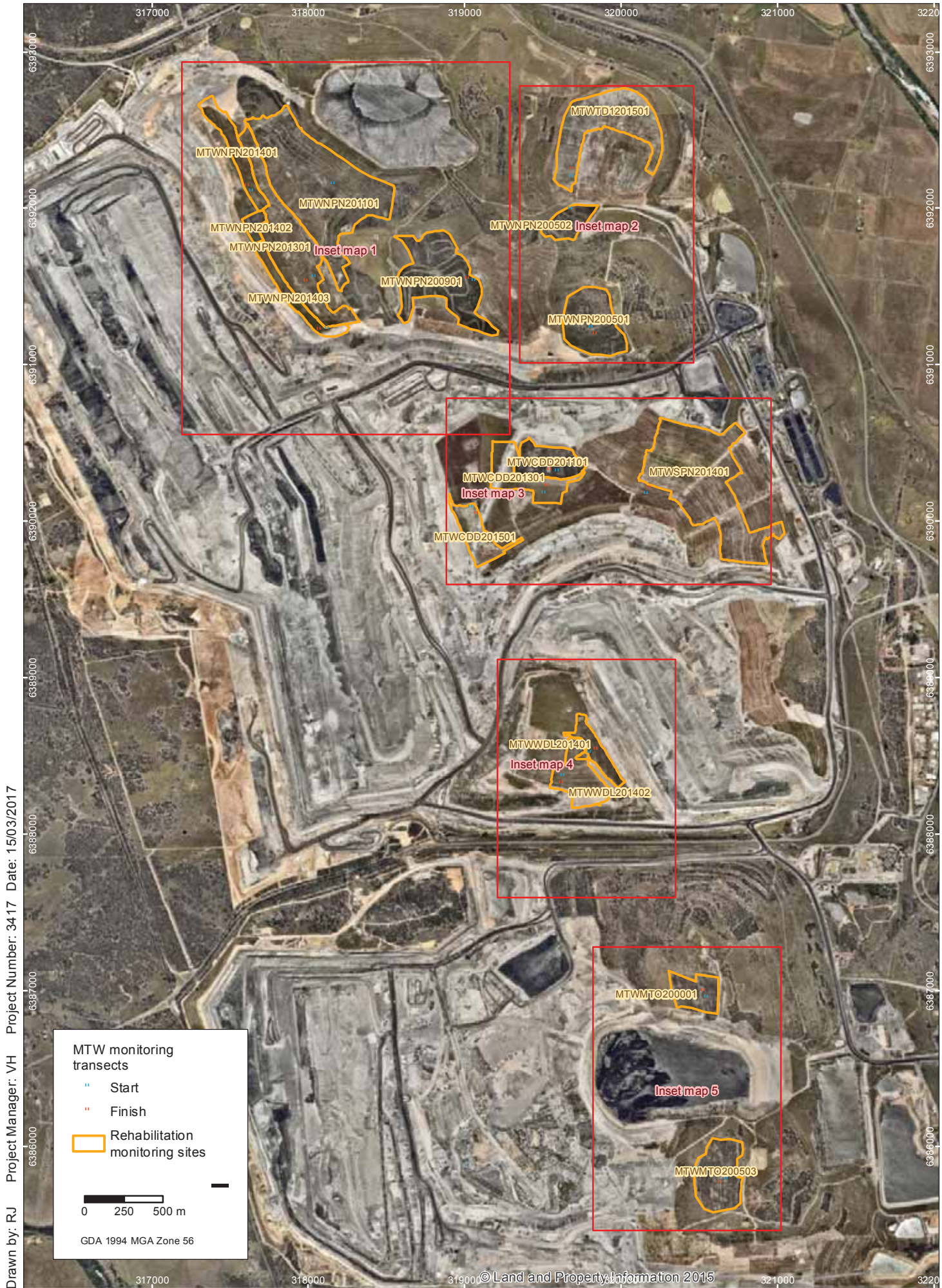
HVO survey locations - Inset map 4  
Coal & Allied Rehabilitation Monitoring

**FIGURE 6**

Imagery: (c) Nearmap 2016-11-13







MTW survey locations overview  
Coal & Allied Rehabilitation Monitoring

**FIGURE 7**

Imagery: (c) Nearmap 2016-11-13







MTW survey locations overview - Inset map 1  
Coal & Allied Rehabilitation Monitoring

**FIGURE 8**

Imagery: (c) Nearmap 2016-11-13



Drawn by: RJ Project Manager: VH Project Number: 3417 Date: 15/03/2017



MTW survey locations overview - Inset map 2  
Coal & Allied Rehabilitation Monitoring





319000

320000

321000

639000

0000659

319000

320000

321000

**MTW monitoring transects**

- Start
- Finish
- Rehabilitation monitoring sites

0 50 100 150 m

GDA 1994 MGA Zone 56

© Land and Property Information 2015

MTW survey locations overview - Inset map 3  
Coal & Allied Rehabilitation Monitoring

**FIGURE 10**  
Imagery: (c) Nearmap 2016-11-13





Drawn by: RJ Project Manager: VH Project Number: 3417 Date: 15/03/2017



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MTW survey locations overview - Inset map 4  
Coal & Allied Rehabilitation Monitoring



**FIGURE 11**

Imagery: (c) Nearmap 2016-11-13





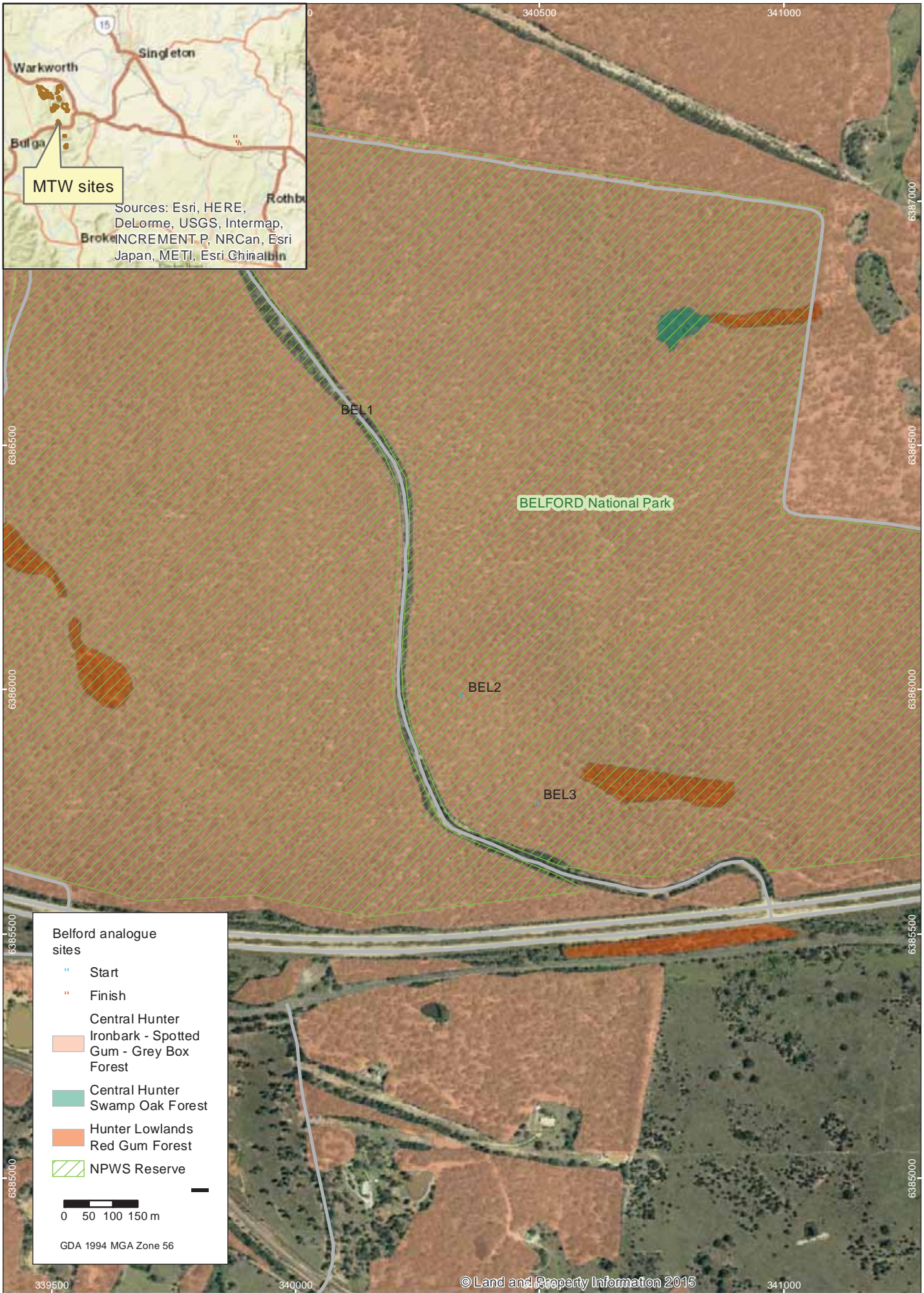
Drawn by: RJ Project Manager: VH Project Number: 3417 Date: 15/03/2017

MTW survey locations overview - Inset map 5  
Coal & Allied Rehabilitation Monitoring

**FIGURE 12**

Imagery: (c) Nearmap 2016-11-13





Drawn by: RJ Project Manager: VH Project Number: 3417 Date: 22/02/2017

**Belford analogue sites**

- " Start
- " Finish
- Central Hunter Ironbark - Spotted Gum - Grey Box Forest
- Central Hunter Swamp Oak Forest
- Hunter Lowlands Red Gum Forest
- NPWS Reserve

0 50 100 150 m

GDA 1994 MGA Zone 56

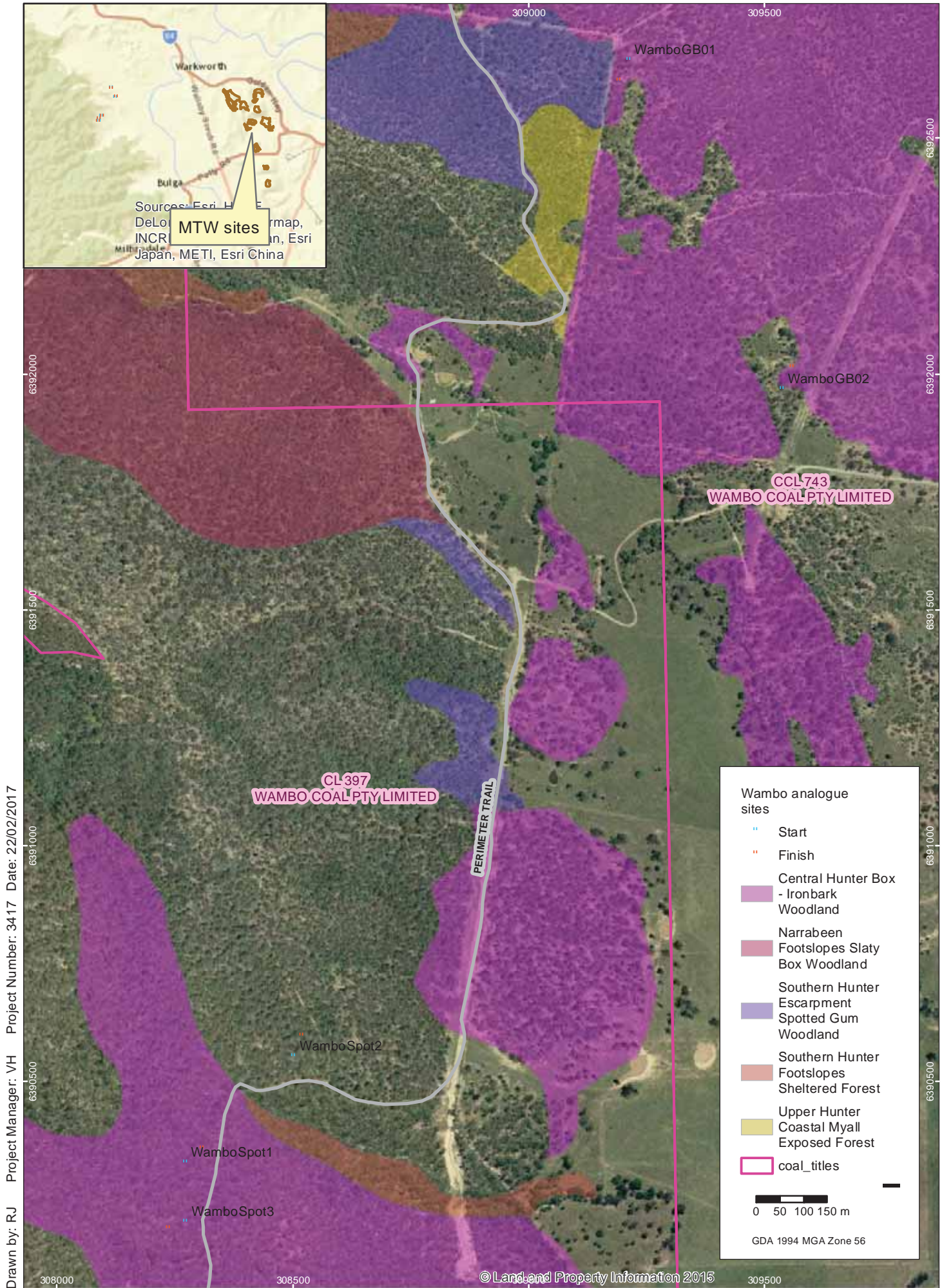
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Analogue sites – Belford National Park  
Coal and Allied Rehabilitation Monitoring

**FIGURE 13**

Imagery: (c) LPI 2008-12-17



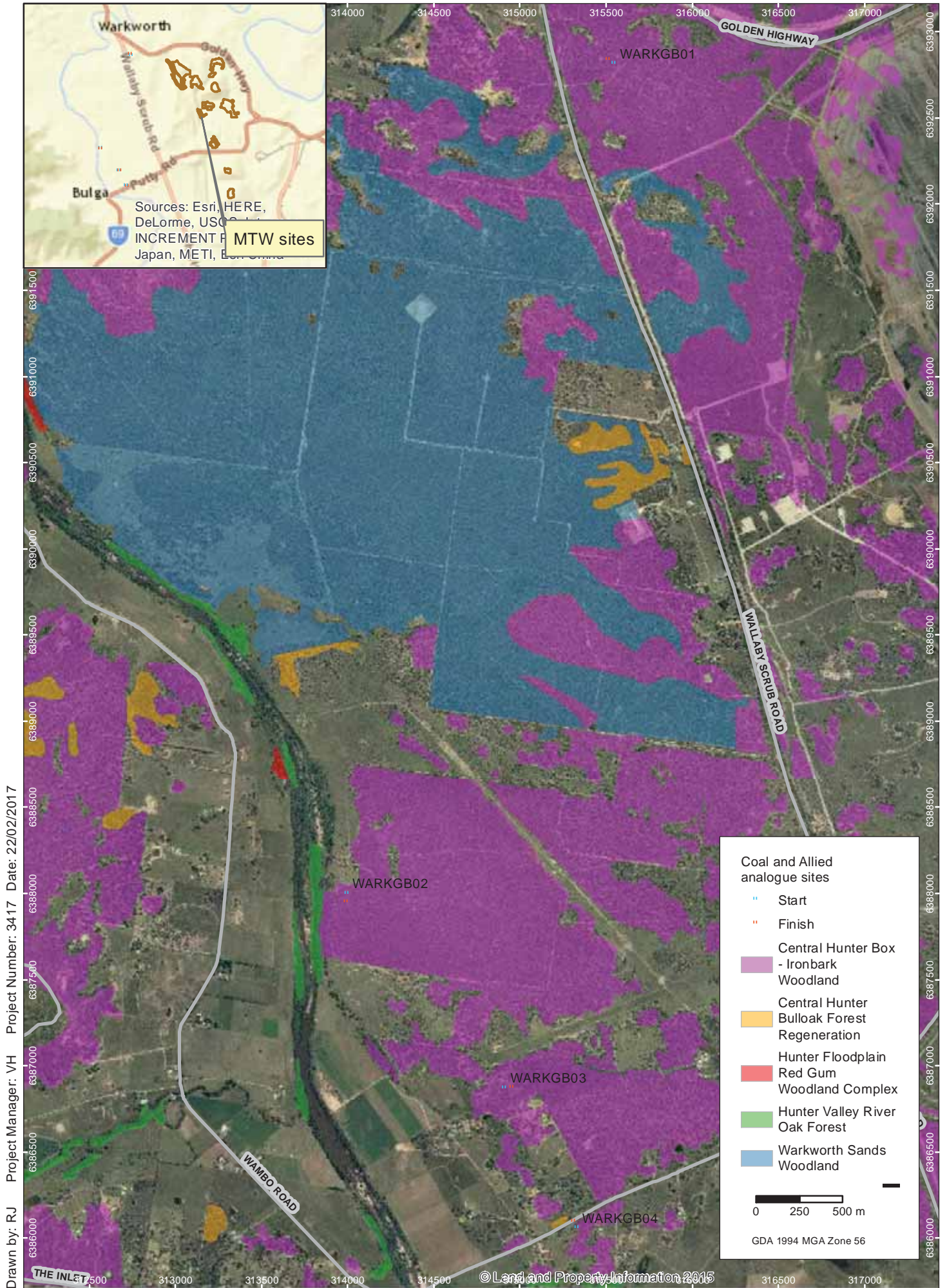


Analogue sites – Wambo Colliery Land  
Coal and Allied Rehabilitation Monitoring

**FIGURE 14**

Imagery: (c) LPI 2008-12-17





Analogue sites – Coal and Allied managed land  
Coal and Allied Rehabilitation Monitoring

**FIGURE 15**

Imagery: (c) LPI 2008-12-17



## Appendix 1 – Monitoring dates

Location	Survey personnel	Date	BioBanking completed
BELSPOT1	Alex Christie and Vivien Howard	06/02/2017	Completed
BELSPOT2	Alex Christie and Vivien Howard	14/02/2017	Completed
BELSPOT3	Alex Christie and Vivien Howard	14/02/2017	Completed
HVO CAR200901	Alex Christie, Vivien Howard, Robert Carter and Bill Baxter	13/02/2017	Completed
HVO CAR200902	Alex Christie, Vivien Howard, Robert Carter and Bill Baxter	13/02/2017	Completed
HVO CAR201401	Alex Christie, Vivien Howard, Robert Carter and Bill Baxter	13/02/2017	Completed
HVO CHE201201	Alex Christie, Vivien Howard and Jess Blair	09/02/2017	Completed
HVO CHE201203	Alex Christie, Vivien Howard and Jess Blair	09/02/2017	Completed
HVO CHE201401	Alex Christie, Vivien Howard and Jess Blair	09/02/2017	Completed
HVO RIV201401	Alex Christie, Vivien Howard and Bill Baxter	13/02/2017	Completed
HVO RIV201402	Alex Christie, Vivien Howard and Bill Baxter	13/02/2017	Completed
HVO RIV201403	Alex Christie, Vivien Howard and Bill Baxter	13/02/2017	Completed
HVO RIV201404	Alex Christie, Vivien Howard and Bill Baxter	09/02/2017	Completed
HVO RIV201405	Alex Christie, Vivien Howard and Bill Baxter	09/02/2017	Completed
HVO RIV201406	Alex Christie, Vivien Howard and Bill Baxter	09/02/2017	Completed
HVO WES200801	Alex Christie, Vivien Howard and Bill Baxter	14/02/2017	Completed
HVO WES201101	Alex Christie, Vivien Howard and Bill Baxter	14/02/2017	Completed
HVO WES201301	Alex Christie, Vivien Howard and Bill Baxter	14/02/2017	Completed
HVO WES201302	Alex Christie, Vivien Howard and Bill Baxter	14/02/2017	Completed
MTWCDD201101	Alex Christie, Vivien Howard and Jess Blair	08/02/2017	Completed
MTWCDD201301	Alex Christie, Vivien Howard and Jess Blair	08/02/2017	Completed
MTWCDD201501	Alex Christie, Vivien Howard and Jess Blair	08/02/2017	Completed
MTWMT0200001	Alex Christie, Vivien Howard and Bill Baxter	09/02/2017	Completed
MTWMT0200503	Alex Christie, Vivien Howard and Bill Baxter	09/02/2017	Completed
MTWNPN200501	Alex Christie, Vivien Howard and Bill Baxter	07/02/2017	Completed
MTWNPN200502	Alex Christie, Vivien Howard and Bill Baxter	08/02/2017	Completed
MTWNPN200901	Alex Christie, Vivien Howard and Jess Blair	15/02/2017	Completed
MTWNPN201101	Alex Christie, Vivien Howard and Bill Baxter	07/02/2017	Completed
MTWNPN201301	Alex Christie, Vivien Howard and Bill Baxter	07/02/2017	Completed
MTWNPN201402	Alex Christie, Vivien Howard and Bill Baxter	07/02/2017	Completed
MTWNPN201403	Alex Christie, Vivien Howard and Bill Baxter	07/02/2017	Completed
MTWSPN201401	Alex Christie, Vivien Howard and Bill Baxter	08/02/2017	Completed
MTWTD1201501	Luke Baker, Vivien Howard and Bill Baxter	08/02/2017	Completed
MTWWDL201401	Alex Christie, Vivien Howard and Bill Baxter	08/02/2017	Completed
MTWWDL201402	Alex Christie, Vivien Howard and Bill Baxter	15/02/2017	Completed
WAMBOGB1	Alex Christie and Vivien Howard	16/02/2017	Completed
WAMBOGB2	Alex Christie and Vivien Howard	16/02/2017	Completed

Location	Survey personnel	Date	BioBanking completed
WAMBOSPOT1	Alex Christie and Vivien Howard	16/02/2017	Completed
WAMBOSPOT2	Alex Christie and Vivien Howard	16/02/2017	Completed
WAMBOSPOT3	Alex Christie and Vivien Howard	16/02/2017	Completed
WARKGB1	Alex Christie and Vivien Howard	15/02/2017	Completed
WARKGB2	Alex Christie and Vivien Howard	10/02/2017	Completed
WARKGB3	Alex Christie and Vivien Howard	10/02/2017	Completed
WARKGB4	Alex Christie and Vivien Howard	10/02/2017	Completed

## Appendix 2 – Monitoring locations

Monitoring site	Position on transection	GDA94 MGA Zone 56	
		Northing	Easting
HVO North rehabilitation monitoring sites			
HVO CAR200901	Start	6405168	310358
HVO CAR200901	Finish	6405171	310311
HVO CAR200902	Start	6403453	309114
HVO CAR200902	Finish	6403430	309076
HVO CAR201401	Start	6403057	309832
HVO CAR201401	Finish	6403083	309872
HVO CHE201201	Start	6400898	315694
HVO CHE201201	Finish	6400937	315660
HVO CHE201203	Start	6400040	315617
HVO CHE201203	Finish	6400044	315667
HVO CHE201401	Start	6399065	315541
HVO CHE201401	Finish	6399040	315582
HVO RIV201401	Start	6398663	311033
HVO RIV201401	Finish	6398633	310994
HVO RIV201402	Start	6398476	311320
HVO RIV201402	Finish	6398516	311293
HVO RIV201403	Start	6398539	311901
HVO RIV201403	Finish	6398558	311854
HVO RIV201404	Start	6398524	312023
HVO RIV201404	Finish	6398476	312029
HVO RIV201405	Start	6398089	312243
HVO RIV201405	Finish	6398114	312269
HVO RIV201406	Start	6397946	312522
HVO RIV201406	Finish	6397895	312522
HVO WES200801	Start	6406920	306340
HVO WES200801	Finish	6406877	306364
HVO WES201101	Start	6409164	308265
HVO WES201101	Finish	6409172	308223
HVO WES201301	Start	6407223	306899
HVO WES201301	Finish	6407251	306859
HVO WES201302	Start	6407365	306889
HVO WES201302	Finish	6407409	306878
MTW Rehabilitation monitoring sites			
MTWCDC201101	Start	6390304	319599
MTWCDC201101	Finish	6390312	319552
MTWCDD201301	Start	6390165	319516
MTWCDD201301	Finish	6390212	319535

Monitoring site	Position on transection	GDA94 MGA Zone 56	
		Northing	Easting
MTWCDD201501	Start	6390074	319049
MTWCDD201501	Finish	6390034	319081
MTWMPN201401	Start	6392128	317619
MTWMPN201401	Finish	6392128	317619
MTWMT0200001	Start	6386940	320551
MTWMT0200001	Finish	6386982	320531
MTWMT0200503	Start	6385782	320678
MTWMT0200503	Finish	6385756	320640
MTWNP200501	Start	6391225	319816
MTWNP200501	Finish	6391183	319842
MTWNP200502	Start	6391981	319682
MTWNP200502	Finish	6391981	319682
MTWNP200901	Start	6391524	319069
MTWNP200901	Finish	6391535	319027
MTWNP201101	Start	6392138	318166
MTWNP201301	Finish	6391519	317995
MTWNP201301	Start	6391551	318047
MTWNP201402	Start	6392098	317646
MTWNP201402	Finish	6392098	317646
MTWNP201403	Start	6391271	318089
MTWNP201403	Finish	6391236	318060
MTWSPN201401	Start	6390161	320170
MTWSPN201401	Finish	6390304	319574
MTWTDI201501	Start	6392186	319688
MTWTDI201501	Finish	6392236	319692
MTWWDL201401	Start	6388508	319805
MTWWDL201401	Finish	6388526	319849
MTWWDL201402	Start	6388357	319636
MTWWDL201402	Finish	6388309	319624
Reference sites			
BEL1	Start	6386547	340083
BEL1	Finish	6386546	340033
BEL2	Start	6386551	340072
BEL2	Finish	6385962	340373
BEL3	Start	6385719	340474
BEL3	Finish	6385760	340498
WamboGB01	Start	6392661	309215
WamboGB01	Finish	6392618	309194
WamboGB02	Start	6391965	309539
WamboGB02	Finish	6392010	309561

Monitoring site	Position on transection	GDA94 MGA Zone 56	
		Northing	Easting
WamboSpot1	Start	6390324	308275
WamboSpot1	Finish	6390355	308311
WamboSpot2	Start	6390550	308504
WamboSpot2	Finish	6390593	308522
WamboSpot3	Start	6390200	308276
WamboSpot3	Finish	6390185	308238
WARKGB01	Start	6392801	315553
WARKGB01	Finish	6392824	315517
WARKGB02	Start	6387985	314002
WARKGB02	Finish	6387939	313998
WARKGB03	Start	6386859	314917
WARKGB03	Finish	6386864	314960
WARKGB04	Start	6386046	315336
WARKGB04	Finish	6386087	315316

## Appendix 3 – Flora species list

Flora two-way table: MTW Sites

Family	Species	Common Name	Exotic *	CDD2 01101	CDD20 1301	CDD20 1501	MTO20 0001	MTO20 0503	NPN200 501	NPN200 502	NPN200 901	NPN201 101	NPN201 301	NPN2 0140 2	NPN2 0140 3	SPN2 0140 1	TDI20 1501	WDL20 1401	WDL20 1402
Aizoaceae	Galenia pubescens	Galenia	*	2			3	2	3	2		2	2	1				1	1
Aizoaceae	Galenia spp.		*												4				
Anthericaceae	Laxmannia gracilis	Slender Wire Lily		1											1				
Apocynaceae	Gomphocarpus fruticosus	Narrow-leaved Cotton Bush	*	1			2	2	2	1		2		1				1	
Asteraceae	Aster spp.		*	2	3									2			2		
Asteraceae	Bidens pilosa	Cobbler's Pegs	*	1			2	2			2	4	3	3					
Asteraceae	Calotis lappulacea	Yellow Burr-daisy					2	2			1	2						2	
Asteraceae	Centaurea solstitialis	St Barnabys Thistle	*		1												1	1	1
Asteraceae	Cirsium vulgare	Spear Thistle	*										2	2	1		1		1
Asteraceae	Conyza spp.	A Fleabane	*	2	3	2	1	2	2		2	2	2	3	1		1		2
Asteraceae	Gnaphalium spp.	Cudweed						2											
Asteraceae	Senecio madagascariensis	Fireweed	*	2		2			1	1				2		1	1		2
Asteraceae	Sonchus spp.	Sowthistle	*										2				1		2
Asteraceae	Tagetes minuta	Stinking Roger	*					1											
Asteraceae	Vittadinia cuneata	A Fuzzweed					2	2	2					2					
Asteraceae	Vittadinia sulcata						2	1		2									
Brassicaceae	Brassica rapa		*							1			4		3				5
Brassicaceae	Lepidium campestre	Field Cress	*			1	1									1			

Family	Species	Common Name	Exotic *	CDD2 01101	CDD20 1301	CDD20 1501	MTO20 0001	MTO20 0503	NPN200 501	NPN200 502	NPN200 901	NPN201 101	NPN201 301	NPN2 0140 2	NPN2 0140 3	SPN2 0140 1	TDI20 1501	WDL20 1401	WDL20 1402
Brassicaceae	Lepidium spp.	A Peppergrass	*		2								2		1		1		
Cactaceae	Opuntia aurotiaca	Tiger Pear	*				2	1											
Cactaceae	Opuntia stricta	Common Prickly Pear, Smooth Pest Pear	*										2						
Caryophyllaceae	Petrophagia prolifera	Proliferous Pink	*	1	1	2							1						
Chenopodiaceae	Atriplex semibaccata	Creeping Saltbush		2		2	2						2					2	2
Chenopodiaceae	Chenopodium album	Fat Hen	*									1						1	
Chenopodiaceae	Einadia nutans	Climbing Saltbush						3	1						2			2	
Chenopodiaceae	Einadia trigonos	Fishweed				2	2											3	
Chenopodiaceae	Enchylaena tomentosa	Ruby Saltbush		2		3	3	3	1			2					2	1	
Commelinaceae	Commelina cyanea	Native Wandering Jew					2												
Convolvulaceae	Dichondra repens	Kidney Weed						1											
Cyperaceae	Carex appressa	Tall Sedge						1											
Cyperaceae	Carex spp.			1															
Fabaceae (Faboideae)	Daviesia genistifolia	Broom											2						
Fabaceae (Faboideae)	Daviesia ulicifolia	Bitter Pea												2					
Fabaceae (Faboideae)	Glycine tabacina	Gorse Bitter Pea																	
Fabaceae (Faboideae)	Hardenbergia violacea	Variable Glycine		2	2	1	2	2	1	1									
Fabaceae (Faboideae)	Indigofera australis	False Sarsaparilla										1						2	
Fabaceae (Faboideae)	Medicago sativa	Australian Indigo											2	2				1	
Fabaceae (Faboideae)	Swainsona galegifolia	Lucerne	*															1	
Fabaceae (Faboideae)	Smooth Darling Pea	Smooth Darling Pea																	1

Family	Species	Common Name	Exotic *	CDD2 01101	CDD20 1301	CDD20 1501	MTO20 0001	MTO20 0503	NPN200 501	NPN200 502	NPN200 901	NPN201 101	NPN201 301	NPN2 0140 2	NPN2 0140 3	NPN2 0140 4	SPN2 0140 1	TDI20 1501	WDL20 1401	WDL20 1402
Fabaceae (Mimosoideae)	Acacia amblygona	Fan Wattle		3		2			2	2	3	4	3	4	3		1		3	
Fabaceae (Mimosoideae)	Acacia binervata	Two-veined Hickory			2									4						
Fabaceae (Mimosoideae)	Acacia cultriformis	Knife-leaved Wattle		2		2						4	3	4	2					
Fabaceae (Mimosoideae)	Acacia decora	Western Silver Wattle		2		2			2	2	3	3	3	3	2				2	
Fabaceae (Mimosoideae)	Acacia decurrens	Black Wattle		2					3											
Fabaceae (Mimosoideae)	Acacia falcata			3						1	3	3	3	2					3	
Fabaceae (Mimosoideae)	Acacia implexa	Hickory Wattle		2		2			2	1	2	3		2					3	
Fabaceae (Mimosoideae)	Acacia longifolia			2					2	2			2	3					1	
Fabaceae (Mimosoideae)	Acacia mearnsii	Black Wattle										2								
Fabaceae (Mimosoideae)	Acacia paradoxa	Kangaroo Thorn											3	2					1	
Fabaceae (Mimosoideae)	Acacia parvippinula	Silver-stemmed Wattle								4				2						
Fabaceae (Mimosoideae)	Acacia salicina	Cooba		2		2				2								1	2	
Fabaceae (Mimosoideae)	Acacia saligna	Golden Wreath Wattle	*				2	4	1	1		3	2							1
Fabaceae (Mimosoideae)	Acacia spectabilis	Mudgee Wattle		2		2													1	



Family	Species	Common Name	Exotic *	CDD2 01101	CDD20 1301	CDD20 1501	MITO20 0001	MITO20 0503	NPN200 501	NPN200 502	NPN200 901	NPN201 101	NPN201 301	NPN2 0140 2	NPN2 0140 3	SPN2 0140 1	TDI20 1501	WDL20 1401	WDL20 1402
Fabaceae (Mimosoideae)	Acacia spp.	Wattle					2												
Gentianaceae	Centaurium spicatum	Spike Centaury			2														
Gentianaceae	Centaurium spp.		*																3
Malvaceae	Modiola caroliniana	Red-flowered Mallow	*										2						
Malvaceae	Sida corrugata	Corrugated Sida		2			2				1								
Malvaceae	Sida rhombifolia	Paddy's Lucerne	*	2			2	3		2			4	1	3			2	
Myoporaceae	Eremophila debilis	Amulla		2			2	1	2	2									2
Myrtaceae	Corymbia citriflora	Lemon-scented Gum	*						4										
Myrtaceae	Corymbia maculata	Spotted Gum		3						5	6		1				2	2	
Myrtaceae	Eucalyptus cladocalyx		*				5	5		2									
Myrtaceae	Eucalyptus crebra	Narrow-leaved Ironbark		2							3	2						2	
Myrtaceae	Eucalyptus fibrosa	Red Ironbark								3	3	1			1				
Myrtaceae	Eucalyptus moluccana	Grey Box		3			3	1		3	3				1				
Myrtaceae	Eucalyptus spp.																1	2	
Phyllanthaceae	Phyllanthus hirtellus	Thyme Spurge						2											
Phytolaccaceae	Phytolacca octandra	Inkweed	*			1													
Plantaginaceae	Plantago lanceolata	Lamb's Tongues	*			2		1		1		2						1	2
Poaceae	Austrostipa aristiglumis	Plains Grass			1											1			
Poaceae	Austrostipa scabra	Speargrass			2									3			2		

Family	Species	Common Name	Exotic *	CDD2 01101	CDD20 1301	CDD20 1501	MT020 0001	MT020 0503	NPN200 501	NPN200 502	NPN200 901	NPN201 101	NPN201 301	NPN2 0140 2	NPN2 0140 3	SPN2 0140 1	TDI20 1501	WDL20 1401	WDL20 1402
Poaceae	Bothriochloa macra	Red Grass		2		2	1	2				1	2	2	3	1			3
Poaceae	Capillipedium spicigerum	Scented-top Grass				1													
Poaceae	Chloris gayana	Rhodes Grass	*	2	5	1	4		1	3	4	3	3	2	5	2	4	2	2
Poaceae	Chloris truncata	Windmill Grass				2	1	2					2				4	3	2
Poaceae	Chloris ventricosa	Tall Chloris		2		3	1										2	3	2
Poaceae	Cymbopogon refractus	Barbed Wire Grass				2	3	4	2										
Poaceae	Cynodon dactylon	Common Couch		1		2		2	1				3	4	2	3		2	3
Poaceae	Digitaria divaricatissima	Umbrella Grass				1													
Poaceae	Echinochloa colona	Awnless Barnyard Grass						4		2			2				2		
Poaceae	Entolasia marginata	Bordered Panic							1										
Poaceae	Eragrostis brownii	Brown's Lovegrass				1													
Poaceae	Eragrostis curvula	African Lovegrass	*					2	2			1		2	1				
Poaceae	Eriochloa pseudoacrotricha	Early Spring Grass											3	2	2			3	5
Poaceae	Heteropogon contortus	Bunch Speargrass																	
Poaceae	Hordeum spp.	A Barley Grass	*													2			
Poaceae	Lolium perenne	Perennial Ryegrass	*																3
Poaceae	Panicum effusum	Hairy Panic				2									1		2	1	
Poaceae	Panicum maximum	Guinea Grass	*																2
Poaceae	Paspalidium spp.	Paspalidium																	2
Poaceae	Paspalum dilatatum	Paspalum	*	2					2				2						

Family	Species	Common Name	Exotic *	CDD2 01101	CDD20 1301	CDD20 1501	MTO20 0001	MTO20 0503	NPN200 501	NPN200 502	NPN200 901	NPN201 101	NPN201 301	NPN2 0140 2	NPN2 0140 3	SPN2 0140 1	TDI20 1501	WDL20 1401	WDL20 1402
Poaceae	Pennisetum clandestinum	Kikuyu Grass	*									2		1					
Poaceae	Pennisetum glaucum	Pearl Millet	*											2					
Poaceae	Rytidosperma spp.			2		2		2			2							2	
Poaceae	Setaria gracilis	Slender Pigeon Grass	*	1			1						2			4		3	2
Poaceae	Setaria parviflora		*							2									
Poaceae	Sporobolus creber	Slender Rat's Tail Grass				2		2									2		
Poaceae	Themeda triandra											2							
Poaceae	Urochloa panicoides	Urochloa Grass	*												3				2
Rubiaceae	Cyclophyllum longipetalum	Coast Canthium											2						
Sapindaceae	Dodonaea viscosa	Sticky Hop-bush																	
Solanaceae	Solanum nigrum	Black-berry Nightshade	*			1												1	
Solanaceae	Solanum prinophyllum	Forest Nightshade					1												
Thymelaeaceae	Pimelea liliifolia	Slender Rice Flower																	2
Verbenaceae	Verbena bonariensis	Purpletop	*	2			1		2	1		2		2				2	

## Flora two-way table: HVO Sites

Family	Species	Common Name	Exotic *	CAR2 00901	CAR2 00902	CAR2 01401	CHE2 01201	CHE2 01203	CHE2 01401	RIV20 1401	RIV20 1402	RIV20 1403	RIV20 1404	RIV20 1405	RIV20 1406	WES2 00801	WES2 01101	WES2 01301	WES2 01302
Aizoaceae	<i>Galenia pubescens</i>	Galenia	*	3		3	2	2	2	3		3	2	2	3	3	3	3	2
Apocynaceae	<i>Gomphocarpus fruticosus</i>	Narrow-leaved Cotton Bush	*	2		2	1			2		2							
Asteraceae	<i>Aster</i> spp.		*							4	2	2		2				3	2
Asteraceae	<i>Bidens pilosa</i>	Cobblers' Pegs	*												1				
Asteraceae	<i>Calotis lappulacea</i>	Yellow Burr-daisy													1				
Asteraceae	<i>Carthamus lanatus</i>	Saffron Thistle	*								2							2	
Asteraceae	<i>Cassinia arcuata</i>	Sifton Bush					1												
Asteraceae	<i>Centaurea solstitialis</i>	St Barnabys Thistle	*									3	2					2	
Asteraceae	<i>Cirsium vulgare</i>	Spear Thistle	*			2				2	3	3						1	
Asteraceae	<i>Conyza</i> spp.	A Fleabane	*		2	2		2		3	3	2	2	2	4	1			3
Asteraceae	<i>Senecio madagascariensis</i>	Fireweed	*	2	3	2				3	3	3	1	2	2			2	
Asteraceae	<i>Senecio</i> spp.	Groundsel, Fireweed	*						1										
Asteraceae	<i>Sonchus</i> spp.	Sowthistle	*							2	3	2							
Asteraceae	<i>Vittadinia muelleri</i>	A Fuzzweed																1	
Asteraceae	<i>Vittadinia sulcata</i>						1												
Brassicaceae	<i>Brassica rapa</i>		*			4				3	2	2	2					4	4
Brassicaceae	<i>Hirschfeldia incana</i>	Buchan Weed	*															1	
Brassicaceae	<i>Lepidium</i> spp.	A Peppergrass	*					2	1										
Cactaceae	<i>Opuntia aurantiaca</i>	Tiger Pear	*				1												
Cactaceae	<i>Opuntia stricta</i>	Common Prickly Pear, Smooth Pest Pear	*											2					

Family	Species	Common Name	Exotic *	CAR2 00901	CAR2 00902	CAR2 01401	CHE2 01201	CHE2 01203	CHE2 01401	RIV20 1401	RIV20 1402	RIV20 1403	RIV20 1404	RIV20 1405	RIV20 1406	WES2 00801	WES2 01101	WES2 01301	WES2 01302
Campanulaceae	Wahlenbergia spp.	Bluebell													1				
Casuarinaceae	Allocasuarina littoralis	Black She-Oak															3		
Chenopodiaceae	Atriplex semibaccata	Creeping Saltbush					2			3			2						
Chenopodiaceae	Chenopodium album	Fat Hen	*										2	3					
Chenopodiaceae	Einadia nutans	Climbing Saltbush											2						2
Chenopodiaceae	Einadia trigonos	Fishweed						3									4		2
Chenopodiaceae	Encchylaena tomentosa	Ruby Saltbush						4	4	4							4	4	4
Chenopodiaceae	Salsola spp.							4	3	3			2						
Chenopodiaceae	Sclerolaena spp.	Copperburr, Poverty-bush													2				
Commelinaceae	Commelina cyanea	Native Wandering Jew											1		1				
Cyperaceae	Carex inversa	Knob Sedge			2														
Eupomatiaceae	Eupomatia laurina	Bolwarra								3									
Fabaceae (Faboideae)	Glycine tabacina	Variable Glycine				1													
Fabaceae (Faboideae)	Hardenbergia violacea	False Sarsaparilla								2							1		
Fabaceae (Faboideae)	Indigofera australis	Australian Indigo															4		
Fabaceae (Faboideae)	Trifolium spp.	A Clover	*																
Fabaceae (Mimosoideae)	Acacia amblygona	Fan Wattle		3												4			
Fabaceae (Mimosoideae)	Acacia binervata	Two-veined Hickory								2									
Fabaceae (Mimosoideae)	Acacia cultriformis	Knife-leaved Wattle		4	4					3		3							
Fabaceae (Mimosoideae)	Acacia decora	Western Silver Wattle								3			1					3	
Fabaceae (Mimosoideae)	Acacia decurrens	Black Wattle		4	4											5	3		
Fabaceae (Mimosoideae)	Acacia falcata									3								2	

Family	Species	Common Name	Exotic *	CAR2 00901	CAR2 00902	CAR2 01401	CHE2 01201	CHE2 01203	CHE2 01401	RIV20 1401	RIV20 1402	RIV20 1403	RIV20 1404	RIV20 1405	RIV20 1406	WES2 00801	WES2 01101	WES2 01301	WES2 01302
Fabaceae (Mimosoideae)	Acacia implexa	Hickory Wattle	*	4	3												3	3	
Fabaceae (Mimosoideae)	Acacia longifolia																3		
Fabaceae (Mimosoideae)	Acacia paradoxa	Kangaroo Thorn														1			
Fabaceae (Mimosoideae)	Acacia salicina	Cooba		5						3	1	2	1			4	4	1	
Fabaceae (Mimosoideae)	Acacia saligna	Golden Wreath Wattle	*	4	3					3	3	3	1						
Gentianaceae	Centaurium spp.		*		3	2													2
Lomandraceae	Lomandra filiformis	Wattle Matt-rush														2			
Malvaceae	Malva spp.	Mallow	*											2					
Malvaceae	Modiola caroliniana	Red-flowered Mallow	*			2						2							
Malvaceae	Sida corrugata	Corrugated Sida		1												2			
Malvaceae	Sida rhombifolia	Paddy's Lucerne	*			2	1									3			
Myoporaceae	Eremophila debilis	Amulla														3			
Myrtaceae	Corymbia maculata	Spotted Gum		5	5											5	5	3	
Myrtaceae	Eucalyptus crebra	Narrow-leaved Ironbark															4		
Myrtaceae	Eucalyptus fibrosa	Red Ironbark		2	1												3	3	
Myrtaceae	Eucalyptus moluccana	Grey Box		5	2					4		4	2				3	3	
Oleaceae	Notelaea microcarpa	Native Olive															1		
Plantaginaceae	Plantago lanceolata	Lamb's Tongues	*		3	2				1	3	2				1		2	3
Poaceae	Aristida vagans	Threawn Speargrass																	
Poaceae	Austrostipa scabra	Speargrass								3		2							
Poaceae	Austrostipa verticillata	Slender Bamboo Grass																	
Poaceae	Avena spp.	Oats	*											1					

Family	Species	Common Name	Exotic *	CAR2 00901	CAR2 00902	CAR2 01401	CHE2 01201	CHE2 01203	CHE2 01401	RIV20 1401	RIV20 1402	RIV20 1403	RIV20 1404	RIV20 1405	RIV20 1406	WES2 00801	WES2 01101	WES2 01301	WES2 01302
Poaceae	<i>Bothriochloa macra</i>	Red Grass	*								2						2	4	
Poaceae	<i>Bromus</i> spp.	A Brome	*															2	
Poaceae	<i>Chloris gayana</i>	Rhodes Grass	*	5	5	5	2	4	2	5	3	5				3	2	3	4
Poaceae	<i>Chloris truncata</i>	Windmill Grass			3					4	2				2			2	4
Poaceae	<i>Chloris ventricosa</i>	Tall Chloris						2											3
Poaceae	<i>Cymbopogon refractus</i>	Barbed Wire Grass														2	2		
Poaceae	<i>Cynodon dactylon</i>	Common Couch		3		3		3		3	2	3	2						
Poaceae	<i>Digitaria divaricatissima</i>	Umbrella Grass										4							
Poaceae	<i>Echinochloa colona</i>	Awnless Barnyard Grass													3				
Poaceae	<i>Echinochloa</i> spp.		*								2			2					
Poaceae	<i>Eragrostis curvula</i>	African Lovegrass	*														3	2	
Poaceae	<i>Eragrostis leptostachya</i>	Paddock Lovegrass														1			
Poaceae	<i>Eragrostis</i> spp.	A Lovegrass	*																
Poaceae	<i>Eriochloa pseudoacrosticha</i>	Early Spring Grass					2	4	5	4	4	4	2		2				6
Poaceae	<i>Lachnagrostis</i> spp.														2				
Poaceae	<i>Lolium perenne</i>	Perennial Ryegrass	*											1					
Poaceae	<i>Panicum effusum</i>	Hairy Panic			2		1			4	4	4	2		2	1		2	
Poaceae	<i>Panicum maximum</i>	Guinea Grass	*	2	2	3													2
Poaceae	<i>Pennisetum glaucum</i>	Pearl Millet	*								2				2				
Poaceae	<i>Rytidosperma</i> spp.							1		3		3				2	3	4	
Poaceae	<i>Setaria gracilis</i>	Slender Pigeon Grass	*						3	3									

Family	Species	Common Name	Exotic *	CAR2 00901	CAR2 00902	CAR2 01401	CHE2 01201	CHE2 01203	CHE2 01401	RIV20 1401	RIV20 1402	RIV20 1403	RIV20 1404	RIV20 1405	RIV20 1406	WES2 00801	WES2 01101	WES2 01301	WES2 01302
Poaceae	Setaria parviflora		*												2				
Poaceae	Spotobolus creber	Slender Rat's Tail Grass		2												1		3	4
Poaceae	Themeda triandra									2							3		
Poaceae	Urochloa panicoides	Urochloa Grass	*						2						1				
Polygonaceae	Rumex crispus	Curled Dock	*									1							
Portulacaceae	Portulaca oleracea	Pigweed						2											
Portulacaceae	Portulaca spp.		*				2						1						
Proteaceae	Hakea sericea	Needlebush															2		
Solanaceae	Solanum nigrum	Black-berry Nightshade	*			1						2						2	
Solanaceae	Solanum prinophyllum	Forest Nightshade				2				2									
Verbenaceae	Verbena bonariensis	Purpletop	*			2		2					2					2	2



## Flora two-way table: Reference sites

Family	Species	Common Name	Exotic *	BEL1	BEL2	BEL3	WAMBO G1	WAMBO GB2	WAMBO SPOT1	WAMBO SPOT2	WAMBO SPOT3	WARK GB01	WARK GB02	WARK GB03	WARK GB04
Acanthaceae	<i>Pseuderanthemum variable</i>	Pastel Flower		1			2								
Adiantaceae	<i>Cheilanthes sieberi</i>	Rock Fern			1	1	2						2		
Aizoaceae	<i>Galenia pubescens</i>	Galenia	*												3
Amaranthaceae	<i>Alternanthera</i> spp.	Joyweed											1		3
Anthericaceae	<i>Dichopogon</i> spp.	Chocolate Lily					2		1				3		
Anthericaceae	<i>Laxmannia gracilis</i>	Slender Wire Lily		2										3	
Asteraceae	<i>Calotis cuneifolia</i>	Purple Burr-Daisy				2						2			
Asteraceae	<i>Calotis lappulacea</i>	Yellow Burr-daisy			3								2		
Asteraceae	<i>Cassinia uncata</i>	Sticky Cassinia										2	1		
Asteraceae	<i>Chrysocephalum apiculatum</i>	Common Everlasting					2						1		
Asteraceae	<i>Olearia elliptica</i>	Sticky Daisy-bush		4			4	1	3	5	3		1		
Asteraceae	<i>Ozothamnus diosmifolius</i>	White Dogwood													1
Asteraceae	<i>Senecio madagascariensis</i>	Fireweed	*		1		2	2				2	2	2	3
Asteraceae	<i>Senecio</i> sp. E				2							2			
Asteraceae	<i>Vittadinia cuneata</i>	A Fuzzweed		2			2					2	2		
Asteraceae	<i>Vittadinia sulcata</i>				3										2
Bignoniaceae	<i>Pandorea pandorana</i>	Wonga Wonga Vine								1					
Cactaceae	<i>Opuntia aurantiaca</i>	Tiger Pear	*										2	2	2
Cactaceae	<i>Opuntia stricta</i>	Common Prickly Pear, Smooth Pest Pear	*				2	2	2			4	1		
Campanulaceae	<i>Wahlenbergia</i> spp.	Bluebell					2	2			1		2		
Casuarinaceae	<i>Allocasuarina luehmannii</i>	Bulloak					5					4	5	5	3
Chenopodiaceae	<i>Einadia hastata</i>	Berry Saltbush										1			
Chenopodiaceae	<i>Einadia nutans</i>	Climbing Saltbush												1	
Chenopodiaceae	<i>Einadia trigonos</i>	Fishweed										2			

Family	Species	Common Name	Exotic *	BEL1	BEL2	BEL3	WAMBO G1	WAMBO GB2	WAMBO SPOT1	WAMBO SPOT2	WAMBO SPOT3	WARK GB01	WARK GB02	WARK GB03	WARK GB04
Chenopodiaceae	Enchylaena tomentosa	Ruby Saltbush													1
Clusiaceae	Hypericum gramineum	Small St John's Wort											1		
Commelinaceae	Commelina cyanea	Native Wandering Jew								2	1		3	3	3
Convolvulaceae	Dichondra repens	Kidney Weed											1		
Cyperaceae	Carex inversa	Knob Sedge				2							2		
Cyperaceae	Cyperus gracilis	Slender Flat-sedge												1	
Cyperaceae	Gahnia aspera	Rough Saw-sedge		2	3	3		2	2		2		1		
Cyperaceae	Lepidosperma laterale	Variable Sword-sedge		3	4										
Dilleniaceae	Hibbertia spp.								2						
Ericaceae	Lissanthe strigosa	Peach Heath		3	3	2									
Euphorbiaceae	Amperea xiphioclada										3				
Fabaceae (Faboideae)	Daviesia genitifolia	Broom Bitter Pea												2	
Fabaceae (Faboideae)	Daviesia ulicifolia	Gorse Bitter Pea												2	3
Fabaceae (Faboideae)	Desmodium brachypodium	Large Tick-trefoil					2	2	2	3					
Fabaceae (Faboideae)	Desmodium varians	Slender Tick-trefoil		2		3	2	2	2	3	2	2	2	3	
Fabaceae (Faboideae)	Glycine clandestina	Twining glycine									2	1	3		
Fabaceae (Faboideae)	Glycine tabacina	Variable Glycine		2	3	3			2			2	3	3	
Fabaceae (Faboideae)	Hardenbergia violacea	False Sarsaparilla		3											
Fabaceae (Faboideae)	Hovea linearis								1						
Fabaceae (Faboideae)	Pultenaea spinosa	A Bush Pea		3	3										
Fabaceae (Faboideae)	Acacia amblygona	Fan Wattle		3				3		3				3	5
Fabaceae (Mimosoideae)	Acacia bulgaensis	Bulga Wattle							4						
Fabaceae (Mimosoideae)	Acacia decora	Western Silver Wattle						2							

Family	Species	Common Name	Exotic *	BEL1	BEL2	BEL3	WAMBO G1	WAMBO GB2	WAMBO SPOT1	WAMBO SPOT2	WAMBO SPOT3	WARK GB01	WARK GB02	WARK GB03	WARK GB04
Fabaceae (Mimosoideae)	Acacia decurrens	Black Wattle											1		
Fabaceae (Mimosoideae)	Acacia falcata			3	4	2		3							2
Fabaceae (Mimosoideae)	Acacia implexa	Hickory Wattle					2		3		4	3			
Fabaceae (Mimosoideae)	Acacia mearnsii	Black Wattle		3	4	2									
Fabaceae (Mimosoideae)	Acacia salicina	Cooba													1
Fabaceae (Mimosoideae)	Acacia saligna	Golden Wreath Wattle	*				2	2				1			
Goodeniaceae	Goodenia rotundifolia			1											
Juncaceae	Juncus prismatocarpus						1	2							
Lauraceae	Cassythia pubescens	Downy Dodder-laurel									2				
Lomandraceae	Lomandra filiformis	Wattle Matt-rush			4	5	2	2		2			2		2
Lomandraceae	Lomandra filiformis subsp. filiformis							2	2	2					
Lomandraceae	Lomandra glauca	Pale Mat-rush												2	3
Lomandraceae	Lomandra multiflora	Many-flowered Mat-rush			2			2	2		2	2			
Luzuriagaceae	Geitonoplesium cymosum	Scrambling Lily								2					
Malvaceae	Sida corrugata	Corrugated Sida					3	2	2	2		3	2		
Malvaceae	Sida rhombifolia	Paddy's Lucerne	*												2
Myoporaceae	Eremophila debilis	Amulla				1						3	2		2
Myrsinaceae	Rapanea howittiana	Brush Muttonwood									2				
Myrtaceae	Corymbia maculata	Spotted Gum		5	5	5				5	4				
Myrtaceae	Eucalyptus amplifolia	Cabbage Gum													5
Myrtaceae	Eucalyptus crebra	Narrow-leaved Ironbark		4			2		4		4	5	5	4	4
Myrtaceae	Eucalyptus fibrosa	Red Ironbark				4	4								
Myrtaceae	Eucalyptus moluccana	Grey Box		3	4	5	3	5		5					

Family	Species	Common Name	Exotic *	BEL1	BEL2	BEL3	WAMBO G1	WAMBO GB2	WAMBO SPOT1	WAMBO SPOT2	WAMBO SPOT3	WARK GB01	WARK GB02	WARK GB03	WARK GB04
Myrtaceae	<i>Eucalyptus punctata</i>	Grey Gum							5		3				
Myrtaceae	<i>Melaleuca decora</i>													4	
Oleaceae	<i>Notelaea longifolia</i>	Large Mock-olive						2	3	2	2	3			
Oleaceae	<i>Notelaea microcarpa</i>	Native Olive						4							
Oleaceae	<i>Olea europaea</i>	Common Olive	*	3	3	5									
Oxalidaceae	<i>Oxalis perennans</i>													1	
Phormiaceae	<i>Dianella longifolia</i>	Blueberry Lily			1										
Phormiaceae	<i>Dianella longifolia</i> var. <i>longifolia</i>	A Blue Flax Lily				2	2			2		1			
Phormiaceae	<i>Dianella revoluta</i>	Blueberry Lily		3	3	4	2				2			2	3
Phyllanthaceae	<i>Breynia oblongifolia</i>	Coffee Bush			4	3			2		2	3	2	2	
Phyllanthaceae	<i>Phyllanthus gunnii</i>														1
Phyllanthaceae	<i>Phyllanthus hirtellus</i>	Thyme Spurge												1	1
Pittosporaceae	<i>Bursaria spinosa</i>	Native Blackthorn			4	3			4	4	4	3	3	3	
Plantaginaceae	<i>Veronica plebeia</i>	Trailing Speedwell					2							2	
Poaceae	<i>Aristida ramosa</i>	Purple Wiregrass			2	3				2		4			
Poaceae	<i>Aristida vagans</i>	Threawn Speargrass		3	1	2			3	3	3	4	4	5	4
Poaceae	<i>Austrostipa scabra</i>	Speargrass		2			4			2		3	3		
Poaceae	<i>Austrostipa verticillata</i>	Slender Bamboo Grass						2	4		4				
Poaceae	<i>Chloris truncata</i>	Windmill Grass								2					3
Poaceae	<i>Chloris ventricosa</i>	Tall Chloris								2					
Poaceae	<i>Cymbopogon refractus</i>	Barbed Wire Grass		3	4	3	4	3	4	4	3	4	3	5	5
Poaceae	<i>Cynodon dactylon</i>	Common Couch												3	
Poaceae	<i>Entolasia marginata</i>	Bordered Panic		2											
Poaceae	<i>Entolasia stricta</i>	Wiry Panic			4	4	2				2	5	5	4	
Poaceae	<i>Eragrostis brownii</i>	Brown's Lovegrass						2						3	3
Poaceae	<i>Microlaena stipoides</i>	Weeping Grass				2									
Poaceae	<i>Oplismenus aemulus</i>										1				

Family	Species	Common Name	Exotic *	BEL1	BEL2	BEL3	WAMBO G1	WAMBO GB2	WAMBO SPOT1	WAMBO SPOT2	WAMBO SPOT3	WARK GB01	WARK GB02	WARK GB03	WARK GB04
Poaceae	Panicum effusum	Hairy Panic						2		2					
Poaceae	Rytidosperma spp.					2									
Poaceae	Sporobolus creber	Slender Rat's Tail Grass					4	3	2	4	2	3	4	3	3
Poaceae	Themeda triandra											2	4		
Proteaceae	Grevillea mucronulata								2						
Proteaceae	Persoonia linearis	Narrow-leaved Geebung							3		3				
Ranunculaceae	Clematis aristata	Old Man's Beard									1				
Rubiaceae	Pomax umbellata	Pomax				2									
Rutaceae	Boronia pinnata									1					
Santalaceae	Exocarpos cupressiformis	Cherry Ballart							4			3	1		
Sapindaceae	Dodonaea viscosa	Sticky Hop-bush						2	3	2	4				
Solanaceae	Solanum prinophyllum	Forest Nightshade				1			2			2	1		
Sterculiaceae	Brachychiton populneus	Kurrajong						1	1	1	1				
Sterculiaceae	Lasiopetalum spp.								1						
Verbenaceae	Lantana camara	Lantana	*									1			
Zamiaceae	Macrozamia flexuosa								3	3	4				



## Appendix 4 – Visual and Photo Monitoring

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## Belford Site 01 (Bell1)

Belford Site 01	MGA 84 Zone 56	
Position	Easting	Northing
Start transect:	340083	6386547
End transect	340031	6386548

**Description:** The Belford Site 01 occurs in Belford National Park. The site was established in an area that aligns to the native vegetation community Central Hunter Ironbark – Spotted Gum – Grey Box Forest, which is listed as an EEC under the NSW TSC Act.

The dominant species, including the structure of the site, is provided in the table below.

The average DBH of the trees is approximately 28 cm.

### Disturbance:

Disturbance present at the site consisted of few weed species, evidence of foot traffic and bike use. Feral animals including the dog (*Canis familiaris familiaris*), European red fox (*Vulpes vulpes*), rabbit (*Oryctolagus cuniculus*), cat (*Felis catus*), black rat (*Rattus rattus*) and Indian mynah (*Acridotheres tristis*) are considered to be impacting the Reserve (DECCW 2010).

Historically the site has been logged, with the majority of trees within the reserve being regrowth from past logging (DECCW 2010).

The following weed species have been identified in DECCW (2010) as a threat to the native vegetation of the reserve; African olive (*Olea europaea subsp. cuspidata*), Prickly Pear and Tiger Pear (*Opuntia* spp.) and Mother of Millions (*Brophyllum* sp.). The Analogue site was set up where little disturbance from these weeds occurred.

**Table. Dominant species and structure at Belford Site 01**

Stratum	Height (m)	% cover*	Dominant native species
Tree layer	15 - 30	40	<i>Eucalyptus moluccana</i> and <i>Corymbia maculata</i>
Midstorey layer	6 - 13	30 - 40	<i>Acacia falcate</i> and <i>Acacia mearnsii</i>
Shrub layer	2	35 - 40	<i>Breynia oblongifolia</i> , <i>Bursaria spinosa</i> , <i>Lissanthe strigosa</i> and <i>Pultenaea spinosa</i> .
Ground layer	1	20 - 30	<i>Aristida vagans</i> , <i>Austrodanthonia racemosa</i> , <i>Billardiera scandens</i> , <i>Bursaria spinosa</i> , <i>Calotis lappulacea</i> , <i>Cheilanthes sieberi</i> , <i>Cymbopogon refractus</i> , <i>Desmodium varians</i> , <i>Dianella revoluta</i> , <i>Dichondra repens</i> , <i>Entolasia marginata</i> , <i>Glycine tabacina</i> , <i>Hardenbergia violacea</i> , <i>Laxmannia gracilis</i> , <i>Lepidosperma laterale</i> and <i>Pratia purpurascens</i> .

\*Projected foliage cover

Site photographs at Belford Site 01 (left to right)

Start position 2016



End position 2016





Start position 2017



End position 2017





## Belford Site 02 (Bell2)

Belford Site 02	MGA 84 Zone 56	
Position	Easting	Northing
Start transect:	340332	6385942
End transect	340373	6385962

**Description:** Belford Site 02 occurs in Belford National Park. The site was established in an area that aligns to the native vegetation community Central Hunter Ironbark – Spotted Gum – Grey Box Forest, which is listed as an EEC under the TSC Act.

The dominant species, including the structure of the site, is provided in the table below.

The average DBH of the trees is approximately 30 cm.

### Disturbance:

Disturbance present at the site consisted of a few weed species, evidence of foot traffic and bike use.

Historically the site has been logged, with the majority of trees within the reserve consisting of regrowth from past logging (DECCW 2010).

The following weed species have been identified in DECCW (2010) as a threat to the native vegetation of the reserve; African olive (*Olea europaea subsp. cuspidata*), Prickly Pear and Tiger Pear (*Opuntia* spp.) and Mother of Millions (*Brophyllum* sp.). The analogue site was set up where little disturbance from these weeds occurred, however few individuals of *Olea europaea subsp. cuspidata* and *Opuntia* spp. were recorded in at the site.

**Table. Dominant species and structure at Belford Site 02**

Stratum	Height(m)	% cover*	Dominant native species
Tree layer	15 - 30	40	<i>Eucalyptus moluccana</i> and <i>Corymbia maculata</i>
Midstorey layer	6 - 13	30 - 40	<i>Acacia falcata</i>
Shrub layer	2	35 - 40	<i>Breynia oblongifolia</i> , <i>Bursaria spinosa</i> , <i>Lissanthe strigosa</i> and <i>Pultenaea spinosa</i> .
Ground layer	1	20 - 30	<i>Aristida vagans</i> , <i>Austrodanthonia racemosa</i> , <i>Billardiera scandens</i> , <i>Bursaria spinosa</i> , <i>Calotis lappulacea</i> , <i>Cheilanthes sieberi</i> , <i>Cymbopogon refractus</i> , <i>Desmodium varians</i> , <i>Dianella revoluta</i> , <i>Dichondra repens</i> , <i>Entolasia marginata</i> , <i>Glycine tabacina</i> , <i>Hardenbergia violacea</i> , <i>Laxmannia gracilis</i> , <i>Lepidosperma laterale</i> and <i>Pratia purpurascens</i> .

\*Projected foliage cover

Site photographs at Belford Site 02 (left to right)

Start position



End position





Start position 2017



End position 2017



## Belford Site 03 (Bell03)

Belford Site 03	MGA 84 Zone 56	
Position	Easting	Northing
Start transect:	340474	6385719
End transect	340498	6385760

**Description:** Belford Site 03 occurs in Belford National Park. The site was established in an area that aligns to the native vegetation community Central Hunter Ironbark – Spotted Gum – Grey Box Forest, which is listed as an EEC under the TSC Act.

The dominant species, including the structure of the site, is provided in the table below.

The average DBH of the trees is approximately 29 cm.

### Disturbance:

Disturbance present at the site consisted of few weed species, evidence of foot traffic and bike use.

Historically the site has been logged, with the majority of trees within the reserve consisting of regrowth from past logging (DECCW 2010).

The following weed species have been identified in DECCW (2010) as a threat to the native vegetation of the reserve; African olive (*Olea europaea subsp. cuspidata*), Prickly Pear and Tiger Pear (*Opuntia* spp.) and Mother of Millions (*Brophyllum* sp.). The analogue site was set up where little disturbance from these weeds occurred, however few individuals of *Olea europaea subsp. cuspidata* and *Opuntia* spp. were recorded in at the site.

**Table. Dominant species and structure at Belford Site 03**

Stratum	Height(m)	% cover*	Dominant native species
Tree layer	15 - 25	40	<i>Eucalyptus crebra</i> , <i>Eucalyptus moluccana</i> and <i>Corymbia maculata</i>
Midstorey layer	6 - 13	30 - 40	<i>Acacia mearnsii</i> and <i>Acacia falcata</i>
Shrub layer	2	35 - 40	<i>Breynia oblongifolia</i> , <i>Bursaria spinosa</i> , <i>Lissanthe strigosa</i> and <i>Pultenaea spinosa</i> .
Ground layer	1	20 - 30	<i>Aristida vagans</i> , <i>Austrodanthonia racemosa</i> , <i>Billardiera scandens</i> , <i>Bursaria spinosa</i> , <i>Calotis lappulacea</i> , <i>Cheilanthes sieberi</i> , <i>Cymbopogon refractus</i> , <i>Desmodium varians</i> , <i>Dianella revoluta</i> , <i>Dichondra repens</i> , <i>Entolasia marginata</i> , <i>Glycine tabacina</i> , <i>Hardenbergia violacea</i> , <i>Laxmannia gracilis</i> , <i>Lepidosperma laterale</i> and <i>Pratia purpurascens</i> .

\*Projected foliage cover



Site photographs at Belford Site 03 (left to right)

Start position



End position





Start position 2017



End position 2017



## WAMBOSPOT1

WamboSpottedGum 01	MGA 84 Zone 56	
Position	Easting	Northing
Start transect:	308275	6390324
End transect	308311	6390355

**Description:** WAMBOSPOT1 occurs in land currently managed by Wambo Coal. The site was established in an area that has been previously mapped as a native vegetation community, consistent with Central Hunter Ironbark – Spotted Gum – Grey Box Forest, which is listed as an EEC under the TSC Act.

The dominant species, including the structure of the site, is provided in the table below.

The average DBH of the trees is approximately 34 cm.

### Disturbance:

Disturbance present at the site consisted of few weed species. Weeds recorded include *Opuntia* spp and *Bidens pilosa*.

No damage from fire activity was observed at the site.

No access tracks, or evidence of trail bikes or foot traffic was observed at the site.

**Table. Dominant species and structure at Wambo Spotted Gum 01**

Stratum	Height(m)	% cover*	Dominant native species
Tree layer	15 - 25	40-50	<i>Eucalyptus crebra</i> , <i>Eucalyptus punctate</i> and <i>Corymbia maculata</i>
Midstorey layer	6 - 13	50-60	<i>Acacia binervata</i> , <i>Acacia bulgaensis</i> , and <i>Acacia longifolia</i>
Shrub layer	2	30-50	<i>Breynia oblongifolia</i> , <i>Exocarpos cupressiformis</i> , <i>Pimelea neo-angelica</i> and <i>Macrozamia flexuosa</i> .
Ground layer	1	20 - 30	<i>Brunoniella australis</i> , <i>Cheilanthes sieberi</i> , <i>Cymbopogon refractus</i> , <i>Desmodium brachypodum</i> , <i>Dianella revoluta</i> , <i>Entolasia stricta</i> , <i>Geitonoplesium cymosum</i> , <i>Glycine clandestina</i> , <i>Goodenia rotundifolia</i> , <i>Hovea linearis</i> , <i>Microlaena stipoides</i> , <i>Olearia elliptica</i> , <i>Solanum prinophyllum</i> , and <i>Themeda australis</i> .

\*Projected foliage cover



Site photographs Wambo Spotted Gum 01 (left to right)

Start position



End position





Start position 2017



End position 2017



## WAMBOSPOT2

WAMBOSPOT2	MGA 84 Zone 56	
Position	Easting	Northing
Start transect:	308504	6390550
End transect	308522	6390593

**Description:** WAMBOSPOT2 occurs in land currently managed by Wambo Coal. The site was established in an area that has been previously mapped as a native vegetation community consistent with Central Hunter Ironbark – Spotted Gum – Grey Box Forest, which is listed as an EEC under the TSC Act.

The dominant species, including the structure of the site, is provided in the table below.

The average DBH of the trees is approximately 34 cm.

### Disturbance:

Disturbance present at the site consisted of few weed species. Weeds recorded include *Opuntia* spp., *Bidens pilosa* and *Senecio madagascariensis*.

No damage from fire activity was observed at the site.

No access tracks, or evidence of trail bikes or foot traffic was observed at the site.

**Table. Dominant species and structure at Wambo Spotted Gum 02**

Stratum	Height(m)	% cover*	Dominant native species
Tree layer	15 - 25	40-50	<i>Eucalyptus moluccana</i> and <i>Corymbia maculata</i>
Midstorey layer	5-10	50-60	<i>Acacia mearnsii</i>
Shrub layer	2	40-60	<i>Bursaria spinosa</i> , <i>Dodonaea viscosa</i> , <i>Breynia oblongifolia</i> , <i>Pimelea neo-angelica</i> and <i>Macrozamia flexuosa</i> .
Ground layer	1	20 - 30	<i>Austrodanthonia racemosa</i> , <i>Brunoniella australis</i> , <i>Cheilanthes sieberi</i> , <i>Cymbopogon refractus</i> , <i>Desmodium brachypodium</i> , <i>Desmodium gunnii</i> , <i>Desmodium varians</i> , <i>Dianella revoluta</i> , <i>Entolasia stricta</i> , <i>Geitonoplesium cymosum</i> , <i>Glycine clandestina</i> , <i>Hovea linearis</i> , <i>Microlaena stipoides</i> , <i>Solanum prinophyllum</i> and <i>Themeda australis</i> .

\*Projected foliage cover



Site photographs at Wambo Spotted Gum 02 (left to right)

Start position



End position





Start position 2017



End position 2017





## WAMBOSPOT3

WAMBOSPOT3	MGA 84 Zone 56	
Position	Easting	Northing
Start transect:	308276	6390200
End transect	308238	6390185

**Description:** WAMBOSPOT3 occurs in land currently managed by Wambo Coal. The site was established in an area that has been previously mapped as a native vegetation community consistent with Central Hunter Ironbark – Spotted Gum – Grey Box Forest, which is listed as an EEC under the TSC Act.

The dominant species, including the structure of the site, is provided in the table below.

The average DBH of the trees is approximately 40 cm.

### Disturbance:

Disturbance present at the site consisted of few weed species. Weeds recorded include *Opuntia* spp., *Bidens pilosa* and *Senecio madagascariensis*.

No damage from fire activity was observed at the site.

No access tracks, or evidence of trail bikes or foot traffic was observed at the site.

**Table. Dominant species and structure at Wambo Spotted Gum 03**

Stratum	Height(m)	% cover*	Dominant native species
Tree layer	15 - 25	40-50	<i>Eucalyptus crebra</i> , <i>Eucalyptus punctate</i> and <i>Corymbia maculata</i>
Midstorey layer	5-10	50-60	<i>Acacia longifolia</i>
Shrub layer	2	30-50	<i>Bursaria spinosa</i> , <i>Dodonaea viscosa</i> , <i>Olearia elliptica</i> , and <i>Exocarpus cupressiformis</i>
Ground layer	1	20 - 30	<i>Austrodanthonia racemosa</i> , <i>Brunoniella australis</i> , <i>Cheilanthes sieberi</i> , <i>Cymbopogon refractus</i> , <i>Desmodium brachypodum</i> , <i>Desmodium gunnii</i> , <i>Desmodium varians</i> , <i>Dianella revoluta</i> , <i>Entolasia stricta</i> , <i>Geitonoplesium cymosum</i> , <i>Glycine clandestina</i> , <i>Hovea linearis</i> , <i>Microlaena stipoides</i> , <i>Solanum prinophyllum</i> and <i>Themeda australis</i> .

\*Projected foliage cover

Site photographs at Wambo Spotted Gum 03 (left to right)

Start position



End position





Start position 2017



End position 2017



## WAMBOGB01

WAMBOGB01	MGA 84 Zone 56	
Position	Easting	Northing
Start transect:	309194	6392618
End transect	309215	6392661

**Description:** WAMBOGB01 occurs in land currently managed by Wambo Coal. The site was established in an area that has been previously mapped as a native vegetation community consistent with Central Hunter Grey-Box – Ironbark Woodland, which is listed as an EEC under the TSC Act.

The dominant species, including the structure of the site, is provided in the table below.

The average DBH of the trees is approximately 30 cm.

### Disturbance:

Disturbance present at the site consisted of few weed species. Weeds recorded include *Opuntia* spp., *Bidens pilosa* and *Senecio madagascariensis*.

No damage from fire activity was observed at the site.

No access tracks, or evidence of trail bikes or foot traffic was observed at the site.

The site has been historically cleared in areas. The site generally lacks mature trees.

**Table. Dominant species and structure at Wambo Grey Box 01**

Stratum	Height(m)	% cover*	Dominant native species
Tree layer	15 - 25	30-40	<i>Eucalyptus crebra</i> and <i>Eucalyptus moluccana</i>
Midstorey layer	5-10	10-20	<i>Casuarina cunninghamiana</i>
Shrub layer	2	10-20	<i>Olearia elliptica</i> and <i>Lissanthe strigosa</i>
Ground layer	1	30-40	<i>Brunoniella australis</i> , <i>Cheilanthes sieberi</i> , <i>Chrysocephalum apiculatum</i> , <i>Vittadinia cuneata</i> , <i>Wahlenbergia gracilis</i> , <i>Einadia nutans</i> , <i>Dichondra repens</i> , <i>Cyperus gracilis</i> , <i>Desmodium brachypodium</i> , <i>Glycine tabacina</i> , <i>Lomandra multiflora</i> , <i>Sida corrugata</i> , <i>Notelaea longifolia</i> , <i>Acianthus</i> spp. <i>Oxalis perennans</i> , <i>Dianella revoluta</i> , <i>Phyllanthus gunnii</i> , <i>Aristida ramosa</i> , <i>Aristida vagans</i> , <i>Austrodanthonia racemosa</i> , <i>Austrostipa scabra</i> , <i>Bothriochloa macra</i> , <i>Chloris ventricosa</i> , <i>Cymbopogon refractus</i> , <i>Panicum effusum</i> , <i>Sporobolus creber</i> and <i>Asperula conferta</i> .

\*Projected foliage cover



Site photographs at Wambo Grey Box 01 (left to right)

Start position



End position



Start position 2017



## WAMBOGB02

WAMBOGB02	MGA 84 Zone 56	
Position	Easting	Northing
Start transect:	309539	6391965
End transect	309561	6392010

**Description:** WAMBOGB02 occurs in land currently managed by Wambo Coal. The site was established in an area that has been previously mapped as a native vegetation community consistent with Central Hunter Grey-Box – Ironbark Woodland, which is listed as an EEC under the TSC Act.

The dominant species, including the structure of the site, is provided in the table below.

The average DBH of the trees is approximately 30 cm.

### Disturbance:

Disturbance present at the site consisted of few weed species. Weeds recorded include *Opuntia* spp., *Bidens pilosa* and *Senecio madagascariensis*.

No damage from fire activity was observed at the site.

No access tracks, or evidence of trail bikes or foot traffic was observed at the site.

The site has been historically cleared in areas. The site generally lacks mature trees.

**Table. Dominant species and structure at Wambo Grey Box 02**

Stratum	Height(m)	% cover*	Dominant native species
Tree layer	15 - 25	10-20	<i>Eucalyptus moluccana</i>
Midstorey layer	5-10	10-20	<i>Acacia amblygona</i> , <i>Acacia dealbata</i> and <i>Acacia falcata</i> .
Shrub layer	2	10-20	<i>Olearia elliptica</i> and <i>Lissanthe strigosa</i>
Ground layer	1	30-40	<i>Brunoniella australis</i> , <i>Cheilanthes sieberi</i> , <i>Chrysocephalum apiculatum</i> , <i>Vittadinia cuneata</i> , <i>Wahlenbergia gracilis</i> , <i>Einadia nutans</i> , <i>Dichondra repens</i> , <i>Cyperus gracilis</i> , <i>Desmodium brachypodium</i> , <i>Glycine tabacina</i> , <i>Lomandra multiflora</i> , <i>Sida corrugata</i> , <i>Notelaea longifolia</i> , <i>Acianthus</i> spp. <i>Oxalis perennans</i> , <i>Dianella revoluta</i> , <i>Phyllanthus gunnii</i> , <i>Aristida ramosa</i> <i>Aristida vagans</i> , <i>Austrodanthonia racemosa</i> , <i>Austrostipa scabra</i> <i>Bothriochloa macra</i> , <i>Chloris ventricosa</i> , <i>Cymbopogon refractus</i> , <i>Panicum effusum</i> , <i>Sporobolus creber</i> and <i>Asperula conferta</i> .

\*Projected foliage cover



Site photographs at Wambo Grey Box 02 (left to right)

Start position



End position





Start position 2017



End position 2017



## WARKGB01

WARKGB01	MGA 84 Zone 56	
Position	Easting	Northing
Start transect:	315553	6392801
End transect	315517	6392823

**Description:** WarkGB01 occurs in land currently managed by Coal and Allied. The site was established in an area that has been previously mapped (Niche 2015a) as a native vegetation community consistent with Central Hunter Grey-Box – Ironbark Woodland, which is listed as an EEC under the TSC Act.

The dominant species, including the structure of the site, is provided in the table below.

The average DBH of the trees is approximately 29 cm.

### Disturbance:

Disturbance present at the site consisted of few weed species. Weeds recorded include *Opuntia* spp., *Bidens pilosa* and *Senecio madagascariensis*.

No damage from fire activity was observed at the site.

No access tracks, or evidence of trail bikes or foot traffic was observed at the site.

The site has been historically cleared in areas. The site generally lacks mature trees.

**Table. Dominant species and structure at Warkworth Grey Box 01**

Stratum	Height(m)	% cover*	Dominant native species
Tree layer	15 - 25	10-20	<i>Eucalyptus crebra</i> and <i>Eucalyptus moluccana</i> ,
Midstorey layer	5-10	10-20	<i>Acacia falcata</i> , <i>Allocasuarina luehmannii</i> and <i>Exocarpos cupressiformis</i> ,
Shrub layer	2	10-20	<i>Breynia oblongifolia</i> , <i>Daviesia ulicifolia</i> , <i>Notelaea longifolia</i>
Ground layer	1	30-40	<i>Aristida ramosa</i> , <i>Bothriochloa macra</i> , <i>Cheilanthes sieberi</i> , <i>Commelina cyanea</i> , <i>Cymbopogon refractus</i> , <i>Desmodium gunnii</i> , <i>Dichelachne micrantha</i> , <i>Dichondra repens</i> , <i>Echinopogon caespitosus</i> , <i>Einadia hastata</i> , <i>Eremophila debilis</i> , <i>Glycine tabacina</i> , <i>Lantana camara</i> <i>Microlaena stipoides</i> , <i>Oxalis perennans</i> , <i>Panicum effusum</i> , <i>Phyllanthus gunnii</i> , <i>Pseuderanthemum variabile</i> , <i>Solanum prinophyllum</i> , <i>Themeda australis</i> and <i>Vittadinia cuneata</i> .

\*Projected foliage cover



Site photographs at Warkworth Grey Box 01 (left to right)

Start position



End position





Start position 2017



End position 2017





## WARKGB02

WARKGB02	MGA 84 Zone 56	
Position	Easting	Northing
Start transect:	314003	6387985
End transect	313998	6387939

**Description:** WarkGB02 occurs in land currently managed by Coal and Allied. The site was established in an area that has been previously mapped as the native vegetation community Central Hunter Grey-Box – Ironbark Woodland, which is listed as an EEC under the TSC Act.

The dominant species, including the structure of the site, is provided in the table below.

The average DBH of the trees is approximately 26 cm.

### Disturbance:

Disturbance present at the site consisted of few weed species. Weeds recorded include *Opuntia* spp., *Bidens pilosa* and *Senecio madagascariensis*.

No damage from fire activity was observed at the site.

No access tracks, or evidence of trail bikes or foot traffic was observed at the site.

The site has been historically cleared in areas. The site generally lacks mature trees.

**Table. Dominant species and structure at Warkworth Grey Box 02**

Stratum	Height(m)	% cover*	Dominant native species
Tree layer	15 - 25	10-20	<i>Eucalyptus crebra</i> ,
Midstorey layer	5-10	10-20	<i>Acacia decurrens</i> and <i>Allocasuarina luehmannii</i> ,
Shrub layer	2	10-20	<i>Breynia oblongifolia</i> , <i>Bursaria spinosa</i> , <i>Notelaea microcarpa</i> , and <i>Olearia elliptica</i> ,
Ground layer	1	30-40	<i>Aristida vagans</i> , <i>Cheilanthes sieberi</i> , <i>Chloris ventricosa</i> , <i>Commelina cyanea</i> , <i>Crassocephalum</i> spp., <i>Cymbopogon refractus</i> , <i>Cyperus gracilis</i> , <i>Desmodium brachypodium</i> , <i>Desmodium varians</i> , <i>Dichelachne micrantha</i> , <i>Dichondra repens</i> , <i>Dichopogon</i> spp., <i>Echinopogon caespitosus</i> , <i>Enchylaena tomentosa</i> , <i>Fimbristylis tristachya</i> , <i>Gahnia aspera</i> , <i>Goodenia rotundifolia</i> , <i>Microlaena stipoides</i> , <i>Sida corrugata</i> , <i>Solanum prinophyllum</i> , <i>Sporobolus creber</i> and <i>Vittadinia cuneata</i> .

\*Projected foliage cover

Site photographs at Warkworth Grey Box 02 (left to right)

Start position



End position





Start position 2017



End position 2017



## WARKGB03

WARKGB03	MGA 84 Zone 56	
Position	Easting	Northing
Start transect:	314917	6386859
End transect:	314960	6386864

**Description:** WARKGB03 occurs in land currently managed by Coal and Allied. The site was established in an area that has been previously mapped as a native vegetation community constituting Central Hunter Grey-Box – Ironbark Woodland, which is listed as an EEC under the TSC Act.

The dominant species, including the structure of the site, is provided in the table below.

The average DBH of the trees is approximately 28 cm.

### Disturbance:

Disturbance present at the site consisted of few weed species. Weeds recorded include *Opuntia* spp., *Bidens pilosa* and *Senecio madagascariensis*.

No damage from fire activity was observed at the site.

No access tracks, or evidence of trail bikes or foot traffic was observed at the site.

The site has been historically cleared in areas. The site generally lacks mature trees.

**Table. Dominant species and structure at Warkworth Grey Box 03**

Stratum	Height(m)	% cover*	Dominant native species
Tree layer	15 - 25	10-20	<i>Eucalyptus tereticornis</i> and <i>Eucalyptus crebra</i> ,
Midstorey layer	5-10	10-20	<i>Allocasuarina luehmannii</i>
Shrub layer	2	10-20	<i>Acacia amblygona</i> <i>Breynia oblongifolia</i> and <i>Bursaria spinosa</i> ,
Ground layer	1	30-40	<i>Alternanthera</i> spp., <i>Austrodanthonia racemosa</i> , <i>Austrostipa scabra</i> , <i>Cheilanthes sieberi</i> , <i>Chrysocephalum apiculatum</i> , <i>Commelina cyanea</i> , <i>Cymbopogon refractus</i> , <i>Cynodon dactylon</i> , <i>Cyperus gracilis</i> , <i>Desmodium varians</i> , <i>Dianella caerulea</i> , <i>Eragrostis brownii</i> , <i>Eragrostis elongata</i> , <i>Eremophila debilis</i> , <i>Fimbristylis tristachya</i> , <i>Glycine tabacina</i> , <i>Goodenia hederacea</i> , <i>Hypochaeris radicata</i> , <i>Laxmannia gracilis</i> , <i>Lomandra multiflora</i> , <i>Melaleuca decora</i> , <i>Melinis repens</i> , <i>Microlaena stipoides</i> , <i>Oxalis perennans</i> , <i>Pennisetum clandestinum</i> , <i>Poa sieberiana</i> , <i>Themeda australis</i> and <i>Wahlenbergia stricta</i> .

\*Projected foliage cover



Site photographs at Warkworth Grey Box 03 (left to right)

Start position



End position





Start position 2017



End position 2017



## WARKGB04

WARKGB04	MGA 84 Zone 56	
Position	Easting	Northing
Start transect:	315316	6386087
End transect:	315336	6386046

**Description:** WarkGB04 occurs in land currently managed by Coal and Allied. The site was established in an area that has been previously mapped as a native vegetation community constituting Central Hunter Grey-Box – Ironbark Woodland, which is listed as an EEC under the TSC Act.

The dominant species, including the structure of the site, is provided in the table below.

The average DBH of the trees is approximately 30 cm.

### Disturbance:

Disturbance present at the site consisted of few weed species. Weeds recorded include *Melinis repens*, *Eragrostis curvula*, *Opuntia* spp., *Bidens pilosa* and *Senecio madagascariensis*.

No damage from fire activity was observed at the site.

No access tracks, or evidence of trail bikes or foot traffic was observed at the site.

The site has been historically cleared in areas. The site generally lacks mature trees.

**Table. Dominant species and structure at Warkworth Grey Box 04**

Stratum	Height(m)	% cover*	Dominant native species
Tree layer	15 - 25	10-20	<i>Eucalyptus crebra</i> ,
Midstorey layer	5-10	10-20	<i>Acacia amblygona</i> , <i>Acacia falcate</i> and <i>Allocasuarina luehmannii</i> ,
Shrub layer	2	10-20	<i>Daviesia ulicifolia</i> ,
Ground layer	1	30-40	<i>Aristida ramosa</i> , <i>Austrostipa scabra</i> , <i>Bothriochloa macra</i> , <i>Calotis lappulacea</i> , <i>Cheilanthes sieberi</i> , <i>Chloris truncata</i> , <i>Chloris ventricosa</i> , <i>Commelina cyanea</i> , <i>Cymbopogon refractus</i> , <i>Cynodon dactylon</i> , <i>Cyperus gracilis</i> , <i>Dichondra repens</i> , <i>Eragrostis brownii</i> , <i>Eremophila debilis</i> , <i>Fimbristylis tristachya</i> , <i>Galenia pubescens</i> , <i>Glycine tabacina</i> , <i>Goodenia rotundifolia</i> , <i>Hardenbergia violacea</i> , <i>Oxalis perennans</i> , <i>Panicum effusum</i> , <i>Paspalidium</i> spp., <i>Sida rhombifolia</i> , <i>Solanum prinophyllum</i> , <i>Themeda australis</i> and <i>Wahlenbergia gracilis</i> .

\*Projected foliage cover



Site photographs at Warkworth Grey Box 04 (left to right)

Start position



End position





Start position 2017



End position 2017



## HVOCAR2009-01

HVOCAR2009-01	MGA 84 Zone 56	
Position	Easting	Northing
Start transect:	310310	6405170
End transect	310358	6405167

### Description:

The HVOCAR2009-01 rehabilitation area occurs on imported topsoil.

The dominant species, including the structure of the site, is provided in the table below.

The average DBH of the trees is approximately 14 cm.

### Disturbance:

Disturbance present at the rehabilitation site consisted mainly of weeds, and grazing by macropods. No evidence of fire was observed in the rehabilitation area. No areas containing rubbish were observed.

Common weeds recorded at the site included *Galenia pubescens*, *Plantago lanceolata*, *Conyza bonariensis*, *Chloris gayana*, *Sida rhombifolia*, and *Verbena bonariensis*.

**Table. Dominant species and structure at HVOCAR2009-01**

Stratum	Height	% cover*	Dominant native species
Tree layer	15 - 30	15	<i>Eucalyptus moluccana</i> , <i>Corymbia maculate</i> , <i>Acacia implexa</i>
Midstorey layer	6 - 13	25	<i>Acacia salicina</i> , and <i>Acacia decurrens</i>
Shrub layer	2	5	<i>Acacia amblygona</i> .
Ground layer	1	5	<i>Cynodon dactylon</i>

\*Projected foliage cover



Site photographs at HVOCAR2009-01 (left to right)

Start position 2016



End position 2016





Start position 2017



End position 2017



## HVOCAR2009-02

HVOCAR2009-02	MGA 84 Zone 56	
Position	Easting	Northing
Start transect:	309114	6403453
End transect	309076	6403430

### Description:

HVOCAR2009-02 rehabilitation area occurs on imported topsoil.

The dominant species, including the structure of the site, is provided in the table below.

The average DBH of the trees is approximately 10 cm.

### Disturbance:

Disturbance present at the rehabilitation site consists mainly of weeds, and grazing by macropods. No evidence of fire was observed in the rehabilitation area. No areas containing rubbish were observed.

Common weeds recorded at the site included *Acacia saligna*, *Galenia pubescens*, *Plantago lanceolata*, *Conyza bonariensis*, *Senecio madagascariensis* and *Chloris gayana*.

**Table. Dominant species and structure at HVOCAR2009-02**

Stratum	Height (m)	% cover*	Dominant native species
Tree layer	6	10	<i>Eucalyptus moluccana</i> , <i>Acacia implexa</i> , <i>Acacia decurrens</i> , <i>Acacia salicina</i> , <i>Eucalyptus fibrosa</i> and <i>Corymbia maculata</i>
Midstorey layer	-	-	-
Shrub layer	2	5	<i>Acacia cultriformis</i>
Ground layer	1	5	<i>Carex inversa</i> , <i>Panicum effusum</i> and <i>Sporobolus creber</i>

\*Projected foliage cover



Site photographs at HVOCAR2009-02 (left to right)

Start position 2016



End position 2016





Start position 2017



End position 2017



## HVOCAR2014-01

HVOCAR2014-01	MGA 84 Zone 56	
Position	Easting	Northing
Start transect:	6403083	309872
End transect	6403057	309832

### Description:

HVOCAR2014-01 rehabilitation area occurs on a combination of topsoil and compost at HVO West.

The dominant species, including the structure of the site, is provided in the table below.

### Disturbance:

Disturbance present at rehabilitation site HVOCAR2014-01 consisted mainly of weeds, and grazing by macropods. No evidence of fire was observed in rehabilitation area. No areas containing rubbish were observed.

Common weeds recorded at the site included *Panicum maximum*, *Chloris gayana*, *Verbena bonariensis*, *Solanum nigrum*, *Senecio madagascariensis*, *Conyza bonariensis* and *Brassica* spp..

**Table. Dominant species and structure at HVOCAR2014-01**

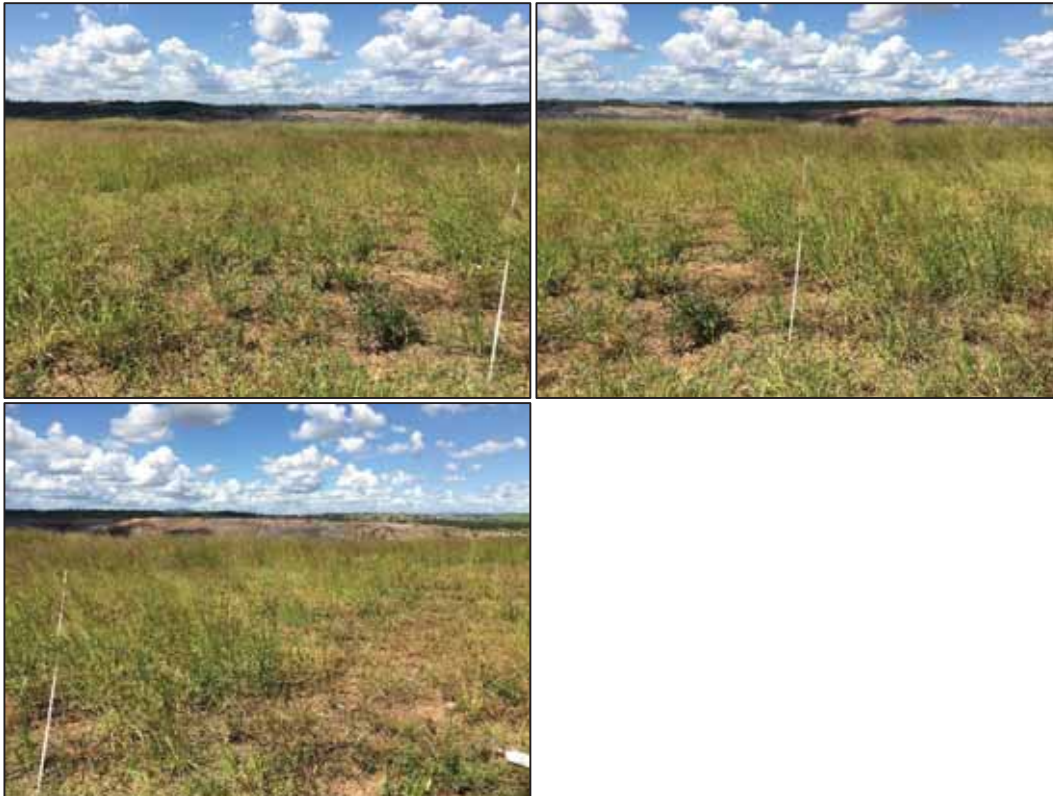
Stratum	Height (m)	% cover*	Dominant native species
Tree layer	-	-	-
Midstorey layer	-	-	-
Shrub layer	-	-	-
Ground layer	1	<5	<i>Glycine tabacina</i> , <i>Chloris truncata</i>

\*Projected foliage cover



Site photographs at HVOCAR2014-01 (left to right)

Start position 2016



End position 2016





Start position 2017



End position 2017



## HVOCHE2012-01

HVOCHE2012-01	MGA 84 Zone 56	
Position	Easting	Northing
Start transect:	315694	6400898
End transect	315660	6400932

### Description:

HVOCHE2012-01 rehabilitation area occurs on a combination of topsoil and compost at HVO West.

The dominant species, including the structure of the site, is provided in the table below.

### Disturbance:

Disturbance present at rehabilitation site HVOCHE2012-01 consisted mainly of weeds, and grazing by macropods. No evidence of fire was observed in the rehabilitation area. No areas containing rubbish were observed.

Common weeds recorded at the site included *Chloris gayana*, *Conyza bonariensis*, *Sida rhombifolia*, and *Galenia pubescens*.

Site had been weed wiped to manage weed species.

**Table. Dominant species and structure at HVOCHE2012-01**

Stratum	Height (m)	% cover*	Dominant native species
Tree layer	-	-	-
Midstorey layer	-	-	-
Shrub layer	-	-	
Ground layer	1	20	<i>Atriplex semibaccata</i> , <i>Echinochloa colona</i> and <i>Cassinia arcuata</i>

\*Projected foliage cover

Site photographs at HVOCHE2012-01 (left to right)

Start position 2016



End position 2016





Start position 2017



End position 2017



## HVOCHE2014-01

HVOCHE2014-01	MGA 84 Zone 56	
Position	Easting	Northing
Start transect:	315581	6399040
End transect	315541	6399065

### Description:

HVOCHE2014-01 rehabilitation area occurs on a combination of topsoil and compost at HVO West.

The dominant species, including the structure of the site, is provided in the table below.

### Disturbance:

Disturbance present at rehabilitation site HVOCHE2014-01 consisted mainly of weeds, and grazing by macropods. No evidence of fire was observed in the rehabilitation area. No areas containing rubbish were observed.

Common weeds recorded at the site included *Chloris gayana*, *Verbena bonariensis*, *Conyza bonariensis* and *Brassica spp.*

Table. Dominant species and structure at HVOCHE2014-01

Stratum	Height (m)	% cover*	Dominant native species
Tree layer	-	-	-
Midstorey layer	-	-	-
Shrub layer	-	-	
Ground layer	1	30	<i>Chloris ventricose</i> , <i>Echinochloa colona</i> and <i>Rytidosperma spp.</i>

\*Projected foliage cover

Site photographs at HVOCHE2014-01 (left to right)

Start position 2016



End position 2016





Start position 2017



End position 2017



## HVOCHE2012-03

HVOCHE2012-03	MGA 84 Zone 56	
Position	Easting	Northing
Start transect:	315667	6400043
End transect	315617	6400040

### Description:

HVOCHE2012-03 rehabilitation area occurs on a combination of topsoil and compost at HVO West.

The dominant species, including the structure of the site, is provided in the table below.

### Disturbance:

Disturbance present at rehabilitation site HVOCHE2012-03 consisted mainly of weeds, and grazing by macropods. No evidence of fire was observed in the rehabilitation area. No areas containing rubbish were observed.

Common weeds recorded at the site included *Chloris gayana*, *Conyza bonariensis*, *Brassica* spp., *Lepidium* spp. and *Portulaca oleracea*.

**Table. Dominant species and structure at HVOCHE2012-03**

Stratum	Height (m)	% cover*	Dominant native species
Tree layer	-	-	-
Midstorey layer	-	-	-
Shrub layer	-	-	
Ground layer	1	20	<i>Cynodon dactylon</i> and <i>Eriochloa pseudoastritrica</i>

\*Projected foliage cover

Site photographs at HVOCHE2012-03 (left to right)

Start position 2016



End position 2016





Start position 2017



End position 2017



## HVORIV2014-01

HVORIV2014-01	MGA 84 Zone 56	
Position	Easting	Northing
Start transect:	311033	6398662
End transect	310993	6398633

### Description:

HVORIV2014-01 rehabilitation area occurs on a combination of spoil and compost at HVO West.

The dominant species, including the structure of the site, is provided in the table below.

It should be noted that a number of regenerating eucalypts, and small acacias and *Enchylaena tomentosa* were also recorded regenerating in the plot.

### Disturbance:

Disturbance present at rehabilitation site HVORIV2014-01 consisted mainly of weeds, and grazing by macropods. No evidence of fire was observed in the rehabilitation area. No areas containing rubbish were observed.

Common weeds recorded at the site included *Chloris gayana*, *Galenia pubescens*, *Plantago lanceolata*, *Senecio mada gascariensis*, *Gomphocarpus fruticosus*, *Panicum maximum*, *Plantago lanceolata* and *Solanum nigrum*.

**Table. Dominant species and structure at HVORIV2014-01**

Stratum	Height (m)	% cover*	Dominant native species
Tree layer	-	-	-
Midstorey layer	-	-	-
Shrub layer	2	5	<i>Eucalyptus moluccana</i> , <i>Acacia decora</i> , <i>Acacia cultriformis</i> , <i>Acacia falcate</i> , <i>Acacia binervata</i> and <i>Acacia salicina</i>
Ground layer	1	25	<i>Chloris truncate</i> , <i>Rytidosperma spp.</i> , <i>Hardenbergia violacea</i> , <i>Enchylaena tomentose</i> , <i>Panicum effusum</i> , <i>Salsola spp.</i> , <i>Cynodon dactylon</i> and <i>Eriochloa pseudoastritrica</i>

\*Projected foliage cover

Site photographs at HVORIV2014-01 (left to right)

Start position 2016



End position 2016





Start position 2017



End position 2017



## HVORIV2014-02

HVORIV2014-02	MGA 84 Zone 56	
Position	Easting	Northing
Start transect:	311293	6398516
End transect	311320	6398476

### Description:

HVORIV2014-02 rehabilitation area occurs on a combination of subsoil and compost at HVO West.

The dominant species, including the structure of the site, is provided in the table below.

The rehabilitation site is dominated by It should be noted that a number of regenerating eucalypts (thin leaves – likely *E. crebra*), small acacias (*Acacia decora*, *Acacia implexa*), *Salsola tragus* and *Enchylaena tomentosa* were also recorded regenerating in the plot.

### Disturbance:

Disturbance present at rehabilitation site HVORIV2014-02 consisted mainly of weeds, and grazing by macropods. No evidence of fire was observed in the rehabilitation area. No areas containing rubbish were observed.

Common weeds recorded at the site included *Conyza bonariensis*, *Chloris gayana*, *Galenia pubescens*, *Senecio mada gascariensis*, *Gomphocarpus fruticosus*, *Panicum maximum*, *Plantago lanceolata*, *Sida rhombifolia* and *Solanum nigrum*.

**Table. Dominant species and structure at HVORIV2014-02**

Stratum	Height (m)	% cover*	Dominant native species
Tree layer	-	-	-
Midstorey layer	-	-	-
Shrub layer	-	-	-
Ground layer	1	20	<i>Chloris truncata</i> , <i>Enchylaena tomentosa</i> , <i>Panicum effusum</i> , <i>Salsola spp.</i> and <i>Cynodon dactylon</i>

\*Projected foliage cover

Site photographs at HVORIV2014-02 (left to right)

Start position 2016



End position 2016





Start position 2017



End position 2017



## HVORIV2014-03

HVORIV2014-03	MGA 84 Zone 56	
Position	Easting	Northing
Start transect:	311900	6398539
End transect	311853	6398557

### Description:

HVORIV2014-03 rehabilitation area occurs on a combination of spoil and compost at HVO West.

The dominant species, including the structure of the site is provided in the table below.

The rehabilitation site is dominated by It should be noted that a number of regenerating eucalypts (large leaves – likely *E. moluccana*), small acacias (*Acacia cultriformis*, *Acacia salicina*), *Salsola spp.* and *Enchylaena tomentosa* were also recorded regenerating in the plot.

### Disturbance:

Disturbance present at rehabilitation site HVORIV2014-03 consisted mainly of weeds, and grazing by macropods. No evidence of fire was observed in the rehabilitation area. No areas containing rubbish were observed.

Common weeds recorded at the site included *Chloris gayana*, *Aster spp.*, *Acacia saligna*, *Galenia pubescens* and *Conyza bonariensis*.

Table. Dominant species and structure at HVORIV2014-03

Stratum	Height (m)	% cover*	Dominant native species
Tree layer	-	-	-
Midstorey layer	-	-	-
Shrub layer	-	-	-
Ground layer	1	25	<i>Enchylaena tomentosa</i> , <i>Panicum effusum</i> , <i>Rytidosperma spp.</i> , <i>Einadia trigonos</i> , <i>Salsola spp.</i> and <i>Cynodon dactylon</i>

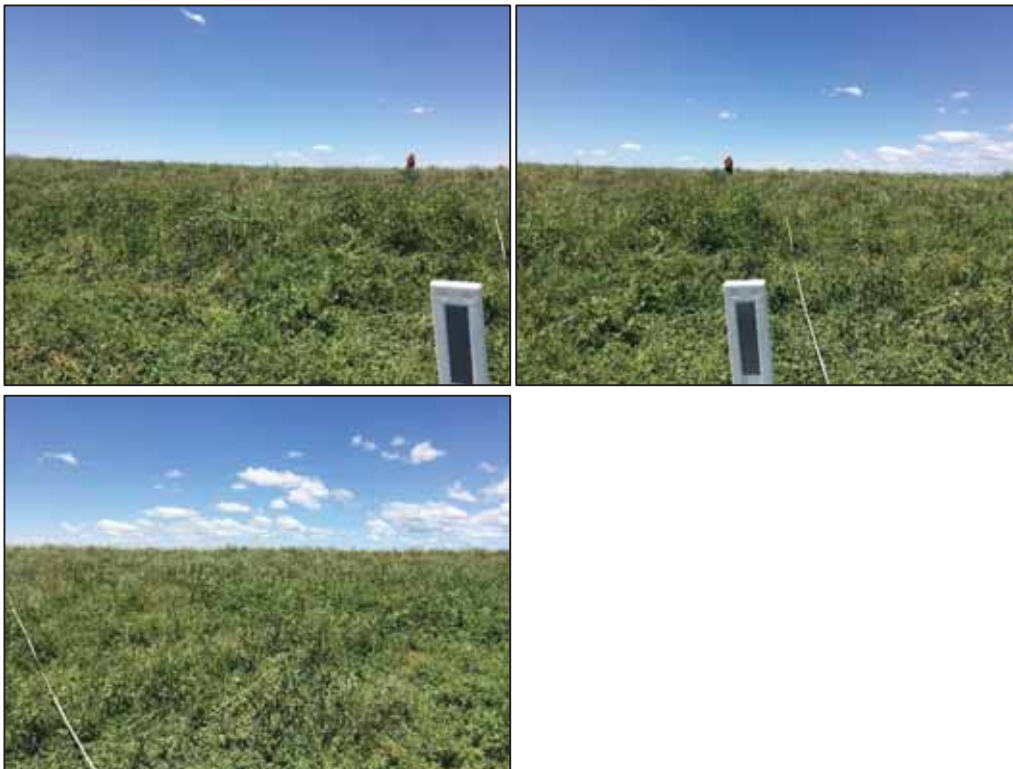
\*Projected foliage cover

Site photographs at HVORIV2014-03 (left to right)

Start position 2016



End position 2016





Start position 2017



End position 2017



## HVORIV2014-04

HVORIV2014-04	MGA 84 Zone 56	
Position	Easting	Northing
Start transect:	311900	6398539
End transect	311853	6398557

### Description:

HVORIV2014-04 rehabilitation area occurs on a combination of subsoil and compost at HVO West.

The dominant species, including the structure of the site, is provided in the table below.

The average DBH of the trees is approximately <5 cm.

### Disturbance:

Disturbance present at rehabilitation site HVORIV2014-04 consisted mainly of weeds, and grazing by macropods. No evidence of fire was observed in the rehabilitation area. No areas containing rubbish were observed.

Common weeds recorded at the site included *Panicum maximum*, *Acacia saligna*, *Chenopodium album*, *Galenia pubescens*, *Senecio madagascariensis*, *Verbena bonariensis* and *Conyza bonariensis*.

**Table. Dominant species and structure at HVORIV2014-04**

Stratum	Height (m)	% cover*	Dominant native species
Tree layer	-	-	-
Midstorey layer	-	-	-
Shrub layer	1.5	5	<i>Eucalyptus moluccana</i> , <i>Acacia salicina</i> , <i>Acacia decora</i>
Ground layer	0.5	25	<i>Eriochloa pseudoacrotricha</i> , <i>Panicum effusum.</i> , <i>Einadia nutans</i> , <i>Commelina cyanea</i> and <i>Cynodon dactylon</i>

\*Projected foliage cover

Site photographs at HVORIV2014-04 (left to right)

Start position 2016



End position 2016





Start position 2017



End position 2017



## HVORIV2014-05

HVORIV2014-05	MGA 84 Zone 56	
Position	Easting	Northing
Start transect:	312242	6398088
End transect	312268	6398113

### Description:

HVORIV2014-05 is rehabilitation area occurs on a combination of subsoil and compost at HVO West.

The dominant species, including the structure of the site, is provided in the table below.

### Disturbance:

Disturbance present at rehabilitation site HVORIV2014-05 consisted mainly of weeds, and grazing by macropods. No evidence of fire was observed in the rehabilitation area. No areas containing rubbish were observed.

Common weeds recorded at the site included *Senecio madagascariensis*, *Galenia pubescens*, *Chenopodium album*, *Opuntia stricta*, *Aster spp.* and *Conyza bonariensis*.

**Table. Dominant species and structure at HVORIV2014-05**

Stratum	Height (m)	% cover*	Dominant native species
Tree layer	-	-	-
Midstorey layer	-	-	-
Shrub layer	-	-	-
Ground layer	0.5	40	<i>Digitaria divaricatissima</i>

\*Projected foliage cover

Site photographs at HVORIV2014-05 (left to right)

Start position 2016

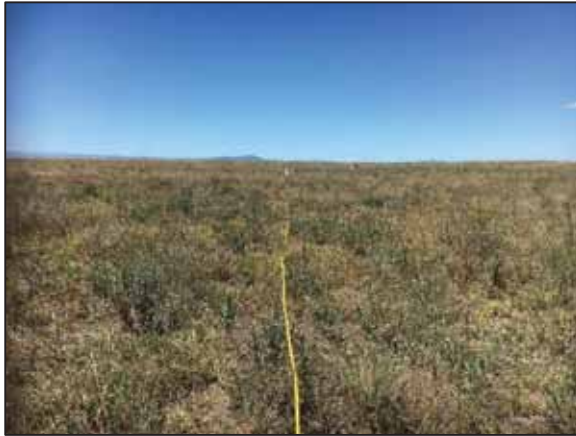


End position 2016





Start position 2017



End position 2017



## HVORIV2014-06

HVORIV2014-06	MGA 84 Zone 56	
Position	Easting	Northing
Start transect:	312521	6397946
End transect	312521	6397895

### Description:

HVORIV2014-06 rehabilitation area occurs on a combination of topsoil and compost at HVO West.

The dominant species, including the structure of the site, is provided in the table below.

### Disturbance:

Disturbance present at rehabilitation site HVORIV2014-06 consisted mainly of weeds, and grazing by macropods. No evidence of fire was observed in the rehabilitation area. No areas containing rubbish were observed.

Common weeds recorded at the site included *Chloris gayana*, *Setaria parviflora*, *Bidens pilosa*, *Galenia pubescens*, *Senecio madagascariensis* and *Conyza bonariensis*.

**Table. Dominant species and structure at HVORIV2014-06**

Stratum	Height (m)	% cover*	Dominant native species
Tree layer	-	-	-
Midstorey layer	-	-	-
Shrub layer	-	-	-
Ground layer	0.5	5	<i>Eriochloa pseudoacrotricha</i> , <i>Echinochloa colona</i> , <i>Chloris truncata</i> and <i>Lachnagrostis spp.</i>

\*Projected foliage cover

Site photographs at HVORIV2014-06 (left to right)

Start position 2016



End position 2016





Start position 2017



End position 2017



## HVOWES2008-01

HVOWES2008-01	MGA 84 Zone 56	
Position	Easting	Northing
Start transect:	306340	6406920
End transect	306364	6406877

### Description:

The HVOWES2008-01 rehabilitation area occurs on imported topsoil.

The dominant species, including the structure of the site, is provided in the table below.

The average DBH of the trees is approximately 15 cm.

### Disturbance:

Disturbance present at the rehabilitation site consisted mainly of weeds, and grazing by macropods. No evidence of fire was observed in the rehabilitation area. No areas containing rubbish were observed.

Common weeds recorded at the site included *Galea pubescens*, *Plantago lanceolata*, *Chloris gayana*, *Sida rhombifolia* and *Verbena bonariensis*.

**Table. Dominant species and structure at HVOWES2008-01**

Stratum	Height (m)	% cover*	Dominant native species
Tree layer	5	20	<i>Eucalyptus moluccana</i> and <i>Corymbia maculata</i>
Midstorey layer	2 – 4	30	<i>Acacia salicina</i> , <i>Acacia implexa</i> and <i>Acacia amblygona</i> ,
Shrub layer	2	25	<i>Acacia paradoxa</i> , <i>Acacia decurrens</i> , <i>Acacia decora</i> and <i>Acacia amblygona</i>
Ground layer	1	40	<i>Austrostipa ramossissima</i> , <i>Bothriochloa macra</i> , <i>Eremophila debilis</i> , <i>Sporobolous creber</i> , <i>Chloris ventricosa</i> and <i>Enchylaena tomentosa</i> .

\*Projected foliage cover



Site photographs at HVOWES2008-01 (left to right)

Start position 2016



End position 2016





Start position 2017



End position 2017



## HVOWES2011-01

HVOWES2011-01	MGA 84 Zone 56	
Position	Easting	Northing
Start transect:	308265	6409164
End transect	308223	6409171

### Description:

The HVOWES2011-01 rehabilitation area occurs on spoil with compost. Native seed has been hydroseeded in the rehabilitation area.

The dominant species, including the structure of the site, is provided in the table below.

The average DBH of the trees is approximately 13 cm.

### Disturbance:

Disturbance present at the site consisted mainly of weeds, and grazing by macropods. No evidence of fire was observed in the rehabilitation area. No areas containing rubbish were observed.

Pig scats were recorded at the site during the monitoring.

Common weeds recorded at the site included *Galea pubescens*, *Plantago lanceolata*, *Conyza bonariensis*, *Chloris gayana*, *Sida rhombifolia* and *Verbena bonariensis*.

**Table. Dominant species and structure at HVOWES2011-01**

Stratum	Height	% cover*	Dominant native species
Tree layer	-	-	-
Midstorey layer	5-6	50	<i>Eucalyptus crebra</i> , <i>Eucalyptus moluccana</i> , <i>Eucalyptus fibrosa</i> , <i>Corymbia maculata</i> , <i>Acacia longifolia</i> , <i>Allocasuarina littoralis</i> , <i>Acacia implexa</i> , <i>Acacia binervata</i> , and <i>Acacia falcata</i> .
Shrub layer	2	5	<i>Indigofera australis</i> and <i>Hakea sericea</i> .
Ground layer	1	60	<i>Austrostipa ramossissima</i> , <i>Bothriochloa macra</i> , <i>Dichondra repens</i> , <i>Sporobolous creber</i> , <i>Chloris truncata</i> , <i>Hardenbergia violacea</i> , <i>Microlaeana stipoides</i> , <i>Enchylaena tomentosa</i> , <i>Glycine tabacina</i> and <i>Themeda australis</i> .

\*Projected foliage cover



Site photographs at HVOWES2011-01 (left to right)

Start position 2016



End position 2016

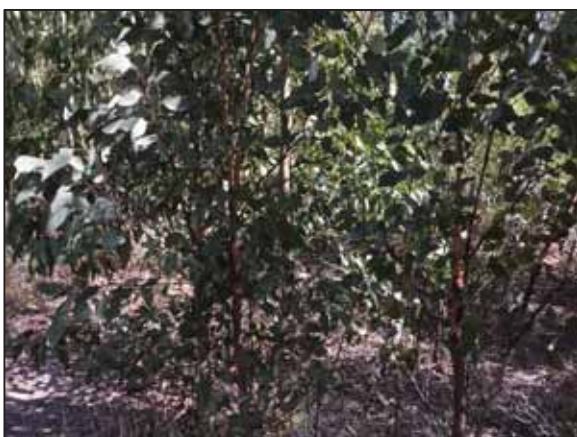




Start position 2017



End position 2017



## HVOWES2013-01

HVOWES2013-01	MGA 84 Zone 56	
Position	Easting	Northing
Start transect:	306899	6407222
End transect	306858	6407251

### Description:

HVOWES2013-01 rehabilitation area occurs on a combination of spoil and compost at HVO West.

The dominant species, including the structure of the site, is provided in the table below.

A number of eucalypts were observed within the rehabilitation area. It is likely that the eucalypts regenerating included *Eucalyptus fibrosa*, *Eucalyptus moluccana* and *Corymbia maculata*.

### Disturbance:

Disturbance present at rehabilitation site HVOWES2013-01 consisted mainly of weeds, and grazing by macropods. No evidence of fire was observed in the rehabilitation area. No areas containing rubbish were observed.

Common weeds recorded at the site included *Eragrostis curvula*, *Chloris gayana*, *Brassica rapa*, *Galenia pubescens* and *Medicago sativa*.

**Table. Dominant species and structure at HVOWES2011-01**

Stratum	Height	% cover*	Dominant native species
Tree layer	-	-	-
Midstorey layer	-	-	
Shrub layer	2	5	<i>Eucalyptus moluccana</i> , <i>Eucalyptus fibrosa</i> , <i>Corymbia maculata</i> , <i>Acacia decora</i> , <i>Acacia implexa</i> , <i>Acacia salicina</i> and <i>Cassinia uncata</i> .
Ground layer	1	40	<i>Austrostipa scabra</i> , <i>Bothriochloa macra</i> , <i>Sporobolus creber</i> , <i>Chloris truncata</i> , <i>Rytidosperma spp.</i> , <i>Enchylaena tomentosa</i> and <i>Austrostipa verticillata</i> .

\*Projected foliage cover



Site photographs at HVOWES2013-01 (left to right)

Start position 2016



End position 2016





Start position 2017



End position 2017



## HVOWES2013-02

HVOWES2013-02	MGA 84 Zone 56	
Position	Easting	Northing
Start transect:	306889	6407365
End transect	306879	6407409

### Description:

HVOWES2013-02 rehabilitation area occurs on a combination of topsoil and compost at HVO West.

The dominant species, including the structure of the site, is provided in the table below.

### Disturbance:

Disturbance present at rehabilitation site HVOWES2013-02 consisted mainly of weeds, and grazing by macropods. No evidence of fire was observed in rehabilitation area. No areas containing rubbish were observed.

Common weeds recorded at the site included *Panicum maximum*, *Chloris gayana*, *Galenia pubescens*, *Verbena bonariensis*, *Conyza bonariensis* and *Brassica* spp..

Table. Dominant species and structure at HVOWES2013-02

Stratum	Height	% cover*	Dominant native species
Tree layer	-	-	-
Midstorey layer	-	-	-
Shrub layer	-	-	-
Ground layer	1	60	<i>Einadia trigonos</i> , <i>Einadia nutans</i> , <i>Chloris truncata</i> , <i>Sporobolus creber</i> , <i>Enchylaena tomentose</i> , <i>Chloris ventricose</i> and <i>Eriochloa pseudoacrotricha</i>

\*Projected foliage cover

Site photographs at HVOWES2013-02 (left to right)

Start position 2016



End position 2016





Start position 2017



End position 2017



## MTWCDD2011-01

MTWCDD2011-01	MGA 84 Zone 56	
Position	Easting	Northing
Start transect:	319599	6390304
End transect	319552	6390312

### Description:

The MTWCDD2011-01 rehabilitation area occurs on imported topsoil with native seeds hydroseeded into the soil.

The dominant species, including the structure of the site, is provided in the table below.

The average DBH of the trees is approximately 13 cm.

### Disturbance:

Disturbance present at the site consisted mainly of weeds, and grazing by macropods. No evidence of fire was observed in the rehabilitation area. No areas containing rubbish were observed.

Common weeds recorded at the site included *Acacia saligna*, *Bidens pilosa*, *Solanum nigrum*, *Galea pubescens*, *Plantago lanceolata*, *Chloris gayana*, *Sida rhombifolia* and *Verbena bonariensis*.

**Table. Dominant species and structure at MTWCDD2011-01**

Stratum	Height (m)	% cover*	Dominant native species
Tree layer	6	5	<i>Corymbia maculata</i> , <i>Eucalyptus moluccana</i> and <i>Eucalyptus crebra</i>
Midstorey layer	4	5	<i>Acacia falcata</i> and <i>Acacia salicina</i>
Shrub layer	1	45	<i>Acacia cultriformis</i> , <i>Acacia amblygona</i> , <i>Acacia spectabilis</i> and <i>Indigofera australis</i>
Ground layer	0.5	15	<i>Dichondra repens</i> , <i>Cynodon dactylon</i> , <i>Bothriochloa macra</i> , <i>Einadia nutans</i> , <i>Echinopogon caespitosus</i> , <i>Cymbopogon refractus</i> , <i>Themeda australis</i> , <i>Fimbristylis dicholoma</i> and <i>Capillipedium spicigerum</i>

\*Projected foliage cover

Site photographs at MTWCDC2011-01 (left to right)

Start position 2016





Start position 2017



End position 2017



## MTWCDD2013-01

MTWCDD2013-01	MGA 84 Zone 56	
Position	Easting	Northing
Start transect:	319516	6390165
End transect	319535	6390212

### Description:

MTWCDD2013-01 rehabilitation area occurs on topsoil at Mount Thorley-Warkworth.

The dominant species, including the structure of the site, is provided in the table below.

No native species were recorded.

### Disturbance:

Disturbance present at rehabilitation site MTWCDD2013-01 consisted mainly of weeds, and grazing by macropods. No evidence of fire was observed in the rehabilitation area. No areas containing rubbish were observed.

Common weeds recorded at the site included *Chloris gayana*, *Conyza spp.*, *Aster sp.* and *Lepidium spp.*.

**Table. Dominant species and structure at MTWCDD2013-01**

Stratum	Height (m)	% cover*	Dominant native species
Tree layer	-	-	-
Midstorey layer	-	-	-
Shrub layer	-	-	-
Ground layer	-	-	-

\*Projected foliage cover

Site photographs at MTWCDD2013-01 (left to right)

Start position 2016



End position 2016





End position 2017



## MTWCDD2015-01

MTWCDD2015-01	MGA 84 Zone 56	
Position	Easting	Northing
Start transect:	319049	6390074
End transect	319081	6390034

### Description:

MTWCDD2015-01 rehabilitation area occurs on a combination of spoil and compost at Mount Thorley-Warkworth.

It should be noted that a number of Eucalypts were regenerating in the area.

The dominant species, including the structure of the site, is provided in the table below.

The average DBH of the trees is approximately <5 cm.

### Disturbance:

Disturbance present at rehabilitation site MTWCDD2015-01 consisted mainly of weeds, and grazing by macropods. No evidence of fire was observed in the rehabilitation area. No areas containing rubbish were observed.

Common weeds recorded at the site included *Conyza bonariensis*, *Chloris gayana*, *Echinochloa crus-gali*, *Senecio madagascariensis*, *Solanum nigrum* and *Panicum maximum*.

**Table. Dominant species and structure at MTWCDD2015-01**

Stratum	Height (m)	% cover*	Dominant native species
Tree layer	-	-	
Midstorey layer	4	5	<i>Corymbia maculata</i> , <i>Allocasurina leuhmannii</i> , <i>Acacia implexa</i> , <i>Acacia mearnsii</i> and <i>Acacia salicina</i>
Shrub layer	1	25	<i>Acacia cultriformis</i> and <i>Acacia amblygona</i>
Ground layer	0.5	30	<i>Eriochloa pseudoastritrica</i> , <i>Rytidosperma spp.</i> , <i>Einadia nutans</i> , <i>Austrostipa scabra</i> , <i>Bothriochloa macra</i> , <i>Einadia trigonos</i> , <i>Atriplex semibaccata</i> , <i>Cymbopogon refractus</i> , <i>Chloris truncate</i>

\*Projected foliage cover

Site photographs at MTWCDD2015-01 (left to right)

Start position 2016



End position 2016





Start position 2017



End position 2017



## MTWNP2005-01

MTWNP2005-01	MGA 84 Zone 56	
Position	Easting	Northing
Start transect:	319816	6391225
End transect	319842	6391183

### Description:

The MTWNP2005-01 rehabilitation area occurs on imported topsoil.

The dominant species, including the structure of the site, is provided in the table below.

The average DBH of the trees is approximately 22 cm.

### Disturbance:

Disturbance present at the rehabilitation site consisted mainly of weeds, and grazing by macropods. No evidence of fire was observed in the rehabilitation area. No areas containing rubbish were observed.

Common weeds recorded at the site included *Corymbia citradora*, *Acacia saligna*, *Galenia pubescens*, *Conyza bonariensis*, *Chloris gayana*, *Sida rhombifolia* and *Verbena bonariensis*.

**Table. Dominant species and structure at MTWNP2005-01**

Stratum	Height (m)	% cover*	Dominant native species
Tree layer	10	5	<i>Corymbia maculata</i> , <i>Acacia implexa</i> and <i>Eucalyptus moluccana</i>
Midstorey layer	4	-	-
Shrub layer	2	5	<i>Acacia amblygona</i> ,
Ground layer	1	40	<i>Bothriochloa macra</i> , <i>Dichondra repens</i> , <i>Hardenbergia violacea</i> , <i>Oxalis perennans</i> , <i>Enchylaena tomentosa</i> , <i>Sporobolus creber</i> , <i>Wahlenbergia stricta</i> and <i>Eremophila debilis</i>

\*Projected foliage cover

Site photographs at MTWNPN2005-01 (left to right)

Start position 2016



End position 2016





Start position 2017



End position 2017



## MTWNPN2005-02

MTWNPN2005-02	MGA 84 Zone 56	
Position	Easting	Northing
Start transect:	319682	6391980
End transect	319682	6391980

### Description:

The MTWNPN2005-01 rehabilitation area occurs on imported topsoil.

The dominant species, including the structure of the site, is provided in the table below.

The average DBH of the trees is approximately 18 cm.

A birds nest was recorded in a small Eucalypt.

### Disturbance:

Disturbance present at the rehabilitation site consisted mainly of weeds, and grazing by macropods. No evidence of fire was observed in the rehabilitation area. No areas containing rubbish were observed.

Common weeds recorded at the site included *Eucalyptus cladocalyx*, *Acacia saligna*, *Plantago lanceolata*, *Conyza bonariensis*, *Chloris gayana*, *Sida rhombifolia* and *Verbena bonariensis*.

**Table. Dominant species and structure at MTWNPN2005-02**

Stratum	Height (m)	% cover*	Dominant native species
Tree layer	8	10	<i>Corymbia maculata</i> , <i>Eucalyptus moluccana</i> , <i>Eucalyptus fibrosa</i> and <i>Acacia implexa</i>
Midstorey layer	5	20	<i>Acacia salicina</i> , <i>Acacia parvipinnula</i>
Shrub layer	2	5	<i>Acacia amblygona</i>
Ground layer	1	40	<i>Bothriochloa macra</i> , <i>Cynodon dactylon</i> , <i>Vittadinia sulcata</i> , <i>Enchylaena tomentosa</i> , <i>Sporobolus creber</i> , <i>Vittadinia cuneata</i> and <i>Eremophila debilis</i>

\*Projected foliage cover



Site photographs at MTWNPN2005-02 (left to right)

Start position 2016



End position 2016





Start position 2017



End position 2017



## MTWNPN2009-01

MTWNPN2009-01	MGA 84 Zone 56	
Position	Easting	Northing
Start transect:	319069	6391524
End transect	319027	6391535

### Description:

The MTWNPN2009-01 rehabilitation area occurs on imported topsoil.

The dominant species, including the structure of the site, is provided in the table below.

The spacing between the eucalypts were noticeable densely compact compared to the other sites.

The average DBH of the trees is approximately 16 cm.

### Disturbance:

Disturbance present at the site consisted mainly of weeds, and grazing by macropods. No evidence of fire was observed in the rehabilitation area. No areas containing rubbish were observed.

Common weeds recorded at the site included *Galea pubescens*, *Plantago lanceolata*, *Conyza bonariensis*, *Chloris gayana*, *Sida rhombifolia* and *Verbena bonariensis*.

Pig scats were found at the site during previous monitoring.

**Table. Dominant species and structure at MTWNPN2009-01**

Stratum	Height	% cover*	Dominant native species
Tree layer	7-8	60	<i>Corymbia maculate</i> , <i>Eucalyptus moluccana</i> and <i>Eucalyptus crebra</i>
Midstorey layer	3	10	<i>Acacia decurrens</i> and <i>Acacia falcata</i>
Shrub layer	2	10	<i>Acacia decora</i> and <i>Acacia amblygona</i>
Ground layer	1	5	<i>Rytidosperma spp.</i> , <i>Glycine tabacina</i> , <i>Cymbopogon refractus</i>

\*Projected foliage cover



Site photographs at MTWNP2009-01 (left to right)

Start position 2016



End position 2016





Start position 2017



End position 2017



## MTWMTO2000-01

MTWMTO2000-01	MGA 84 Zone 56	
Position	Easting	Northing
Start transect:	320551	6386940
End transect	320531	6386982

### Description:

The MTWMTO2000-01 rehabilitation area occurs on imported topsoil.

The dominant species, including the structure of the site, is provided in the table below.

The average DBH of the trees is approximately 23 cm.

### Disturbance:

Disturbance present at the site consisted mainly of weeds, and grazing by macropods. No evidence of fire was observed in the rehabilitation area. No areas containing rubbish were observed.

Common weeds recorded at the site included *Eucalyptus cladocalyx* (dominant overstorey), *Opuntia aurantiaca*, *Galenia pubescens*, *Bidens pilosa*, *Plantago lanceolata*, *Conyza bonariensis*, *Chloris gayana*, *Sida rhombifolia* and *Verbena bonariensis*.

**Table. Dominant species and structure at MTWMTO2000-01**

Stratum	Height	% cover*	Dominant native species
Tree layer	8	5	<i>Eucalyptus moluccana</i>
Midstorey layer	-	-	-
Shrub layer	-	-	-
Ground layer	1	20	<i>Solanum prinophyllum</i> , <i>Einadia trigonos</i> , <i>Cheilanthes sieberi</i> , <i>Themeda australis</i> , <i>Chloris truncata</i> , <i>Atriplex semibaccata</i> , <i>Enchylaena tomentosa</i> , and <i>Eremophila debilis</i> .

\*Projected foliage cover

Site photographs at MTWMT02000-01 (left to right)

Start position 2017





## MTWMT02005-03

MTWMT02005-03	MGA 84 Zone 56	
Position	Easting	Northing
Start transect:	320678	6385782
End transect	320640	6385756

### Description:

The MTWMT02005-03 rehabilitation area occurs on imported topsoil.

The dominant species, including the structure of the site, is provided in the table below.

The average DBH of the average trees is approximately 17 cm.

### Disturbance:

Disturbance present at the rehabilitation site consisted mainly of weeds, and grazing by macropods. No evidence of fire was observed in the rehabilitation area. No areas containing rubbish were observed.

Common weeds recorded at the site included *Eucalyptus cladocalyx* (dominant overstorey), *Acacia saligna*, *Eragrostis curvula*, *Bidens pilosa*, *Plantago lanceolata*, *Conyza bonariensis*, *Chloris gayana*, *Sida rhombifolia*, *Verbena bonariensis*.

**Table. Dominant species and structure at MTWMT02005-03**

Stratum	Height	% cover*	Dominant native species
Tree layer	-	-	-
Midstorey layer	-	-	-
Shrub layer	-	-	-
Ground layer	1	20	<i>Einadia nutans</i> , <i>Sporobolus creber</i> , <i>Chloris truncata</i> , <i>Chloris ventricosa</i> , <i>Calotis lappulacea</i> , <i>Bothriochloa macra</i> , <i>Dichondra repens</i> , <i>Oxalis perennans</i> , <i>Enchylaena tomentosa</i> , <i>Cyperus gracilis</i> , <i>Eremophila debilis</i> , and <i>Aristida vagans</i> .

\*Projected foliage cover

Site photographs at MTWMT02005-03 (left to right)  
Start position 2016



End position 2016





Start position 2017



End position 2017





## MTWNP2011-01

MTWNP2011-01	MGA 84 Zone 56	
Position	Easting	Northing
Start transect:	318166	6392138
End transect	318115	6392138

### Description:

MTWNP2011-01 rehabilitation area occurs on a combination of topsoil and compost at Mount Thorley-Warkworth.

The dominant species, including the structure of the site, is provided in the table below.

The average DBH of the trees is approximately 10 cm.

### Disturbance:

Disturbance present at rehabilitation site MTWNP2011-01 consisted mainly of weeds, and grazing by macropods. No evidence of fire was observed in the rehabilitation area. No areas containing rubbish were observed.

Common weeds recorded at the site included *Acacia saligna*, *Panicum maximum*, *Chloris gayana*, *Conyza bonariensis*, *Brassica* spp., *Gomphocarpus fruiticosis* and *Sida rhombifolia*.

**Table. Dominant species and structure at MTWNP2011-01**

Stratum	Height (m)	% cover*	Dominant native species
Tree layer	5	5	<i>Corymbia maculata</i> , <i>Eucalyptus moluccana</i> , <i>Acacia implexa</i> , <i>Eucalyptus fibrosa</i> and <i>Eucalyptus crebra</i>
Midstorey layer	2	10	<i>Acacia falcata</i> , <i>Acacia mearnsii</i>
Shrub layer	1	30	<i>Acacia cultriformis</i> , <i>Acacia amblygona</i> , <i>Acacia decora</i> , <i>Dodonaea viscosa</i> and <i>Daviesia genistifolia</i>
Ground layer	0.5	15	<i>Bothriochloa macra</i> , <i>Einadia nutans</i> , <i>Cymbopogon refractus</i> , <i>Themeda australis</i>

\*Projected foliage cover

Site photographs at MTWNPN2011-01 (left to right)

Start position 2016



Start position 2017



End position 2017





## MTWNP2013-01

MTWNP2013-01	MGA 84 Zone 56	
Position	Easting	Northing
Start transect:	318046	6391550
End transect	317995	6391518

### Description:

MTWNP2013-01 rehabilitation area occurs on a combination of topsoil and compost at Mount Thorley-Warkworth.

The dominant species, including the structure of the site, is provided in the table below.

### Disturbance:

Disturbance present at rehabilitation site MTWNP2013-01 consisted mainly of weeds, and grazing by macropods. No evidence of fire was observed in the rehabilitation area. No areas containing rubbish were observed.

Common weeds recorded at the site included *Bidens pilosa*, *Galenia pubescens*, *Conyza bonariensis*, *Brassica rapa*, *Chloris gayana*, *Solanum nigrum* and *Verbena bonariensis*.

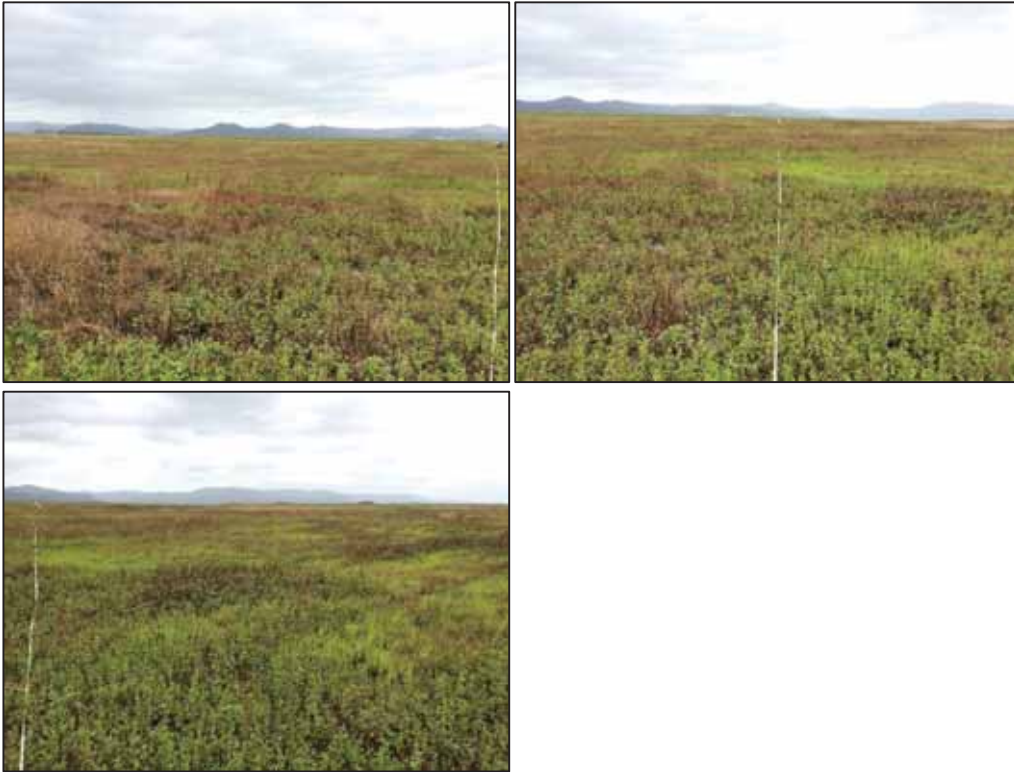
**Table. Dominant species and structure at MTWNP2013-01**

Stratum	Height (m)	% cover*	Dominant native species
Tree layer	-	-	-
Midstorey layer	-	-	-
Shrub layer	1	5	<i>Acacia cultriformis</i> , <i>Acacia amblygona</i> , <i>Indigofera australis</i> , <i>Acacia decora</i> , <i>Acacia paradoxa</i> and <i>Acacia falcata</i>
Ground layer	0.5	30	<i>Bothriochloa macra</i> , <i>Chloris truncata</i> , <i>Cymbopogon refractus</i> , <i>Atriplex semibaccata</i> , <i>Cynodon dactylon</i>

\*Projected foliage cover

Site photographs at MTWNP2013-01 (left to right)

Start position 2016



End position 2016



Start position 2017



End position 2017





## MTWNP2014-01

MTWNP2014-01	MGA 84 Zone 56	
Position	Easting	Northing
Start transect:	317645	6392097
End transect	317618	6392128

### Description:

MTWNP2014-01 rehabilitation area occurs on a combination of topsoil and compost at Mount Thorley-Warkworth.

The dominant species, including the structure of the site, is provided in the table below.

### Disturbance:

Disturbance present at rehabilitation site MTWNP2014-01 consisted mainly of weeds, and grazing by macropods. No evidence of fire was observed in the rehabilitation area. No areas containing rubbish were observed.

Common weeds recorded at the site included *Bidens pilosa*, *Coryza bonariensis*, *Lepidium spp.*, *Pennisetum cladenstina*, *Senecio madagascariensis*, *Solanum nigrum*, and *Verbena bonariensis*.

**Table. Dominant species and structure at MTWNP2014-01**

Stratum	Height (m)	% cover*	Dominant native species
Tree layer	-	-	-
Midstorey layer	4	10	<i>Acacia falcate</i> and <i>Acacia salicina</i>
Shrub layer	2	20	<i>Acacia cultriformis</i> , <i>Acacia amblygona</i> , <i>Acacia binervata</i> , <i>Dodonaea viscosa</i> , <i>Indigofera australis</i> , <i>Acacia longifolia</i> , <i>Acacia parvipinnula</i> , <i>Acacia decora</i> and <i>Acacia paradoxa</i>
Ground layer	0.5	30	<i>Bothriochloa macra</i> , <i>Chloris truncata</i> , <i>Cymbopogon refractus</i> , <i>Atriplex semibaccata</i> , <i>Cynodon dactylon</i>

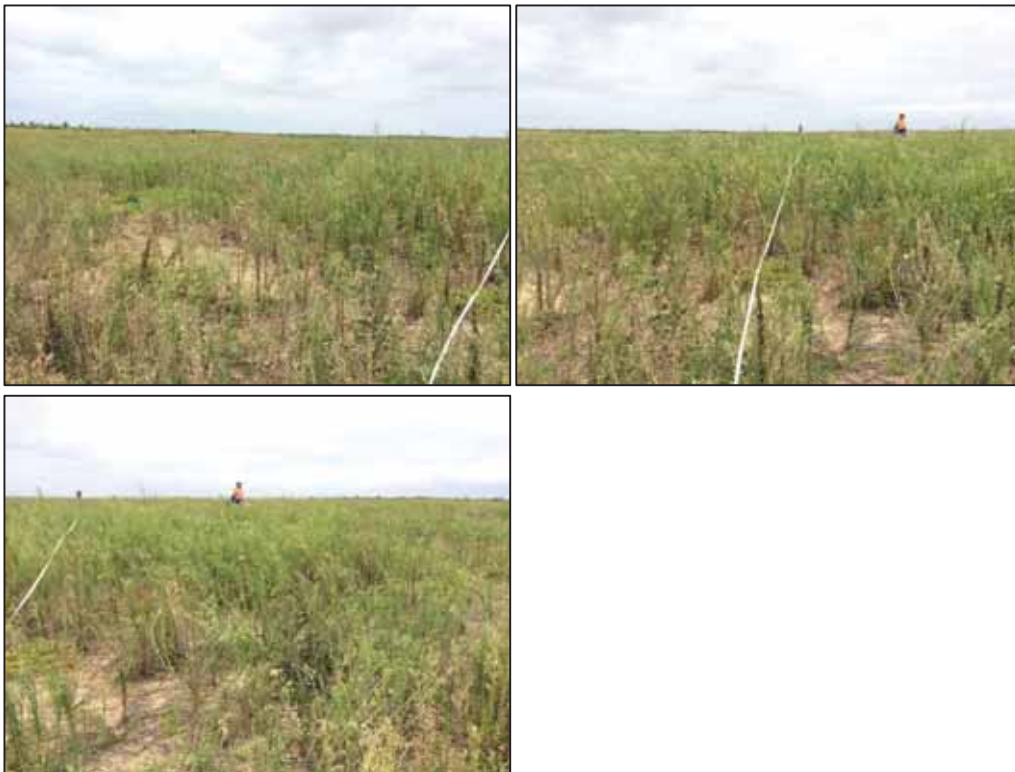
\*Projected foliage cover

Site photographs at MTWNP2014-01 (left to right)

Start position 2016



End position 2016



Start position 2017



End position 2017





## MTWNP2014-03

MTWNP2014-03	MGA 84 Zone 56	
Position	Easting	Northing
Start transect:	318089	6391271
End transect	318060	6391236

### Description:

MTWNP2014-03 rehabilitation area occurs on a combination of subsoil and compost at Mount Thorley-Warkworth.

Site relocated 30m to the West due to construction of wall road consuming previous site location.

The dominant species, including the structure of the site, is provided in the table below.

### Disturbance:

Disturbance present at rehabilitation site MTWNP2014-03 consisted mainly of weeds, and grazing by macropods. No evidence of fire was observed in the rehabilitation area. No areas containing rubbish were observed.

Common weeds recorded at the site included *Pennisetum cladenstina*, *Acacia saligna*, *Bidens pilosa*, *Conyza bonariensis*, *Chenopodium spp.* and *Trifolium repens*.

Table. Dominant species and structure at MTWNP2014-03

Stratum	Height (m)	% cover*	Dominant native species
Tree layer	-	-	-
Midstorey layer	-	-	-
Shrub layer	2	<5	<i>Acacia cultriformis</i> , <i>Acacia decora</i> , <i>Acacia implexa</i> , <i>Eucalyptus moluccana</i> and <i>Eucalyptus fibrosa</i>
Ground layer	0.5	15	<i>Bothriochloa macra</i> , <i>Laxmannia gracilis</i> , <i>Einadia nutans</i> and <i>Cynodon dactylon</i>

\*Projected foliage cover

Site photographs at MTWNP2014-0 (left to right)

Start position 2016



End position 2016



Start position 2017



End position 2017





## MTWSPN2014-01

MTWSPN2014-01	MGA 84 Zone 56	
Position	Easting	Northing
Start transect:	320170	6390161
End transect	320186	6390201

### Description:

MTWSPN2014-01 rehabilitation area occurs on a combination of topsoil and compost at Mount Thorley-Warkworth.

The dominant species, including the structure of the site, is provided in the table below.

### Disturbance:

Disturbance present at rehabilitation site MTWSPN2014-01 consisted mainly of weeds, and grazing by macropods. No evidence of fire was observed in the rehabilitation area. No areas containing rubbish were observed.

Common weeds recorded at the site included *Conyza bonariensis*, *Chloris gayana* and *Panicum maximum*.

**Table. Dominant species and structure at MTWSPN2014-01**

Stratum	Height (m)	% cover*	Dominant native species
Tree layer	-	-	-
Midstorey layer	-	-	-
Shrub layer	-	-	-
Ground layer	0.5	80	<i>Bothriochloa macra</i> , <i>Panicum effusum</i> , <i>Chloris truncata</i> , <i>Enchylaena tomentosa</i> , <i>Austrostipa scabra</i> , <i>Einadia nutans</i> and <i>Cynodon dactylon</i>

\*Projected foliage cover

Site photographs at MTWSPN2014-01 (left to right)

Start position 2016



End position 2016



Start position 2017



End position 2017





## MTWTDI2015-01

MTWTDI2015-01	MGA 84 Zone 56	
Position	Easting	Northing
Start transect:	319687	6392186
End transect	319691	6392236

### Description:

MTWTDI2015-01 rehabilitation area occurs on a combination of spoil and compost at Mount Thorley-Warkworth.

The dominant species, including the structure of the site, is provided in the table below.

### Disturbance:

Disturbance present at rehabilitation site MTWTDI2015-01 consisted mainly of weeds, and grazing by macropods. No evidence of fire was observed in the rehabilitation area. No areas containing rubbish were observed.

Common weeds recorded at the site included *Chloris gayana*, *Aster spp.*, *Senecio madagascariensis* and *Conyza bonariensis*.

**Table. Dominant species and structure at MTWTDI2015-01**

Stratum	Height (m)	% cover*	Dominant native species
Tree layer	-	-	-
Midstorey layer	-	-	-
Shrub layer	-	-	-
Ground layer	0.5	10	<i>Bothriochloa macra</i> , <i>Atriplex semibaccata</i> , <i>Chloris truncata</i> , <i>Chloris ventricosa</i> and <i>Cynodon dactylon</i>

\*Projected foliage cover

Site photographs at MTWTDI2015-01 (left to right)

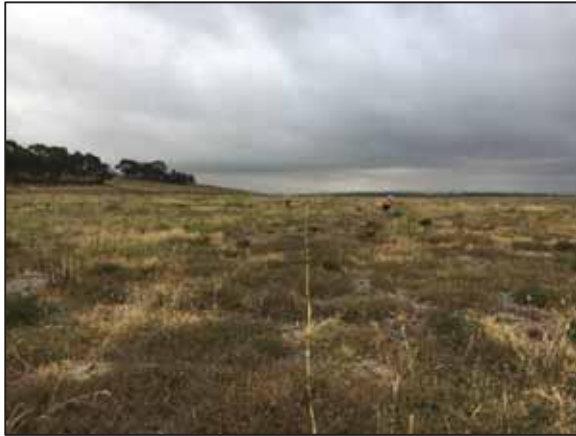
Start position 2016



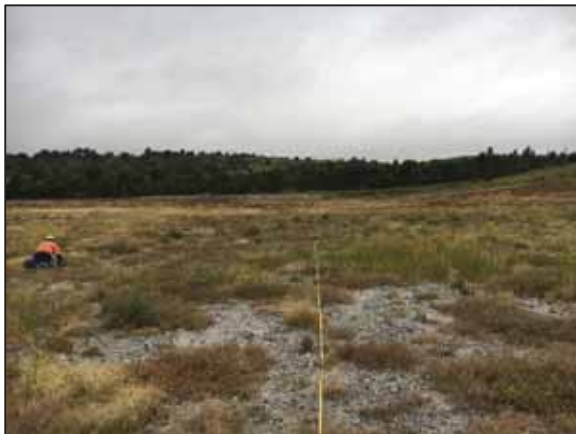
End position 2016



Start position 2017



End position 2017





## MTWWDL2014-01

MTWWDL2014-01	MGA 84 Zone 56	
Position	Easting	Northing
Start transect:	319804	6388507
End transect	319849	6388525

### Description:

MTWWDL2014-01 rehabilitation area occurs on a combination of topsoil and compost at Mount Thorley-Warkworth.

The dominant species, including the structure of the site, is provided in the table below.

### Disturbance:

Disturbance present at rehabilitation site MTWWDL2014-01 consisted mainly of weeds, and grazing by macropods. No evidence of fire was observed in the rehabilitation area. No areas containing rubbish were observed.

Common weeds recorded at the site included *Conyza bonariensis*, *Sida rhombifolia*, *Verbena bonariensis* and *Chloris gayana*.

**Table. Dominant species and structure at MTWWDL2014-01**

Stratum	Height (m)	% cover*	Dominant native species
Tree layer	-	-	-
Midstorey layer	-	-	-
Shrub layer	2	25	<i>Corymbia maculate</i> , <i>Eucalyptus crebra</i> , <i>Acacia cultriformis</i> , <i>Acacia salicina</i> , <i>Acacia implexa</i> , <i>Acacia amblygona</i> , <i>Indigofera australis</i> , <i>Acacia decora</i> , <i>Acacia paradoxa</i> and <i>Acacia falcata</i>
Ground layer	0.5	35	<i>Chloris ventricose</i> , <i>Panicum effusum</i> , <i>Einadia nutans</i> , <i>Atriplex semibaccata</i> , <i>Chloris truncata</i> , <i>Chloris ventricosa</i> and <i>Cynodon dactylon</i>

\*Projected foliage cover

Site photographs at MTWWDL2014-01 (left to right)

Start position 2016



End position 2016



Start position 2017





## MTWWDL2014-02

MTWWDL2014-02	MGA 84 Zone 56	
Position	Easting	Northing
Start transect:	319636	6388357
End transect	319624	6388309

### Description:

MTWWDL2014-02 rehabilitation area occurs on a combination of topsoil and compost at Mount Thorley-Warkworth.

The dominant species, including the structure of the site, is provided in the table below.

### Disturbance:

Disturbance present at rehabilitation site MTWWDL2014-02 consisted mainly of weeds, and grazing by macropods. No evidence of fire was observed in the rehabilitation area. No areas containing rubbish were observed.

Common weeds recorded at the site included *Chloris gayana*, *Panicum maximum*, *Brassica rapa*, *Centaureum spp.* and *Coryza bonariensis*.

Table. Dominant species and structure at MTWWDL2014-02

Stratum	Height (m)	% cover*	Dominant native species
Tree layer	-	-	-
Midstorey layer	-	-	-
Shrub layer	-	-	-
Ground layer	0.5	15	<i>Cynodon dactylon</i> , <i>Eriochloa pseudoacrotricha</i> and <i>Echinochloa colona</i>

\*Projected foliage cover

Site photographs at MTWVDL2014-02 (left to right)

Start position 2016



End position 2016



Start position 2017



End position 2017





## Appendix 5 – Tree and canopy data

Bell 1				
Tree Number	Tree Species	Fruit/Flowers	Width range (cm)	Hollows
1	<i>C. maculata</i>		20	
2	<i>E. crebra</i>		30	
3	<i>C. maculata</i>		13	
4	<i>C. maculata</i>		16	
5	<i>E. crebra</i>		15	
6	<i>E. crebra</i>		30	
7	<i>C. maculata</i>		12	
8	<i>C. maculata</i>		20	
9	<i>C. maculata</i>		18	
10	<i>E. crebra</i>		28	
11	<i>C. maculata</i>		15	
12	<i>E. crebra</i>		25	
13	<i>E. crebra</i>		12	
14	<i>E. crebra</i>		10	
15	<i>E. crebra</i>		10	
16	<i>E. crebra</i>		10	
17	<i>E. crebra</i>		25	
18	<i>E. crebra</i>		25	
19	<i>E. crebra</i>		30	
20	<i>E. crebra</i>		10	

Bell 2				
Tree Number	Tree Species	Fruit/Flowers	Width range (cm)	Hollows
1	<i>C. maculata</i>		20	
2	<i>E. moluccana</i>		16	
3	<i>C. maculata</i>		22	
4	<i>C. maculata</i>		21	
5	<i>C. maculata</i>		20	1
6	<i>C. maculata</i>		12	
7	<i>C. maculata</i>		18	
8	<i>C. maculata</i>		8	
9	<i>C. maculata</i>		13	
10	<i>C. maculata</i>		20	
11	<i>C. maculata</i>		13	

Bell 2				
Tree Number	Tree Species	Fruit/Flowers	Width range (cm)	Hollows
12	<i>C. maculata</i>		43	
13	<i>E. moluccana</i>		18	
			244	

Bell 3				
Tree Number	Tree Species	Fruit/Flowers	Width range (cm)	Hollows
1	<i>C. maculata</i>		26	
2	<i>C. maculata</i>		25	
3	<i>C. maculata</i>		12	
4	<i>E. moluccana</i>		15	
5	<i>C. maculata</i>		11	
6	<i>C. maculata</i>		28	
7	<i>C. maculata</i>		24	
8	<i>C. maculata</i>		11	
9	<i>C. maculata</i>		17	
10	<i>C. maculata</i>		12	
11	<i>E. moluccana</i>		15	
12	<i>C. maculata</i>		11	
13	<i>E. moluccana</i>		15	
14	<i>C. maculata</i>		10	
15	<i>E. fibrosa</i>		12	
16	<i>C. maculata</i>		8	
17	<i>C. maculata</i>		18	
18	<i>C. maculata</i>		18	
19	<i>C. maculata</i>		12	
20	<i>C. maculata</i>		15	
21	<i>C. maculata</i>		11	

HVOCAR200901				
Tree Number	Tree Species	Fruit/Flowers	Width range (cm)	Hollows
1	<i>C. maculata</i>		7	
2	<i>C. maculata</i>		7	
3	<i>C. maculata</i>		7	
4	<i>C. maculata</i>		7	
5	<i>C. maculata</i>		6	
6	<i>C. maculata</i>		12	
7	<i>E. moluccana</i>		13	

HVOCAR200901				
Tree Number	Tree Species	Fruit/Flowers	Width range (cm)	Hollows
8	<i>E. moluccana</i>		10	
9	<i>C. maculata</i>		15	
10	<i>C. maculata</i>		11	
11	<i>C. maculata</i>		15	
12	<i>C. maculata</i>		9	
13	<i>C. maculata</i>		5	
14	<i>C. maculata</i>		7	
15	<i>A. implexa</i>		13	
16	<i>E. moluccana</i>		11	
17	<i>C. maculata</i>		13	
18	<i>C. maculata</i>		12	
19	<i>E. moluccana</i>		6	
20	<i>C. maculata</i>		10	
21	<i>C. maculata</i>		5	
22	<i>E. moluccana</i>		7	
23	<i>C. maculata</i>		8	
24	<i>C. maculata</i>		7	
25	<i>E. moluccana</i>		12	
26	<i>C. maculata</i>		9	
27	<i>C. maculata</i>		10	
28	<i>E. moluccana</i>		5	

HVOCAR200902				
Tree Number	Tree Species	Fruit/Flowers	Width range (cm)	Hollows
1	<i>E. moluccana</i>		6	
2	<i>C. maculata</i>		7	
3	<i>A. implexa</i>		7	
4	<i>C. maculata</i>		6	

HVOWES200801				
Tree Number	Tree Species	Fruit/Flowers	Width range (cm)	Hollows
1	<i>E. moluccana</i>		5	
2	<i>C. maculata</i>		6	
3	<i>C. maculata</i>		5	
4	<i>C. maculata</i>		5	
5	<i>C. maculata</i>		6	
6	<i>C. maculata</i>		6	



HVOWES200801				
Tree Number	Tree Species	Fruit/Flowers	Width range (cm)	Hollows
7	<i>C. maculata</i>		5	
8	<i>C. maculata</i>		6	
9	<i>C. maculata</i>		9	
10	<i>C. maculata</i>		5	
11	<i>C. maculata</i>		5	
12	<i>E. moluccana</i>		5	
13	<i>C. maculata</i>		5	
14	<i>C. maculata</i>		6	
15	<i>C. maculata</i>		6	
16	<i>C. maculata</i>		5	
17	<i>C. maculata</i>		9	
18	<i>C. maculata</i>		5	
19	<i>C. maculata</i>		6	
20	<i>C. maculata</i>		7	
21	<i>E. moluccana</i>		7	
22	<i>C. maculata</i>		6	
23	<i>C. maculata</i>		8	
24	<i>C. maculata</i>		11	
25	<i>C. maculata</i>		6	
26	<i>C. maculata</i>		6	
27	<i>C. maculata</i>		6	
28	<i>C. maculata</i>		6	
29	<i>C. maculata</i>		7	
30	<i>C. maculata</i>		10	
31	<i>C. maculata</i>		8	
32	<i>C. maculata</i>		6	
33	<i>C. maculata</i>		6	
34	<i>C. maculata</i>		5	
35	<i>C. maculata</i>		6	
36	<i>C. maculata</i>		7	
37	<i>C. maculata</i>		6	

HVOWES201101				
Tree Number	Tree Species	Fruit/Flowers	Width range (cm)	Hollows
1	<i>C. maculata</i>		6	
2	<i>E. moluccana</i>		7	
3	<i>C. maculata</i>		5	

HVOVES201101				
Tree Number	Tree Species	Fruit/Flowers	Width range (cm)	Hollows
4	<i>C. maculata</i>		5	
5	<i>C. maculata</i>		6	
6	<i>C. maculata</i>		7	
7	<i>C. maculata</i>		6	
8	<i>C. maculata</i>		7	
9	<i>C. maculata</i>		8	
10	<i>C. maculata</i>		6	
11	<i>C. maculata</i>		6	
12	<i>C. maculata</i>		7	
13	<i>E. moluccana</i>		7	
14	<i>E. moluccana</i>		6	
15	<i>C. maculata</i>		6	
16	<i>C. maculata</i>		6	
17	<i>E. moluccana</i>		6	

MTWCDD201101				
Tree Number	Tree Species	Fruit/Flowers	Width range (cm)	Hollows
1	<i>E. moluccana</i>		8	
2	<i>C. maculata</i>		5	
3	<i>C. maculata</i>		4	
4	<i>C. maculata</i>		5	
5	<i>C. maculata</i>		5	
6	<i>C. maculata</i>	flowers	7	
7	<i>E. moluccana</i>		6	
8	<i>E. moluccana</i>		5	
9	<i>C. maculata</i>		5	
10	<i>C. maculata</i>		5	
11	<i>E. moluccana</i>		4	
12	<i>C. maculata</i>		8	
13	<i>C. maculata</i>		5	
14	<i>C. maculata</i>		7	
15	<i>C. maculata</i>		6	
16	<i>C. maculata</i>		6	
17	<i>C. maculata</i>	heavy flower	9	

MTWMT0200001				
Tree Number	Tree Species	Fruit/Flowers	Width range (cm)	Hollows
1	<i>E. moluccana</i>		11	
2	<i>E. moluccana</i>		10	
3	<i>E. moluccana</i>		7	
4	<i>E. moluccana</i>		9	
5	<i>E. moluccana</i>		6	

MTWNPN200501				
Tree Number	Tree Species	Fruit/Flowers	Width range (cm)	Hollows
1	<i>A. implexa</i>	flowers	15	
2	<i>A. implexa</i>	flowers	15	

MTWNPN200502				
Tree Number	Tree Species	Fruit/Flowers	Width range (cm)	Hollows
1	<i>C. maculata</i>		5	
2	<i>Unknown</i>		7	
3	<i>C. maculata</i>		10	
4	<i>C. maculata</i>		9.5	
5	<i>C. maculata</i>		13	
6	<i>C. maculata</i>		11	
7	<i>C. maculata</i>		9	
8	<i>C. maculata</i>		9	
9	<i>C. maculata</i>		14	
10	<i>Unknown</i>		8.5	
11	<i>C. maculata</i>		15	
12	<i>Unknown</i>		9.5	
13	<i>Unknown</i>		7	
14	<i>C. maculata</i>		15	
15	<i>C. maculata</i>		8	
16	<i>Oposite leaves</i>		5	
17	<i>C. maculata</i>		8	
18	<i>C. maculata</i>		5.5	
19	<i>C. maculata</i>		11.5	
20	<i>C. maculata</i>		7.5	
21	<i>C. maculata</i>		7.5	
22	<i>Oposite leaves</i>		9	
24	<i>C. maculata</i>		10	
25	<i>C. maculata</i>		11	



MTWNPN200502				
Tree Number	Tree Species	Fruit/Flowers	Width range (cm)	Hollows
26	<i>C. maculata</i>		10	
27	<i>C. maculata</i>		11	
28	<i>C. maculata</i>		7	
29	<i>C. maculata</i>		9	
30	<i>E. moluccana</i>		9.5	

WAMBOGB1				
Tree Number	Tree Species	Fruit/Flowers	Width range (cm)	Hollows
1	<i>A. luehmannii</i>		10	
2	<i>A. luehmannii</i>		7	
3	<i>A. luehmannii</i>		12	
4	<i>A. luehmannii</i>		9	
5	<i>A. luehmannii</i>		8	
6	<i>A. luehmannii</i>		9	
7	<i>A. luehmannii</i>		9	
8	<i>E. fibrosa</i>		21	
9	<i>E. fibrosa</i>		9	
10	<i>E. fibrosa</i>		12	
11	<i>E. fibrosa</i>		18	
12	<i>E. fibrosa</i>		10	
13	<i>E. fibrosa</i>		13	
14	<i>E. fibrosa</i>		6	
15	<i>E. fibrosa</i>		11	
16	<i>E. fibrosa</i>		10	
17	<i>E. fibrosa</i>		17	
18	<i>E. crebra</i>		18	
19	<i>E. moluccana</i>		12	
20	<i>A. luehmannii</i>		11	
21	<i>A. luehmannii</i>		15	
22	<i>A. luehmannii</i>		10	

WAMBOGB2				
Tree Number	Tree Species	Fruit/Flowers	Width range (cm)	Hollows
1	<i>E. moluccana</i>		13	
2	<i>E. moluccana</i>		13	
3	<i>E. moluccana</i>		55	
4	<i>E. moluccana</i>		7	

WAMBOSPOT1				
Tree Number	Tree Species	Fruit/Flowers	Width range (cm)	Hollows
1	<i>E. crebra</i>		17	
2	<i>E. punctata</i>		35	1
3	<i>E. crebra</i>		17	
4	<i>E. crebra</i>		22	
5	<i>E. crebra</i>		21	
6	<i>E. punctata</i>		26	2
7	<i>C. maculata</i>		6	
8	<i>E. punctata</i>		35	2

WAMBOSPOT2				
Tree Number	Tree Species	Fruit/Flowers	Width range (cm)	Hollows
1	<i>E. moluccana</i>	fruit	23	
2	<i>E. moluccana</i>		16	
3	<i>C. maculata</i>	fruit	9	
4	<i>C. maculata</i>		10	
5	<i>C. maculata</i>		12	
6	<i>C. maculata</i>		9, 7.5	
7	<i>E. moluccana</i>		23	
8	<i>E. moluccana</i>		14	
9	<i>C. maculata</i>		11	
10	<i>C. maculata</i>		9	
11	<i>E. moluccana</i>		11	
12	<i>E. moluccana</i>		20	
13	<i>E. moluccana</i>		8	
14	<i>E. moluccana</i>		7.5	
15	<i>E. moluccana</i>		7	
16	<i>E. moluccana</i>		9	
17	<i>C. maculata</i>		48	
18	<i>E. moluccana</i>		13	
19	<i>E. moluccana</i>		13	
20	<i>E. moluccana</i>		15	
21	<i>E. moluccana</i>		14	
22	<i>E. moluccana</i>		9	
23	<i>E. moluccana</i>		13	
24	<i>E. moluccana</i>		8	
25	<i>E. moluccana</i>		18	
26	<i>E. moluccana</i>		12	

WAMBOSPOT2				
Tree Number	Tree Species	Fruit/Flowers	Width range (cm)	Hollows
27	<i>C. maculata</i>		8	
28	<i>C. maculata</i>		9	
29	<i>E. moluccana</i>		13	

WAMBOSPOT3				
Tree Number	Tree Species	Fruit/Flowers	Width range (cm)	Hollows
1	<i>E. crebra</i>		24	
2	<i>E. crebra</i>		17	
3	<i>E. punctata</i>		28	
4	<i>E. crebra</i>		16	
5	<i>C. maculata</i>		24	
6	<i>C. maculata</i>		17	
7	<i>C. maculata</i>		32	
8	<i>E. crebra</i>		22	
9	<i>E. crebra</i>		18	

WARKGB1				
Tree Number	Tree Species	Fruit/Flowers	Width range (cm)	Hollows
1	<i>E. crebra</i>		29	
2	<i>E. crebra</i>		16.5	
3	<i>E. crebra</i>		15	
4	<i>E. crebra</i>		21	
5	<i>E. crebra</i>		17	
6	<i>E. crebra</i>		9	
7	<i>E. crebra</i>		14	
8	<i>E. crebra</i>		16	
9	<i>A. leuhmannii</i>		10	
10	<i>E. crebra</i>		8	
11	<i>E. crebra</i>		16	
12	<i>E. crebra</i>		11.5	
13	<i>E. crebra</i>		14	
14	<i>E. crebra</i>		20	
15	<i>E. crebra</i>		12	
16	<i>E. crebra</i>		10	
17	<i>E. crebra</i>		9	
18	<i>E. crebra</i>		17	
19	<i>E. crebra</i>		12	
20	<i>E. crebra</i>		12	



WARKGB1				
21	<i>E. crebra</i>		14	
22	<i>E. crebra</i>		13	
23	<i>E. crebra</i>		23	
24	<i>A. leuhmannii</i>		18	
25	<i>E. crebra</i>		13	

WARKGB2				
Tree Number	Tree Species	Fruit/Flowers	Width range (cm)	Hollows
1	<i>A. leuhmannii</i>		8	
2	<i>E. crebra</i>		26	
3	<i>A. leuhmannii</i>		7	
4	<i>A. leuhmannii</i>		7	
5	<i>E. crebra</i>		14	
6	<i>E. crebra</i>		22	
7	<i>E. crebra</i>		16	
8	<i>A. leuhmannii</i>		8	
9	<i>A. leuhmannii</i>		11	
10	<i>A. leuhmannii</i>		11	
11	<i>E. crebra</i>		14	
12	<i>A. leuhmannii</i>		11	
13	<i>E. crebra</i>		8	
14	<i>E. crebra</i>		9	
15	<i>E. crebra</i>		9	
16	<i>E. crebra</i>		35	
17	<i>E. crebra</i>		18	
18	<i>E. crebra</i>		21	
19	<i>A. leuhmannii</i>		8	
20	<i>E. crebra</i>		18	
21	<i>E. crebra</i>		8	
22	<i>E. crebra</i>		13	
23	<i>A. leuhmannii</i>		8	
24	<i>E. crebra</i>		26	

WARKGB3				
Tree Number	Tree Species	Fruit/Flowers	Width range (cm)	Hollows
1	<i>A. leuhmannii</i>		9	
2	<i>A. leuhmannii</i>		11	
3	<i>E. crebra</i>		28	
4	<i>E. amplifolia</i>		9.5	

WARKGB3				
Tree Number	Tree Species	Fruit/Flowers	Width range (cm)	Hollows
5	<i>E. amplifolia</i>		9	
6	<i>A. leuhmannii</i>		11	
7	<i>A. leuhmannii</i>		11	
8	<i>E. amplifolia</i>		18	
9	<i>A. leuhmannii</i>		18	
10	<i>E. amplifolia</i>		26	
11	<i>A. leuhmannii</i>		11	
12	1B		17	
13	<i>A. leuhmannii</i>		14	
14	<i>E. amplifolia</i>		19	
15	<i>E. amplifolia</i>		7	
16	<i>E. amplifolia</i>		17	
17	<i>E. crebra</i>		25	
18	<i>A. leuhmannii</i>		14	
19	<i>E. amplifolia</i>		19	
20	<i>E. amplifolia</i>		15	
21	<i>E. amplifolia</i>		9.5	
22	<i>A. leuhmannii</i>		12	
23	<i>A. leuhmannii</i>		13	
24	<i>E. crebra</i>		15	
25	<i>E. amplifolia</i>		21	
26	<i>E. amplifolia</i>		13	
27	<i>E. amplifolia</i>		6	
28	<i>A. leuhmannii</i>		8	

WARKGB4				
Tree Number	Tree Species	Fruit/Flowers	Width range (cm)	Hollows
1	<i>E. crebra</i>		110	3
2	<i>E. crebra</i>		20	

BELL1						
LHS		RHS		Total trees	Width	Trees per m2
Genus	Number	Genus	Number			
<i>E. crebra</i>	2	<i>E. moluccana</i>	1	3	2	0.03

BELL2						
LHS		RHS		Total trees	Width	Trees per m2
Genus	Number	Genus	Number			
<i>C. maculata</i>	3	<i>C. maculata</i>	8	17	4	0.085
<i>E. moluccana</i>	4	<i>E. moluccana</i>	2			
BELL3						
LHS		RHS		Total trees	Width	Trees per m2
Genus	Number	Genus	Number			
<i>C. maculata</i>	3	<i>C. maculata</i>	7	20	4	0.1
<i>E. moluccana</i>	1	<i>E. moluccana</i>	4			
<i>E. crebra</i>	4	<i>E. crebra</i>				
<i>A. leuhmannii</i>	1					
HVOCAR200901						
LHS		RHS		Total trees	Width	Trees per m2
Genus	Number	Genus	Number			
<i>E. moluccana</i>	1	<i>E. moluccana</i>	2	38	4	0.19
<i>C. maculata</i>	17	<i>C. maculata</i>	12			
<i>A. implexa</i>	4	<i>A. implexa</i>	2			
HVOCAR200902						
LHS		RHS		Total trees	Width	Trees per m2
Genus	Number	Genus	Number			
<i>C. maculata</i>	19	<i>C. maculata</i>	24	48	4	0.24
<i>E. moluccana</i>	2	<i>E. moluccana</i>	1			
<i>Unknown</i>	2					
HVORIV201401						
LHS		RHS		Total trees	Width	Trees per m2
Genus	Number	Genus	Number			
<i>E. moluccana</i>	1	<i>E. moluccana</i>	3	7	4	0.035
		<i>Unknown</i>	2			
		<i>E. crebra</i>	1			
HVORIV201402						
LHS		RHS		Total trees	Width	Trees per m2
Genus	Number	Genus	Number			
<i>E. crebra</i>	1			1	4	0.005



HVOVES200801						
LHS		RHS		Total trees	Width	Trees per m2
Genus	Number	Genus	Number			
<i>C. maculata</i>	20	<i>C. maculata</i>	43	85	4	0.425
<i>E. moluccana</i>	4	<i>E. moluccana</i>	4			
<i>Eucalypt sp.</i>	4	<i>Eucalypt sp.</i>	8			
		<i>A. implexa</i>	2			
HVOVES201101						
LHS		RHS		Total trees	Width	Trees per m2
Genus	Number	Genus	Number			
<i>C. maculata</i>	21	<i>C. maculata</i>	30	93	4	0.465
<i>E. moluccana</i>	10	<i>E. moluccana</i>	11			
<i>E. fibrosa</i>	1	<i>E. fibrosa</i>				
<i>E. crebra</i>	2	<i>E. crebra</i>	4			
<i>A. implexa</i>	6	<i>A. implexa</i>	4			
<i>Eucalypt sp.</i>	2	<i>Eucalypt sp.</i>	2			
HVOVES201301						
LHS		RHS		Total trees	Width	Trees per m2
Genus	Number	Genus	Number			
<i>E. crebra</i>	3	<i>E. crebra</i>	2	12	4	0.06
<i>A. implexa</i>	2	<i>A. implexa</i>				
<i>Eucalypt sp.</i>	1	<i>C. maculata</i>	2			
		<i>E. moluccana</i>	2			
MTWCDD201101						
LHS		RHS		Total trees	Width	Trees per m2
Genus	Number	Genus	Number			
<i>Eucalypt sp. 1</i>	4	<i>Eucalypt sp. 1</i>	3	35	4	0.175
<i>Eucalypt sp. 2</i>	2	<i>Eucalypt sp. 2</i>				
<i>C. maculata</i>	5	<i>C. maculata</i>	16			
<i>A. implexa</i>	3	<i>A. implexa</i>	2			
MTWCDD2015						
LHS		RHS		Total trees	Width	Trees per m2
Genus	Number	Genus	Number			
<i>E. fibrosa</i>	1	<i>E. fibrosa</i>	1	97	4	0.485
<i>C. maculata</i>	33	<i>C. maculata</i>	37			
<i>E. moluccana</i>	11	<i>E. moluccana</i>	14			
MTWMT0200001						

LHS		RHS		Total trees	Width	Trees per m2
Genus	Number	Genus	Number			
<i>E. cladocalyx</i>	10	<i>E. cladocalyx</i>	4	17	4	0.085
<i>E. moluccana</i>	1	<i>E. moluccana</i>	2			
MTWMT0200503						
LHS		RHS		Total trees	Width	Trees per m2
Genus	Number	Genus	Number			
<i>E. cladocalyx</i>	14	<i>E. cladocalyx</i>	8	23	4	0.115
<i>E. moluccana</i>	1					
MTWNP200501						
LHS		RHS		Total trees	Width	Trees per m2
Genus	Number	Genus	Number			
<i>A. implexa</i>	2			2	4	0.01
MTWNP200502						
LHS		RHS		Total trees	Width	Trees per m2
Genus	Number	Genus	Number			
<i>C. maculata</i>	13	<i>C. maculata</i>	12	30	4	0.15
<i>A. mearnsii</i>	3	<i>A. mearnsii</i>	2			
MTWNP200901						
LHS		RHS		Total trees	Width	Trees per m2
Genus	Number	Genus	Number			
		<i>C. maculata</i>	43	70	4	0.35
		<i>E. crebra</i>	12			
		<i>E. moluccana</i>	14			
		<i>A. implexa</i>	1			
MTWNP201101						
LHS		RHS		Total trees	Width	Trees per m2
Genus	Number	Genus	Number			
<i>Eucalypt sp. 1</i>	6	<i>Eucalypt sp. 1</i>	1	12	4	0.06
		<i>Eucalypt sp. 2</i>	5			

MTWNP201403						
LHS		RHS		Total trees	Width	Trees per m2
Genus	Number	Genus	Number			
		<i>Eucalypt sp. 1</i>	2	2	4	0.01
MTWTDI201501						
LHS		RHS		Total trees	Width	Trees per m2
Genus	Number	Genus	Number			
<i>Eucalypt sp. 1</i>	1			1	4	0.005
MTWWDL201401						
LHS		RHS		Total trees	Width	Trees per m2
Genus	Number	Genus	Number			
<i>C. maculata</i>	3	<i>C. maculata</i>	5	15	4	0.075
<i>A. implexa</i>	1	<i>A. implexa</i>	5			
<i>E. moluccana</i>	1	<i>E. moluccana</i>				
WAMBOGB1						
LHS		RHS		Total trees	Width	Trees per m2
Genus	Number	Genus	Number			
<i>A. leuhmannii</i>	8	<i>A. leuhmannii</i>	7	19	4	0.095
<i>E. crebra</i>		<i>E. crebra</i>	4			
WAMBOGB2						
LHS		RHS		Total trees	Width	Trees per m2
Genus	Number	Genus	Number			
<i>E. moluccana</i>	3	<i>E. moluccana</i>	2	5	4	0.025
WAMBOSPOT1						
LHS		RHS		Total trees	Width	Trees per m2
Genus	Number	Genus	Number			
<i>E. punctata</i>	1	<i>E. punctata</i>		33	4	0.165



<i>E. crebra</i>	3	<i>E. crebra</i>				
<i>C. maculata</i>	2	<i>C. maculata</i>	3			
<i>A. bulgaensis</i>	13	<i>A. bulgaensis</i>	11			
WAMBOSPOT2						
LHS		RHS				
Genus	Number	Genus	Number	Total trees	Width	Trees per m2
<i>E. moluccana</i>	7	<i>E. moluccana</i>	5			
<i>C. maculata</i>	3	<i>C. maculata</i>	2			
		<i>E. crebra</i>	1			
		<i>A. leuhmannii</i>	1	19	4	0.095
WAMBOSPOT3						
LHS		RHS				
Genus	Number	Genus	Number	Total trees	Width	Trees per m2
<i>E. crebra</i>	3	<i>E. crebra</i>	3			
<i>C. maculata</i>	2	<i>C. maculata</i>	3			
<i>A. implexa</i>	4	<i>A. implexa</i>	1			
				16	4	0.08
WARKGB01						
LHS		RHS				
Genus	Number	Genus	Number	Total trees	Width	Trees per m2
<i>A. leuhmannii</i>	23	<i>A. leuhmannii</i>	26			
<i>E. crebra</i>	4	<i>E. crebra</i>	10			
				63	4	0.315
WARKGB02						
LHS		RHS				
Genus	Number	Genus	Number	Total trees	Width	Trees per m2
<i>E. crebra</i>	14	<i>A. leuhmannii</i>	2			
		<i>E. crebra</i>	5			
				21	4	0.105
WARKGB03						
LHS		RHS				
Genus	Number	Genus	Number	Total trees	Width	Trees per m2
<i>A. leuhmannii</i>	27	<i>A. leuhmannii</i>	16			
<i>E. crebra</i>	1	<i>E. crebra</i>	1			
<i>E. amplifolia</i>	5	<i>E. amplifolia</i>	5			
				55	4	0.275
WARKGB04						
LHS		RHS		Total trees	Width	Trees per m2

Genus	Number	Genus	Number			
<i>E. crebra</i>	3	<i>E. crebra</i>	5			
		<i>A. leuhmannii</i>	2			
				10	4	0.05

## Appendix 6 – EAL Soil Results

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## ROUTINE AGRICULTURAL SOIL ANALYSIS REPORT

Job No:	F7229	Sample ID:	Sample 1 HVO WES200801	Sample 2 HVO WES201101	Sample 3 HVO WES201301	Sample 4 HVO WES201302
No of Samples:	45	Crop:	N/G	N/G	N/G	N/G
Date Supplied:	24th February 2017	Client:	Niche-eh	Niche-eh	Niche-eh	Niche-eh
Supplied by:	Niche-eh					
Method	Nutrient	Units	F7229/1	F7229/2	F7229/3	F7229/4
Morgan 1	Calcium	Ca	650	1311	1710	2051
	Magnesium	Mg	466	672	546	492
	Potassium	K	137	139	188	264
	Phosphorus	P	1.8	4.2	8.1	9.3
Bray1 Colwell Bray2	Phosphorus	P	2.9	8.3	19	18
			6.5	26	50	79
			17	88	146	186
KCl	Nitrate Nitrogen	N	4.6	2.5	6.3	1.3
	Ammonium Nitrogen	N	3.4	1.9	3.6	3.8
	Sulfur	S	18	15	15	351
1:5 Water	pH	units	7.24	8.44	8.37	7.81
	Conductivity	dS/m	0.110	0.160	0.179	0.544
Calculation	Estimated Organic Matter	% OM	4.4	5.6	4.4	8.8
Ammonium Acetate + Calculations	Calcium	cmol <sup>+</sup> /Kg	6.67	11.35	12.39	16.20
		kg/ha	2996	5095	5563	7270
		mg/kg	1338	2275	2484	3246
	Magnesium	cmol <sup>+</sup> /Kg	6.05	7.67	5.54	5.90
		kg/ha	1646	2089	1507	1607
		mg/kg	735	932	673	717
	Potassium	cmol <sup>+</sup> /Kg	0.75	0.64	0.78	1.31
		kg/ha	660	563	682	1144
	Sodium	mg/kg	294	251	305	511
		cmol <sup>+</sup> /Kg	0.28	0.41	0.24	0.39
		kg/ha	143	212	124	203
	KCl	Aluminium	mg/kg	64	94	55
cmol <sup>+</sup> /Kg			0.01	0.01	0.01	0.01
kg/ha			2	2	3	3
Acidity Titration	Hydrogen	mg/kg	1	1	1	1
		cmol <sup>+</sup> /Kg	0.00	0.00	0.00	0.00
		kg/ha	0	0	0	0
Calculation	Effective Cation Exchange Capacity (ECEC)	mg/kg	0	0	0	0
		cmol <sup>+</sup> /Kg	13.76	20.09	18.96	23.81
		kg/ha	0	0	0	0
Base Saturation Calculations	Calcium	Ca	48.5	56.5	65.4	68.0
	Magnesium	Mg	43.9	38.2	29.2	24.8
	Potassium	K	5.5	3.2	4.1	5.5
	Sodium - ESP	Na	2.0	2.0	1.3	1.7
	Aluminium	Al	0.1	0.0	0.1	0.1
	Hydrogen	H <sup>+</sup>	0.0	0.0	0.0	0.0
Calculation	Calcium / Magnesium Ratio	ratio	1.1	1.5	2.2	2.7
DTPA	Zinc	Zn	2.3	12	14	24
	Manganese	Mn	12	4.4	5.6	7.0
	Iron	Fe	35	16	20	38
	Copper	Cu	1.0	2.3	2.8	4.1
CaCl <sub>2</sub>	Boron	B	0.41	0.35	0.45	0.81
	Silicon	Si	34	20	24	33
LECO IR Analyser	Total Carbon	C	2.53	3.23	2.49	5.05
	Total Nitrogen	N	0.13	0.16	0.18	0.31
Calculation	Carbon/ Nitrogen Ratio	ratio	19.3	19.7	13.8	16.4
	Basic Texture		Clay Loam	Clay Loam	Clay Loam	Clay Loam
	Basic Colour		Brownish	Brownish	Brownish	Brownish
Calculation	Chloride Estimate	equiv. ppm	70	102	115	348

<b>Job No:</b>	F7229
<b>No of Samples:</b>	45
<b>Date Supplied:</b>	24th February 2017
<b>Supplied by:</b>	Niche-eh

Sample ID:	Sample 1	Sample 2	Sample 3	Sample 4
<b>Crop:</b>	HVO WES200801	HVO WES201101	HVO WES201301	HVO WES201302
<b>Client:</b>	N/G	N/G	N/G	N/G
	Niche-eh	Niche-eh	Niche-eh	Niche-eh

Method	Nutrient	Units	F7229/1	F7229/2	F7229/3	F7229/4
Total Acid Extractable	Calcium	Ca	2,971	6,158	8,141	6,926
	Magnesium	Mg	2,060	3,230	3,639	2,428
	Potassium	K	1,439	1,297	1,245	1,579
	Sodium	Na	151	189	139	197
	Sulfur	S	563	420	270	753
Total Acid Extractable	Phosphorus	P	190	234	417	797
Total Acid Extractable	Zinc	Zn	51	90	106	126
	Manganese	Mn	407	174	197	341
	Iron	Fe	30,775	14,794	17,334	20,761
	Copper	Cu	15	27	26	38
	Boron	B	2.5	2.4	2.5	3.9
	Silicon	Si	1,042	638	637	737
	Aluminium	Al	7,761	3,400	2,964	5,147
Total Acid Extractable	Molybdenum	Mo	0.7	0.8	0.7	0.9
	Cobalt	Co	10	9.3	11	11
	Selenium	Se	0.8	0.9	<0.5	0.6
Total Acid Extractable	Cadmium	Cd	<0.5	<0.5	<0.5	<0.5
	Lead	Pb	13	23	20	32
	Arsenic	As	6.6	14	5.7	6.7
	Chromium	Cr	8.6	7.1	19	8.9
	Nickel	Ni	9.4	11	12	13
	Mercury	Hg	<0.1	0.1	<0.1	<0.1
	Silver	Ag	<1	<1	<1	<1

### EAL Soil Testing Notes

- All results presented as a 40°C oven dried weight. Soil sieved and lightly crushed to <2 mm
- Methods from Rayment and Lyons, 2011. *Soil Chemical Methods*
- Soluble Salts included in Exchangeable Cations - NO PRE-WASH
- 'Morgan 1 Extract' adapted from 'Science in Agriculture', 'Non-Toxic Farming' and Lamonte Soil Handbook.
- Guidelines for phosphorus have been reduced for Australian soils
- Indicative guidelines are based on 'Albrecht' and 'Reams' concepts
- Total Acid Extractable Nutrients indicate a store of nutrients
- Contaminant Guides based on 'Residential with gardens and accessible soil including childrens daycare centres, preschools, primary schools, town houses or villas' (NSW EPA 1998).
- Information relating to testing colour codes is available on Sheet 2 - "Understanding you soil results"

### Calculations

- For conductivity 1 dS/m = 1 mS/cm = 1000 µS/cm
- 1 cmol<sup>+</sup>/Kg = 1 meq/100g; 1 Lb/Acre = 2 ppm (parts per million); kg/ha = 2.24 x ppm; mg/kg = ppm
- Conversions for 1 cmol<sup>+</sup>/Kg = 230 mg/Kg Sodium, 390 mg/Kg Potassium, 122 mg/Kg Magnesium, 200 mg/Kg Calcium
- Organic Matter = %C x 1.75
- Chloride Estimate = EC x 640 (most likely over-estimate)
- ECEC = sum of the exchangeable cations cmol<sup>+</sup>/Kg
- Base saturation calculations = (cation cmol<sup>+</sup>/Kg) / ECEC x 100
- Ca / Mg ratio from the exchangeable cmol<sup>+</sup>/Kg results

Quality Checked: Kris Saville  
Manager, Agricultural testing division

## ROUTINE AGRICULTURAL SOIL ANALYSIS REPORT

Job No:	F7229	Sample ID:	Sample 5 HVO CAR200901	Sample 6 HVO CAR200902	Sample 7 HVO CAR201401	Sample 8 HVO RIV201406	
No of Samples:	45	Crop:	N/G	N/G	N/G	N/G	
Date Supplied:	24th February 2017	Client:	Niche-eh	Niche-eh	Niche-eh	Niche-eh	
Supplied by:	Niche-eh						
Method	Nutrient	Units	F7229/5	F7229/6	F7229/7	F7229/8	
Morgan 1	Calcium	Ca	597	1004	1410	961	
	Magnesium	Mg	594	617	546	639	
	Potassium	K	160	147	177	169	
	Phosphorus	P	1.8	1.3	2.8	3.3	
Bray1 Colwell Bray2	Phosphorus	P	6.2	4.8	9.5	9.3	
			18	15	32	38	
			15	12	48	56	
KCl	Nitrate Nitrogen	N	3.0	2.1	1.0	7.0	
	Ammonium Nitrogen	N	3.0	3.9	2.8	4.1	
	Sulfur	S	24	7.3	25	29	
1:5 Water	pH	units	7.60	7.70	8.03	7.78	
	Conductivity	dS/m	0.121	0.084	0.150	0.172	
Calculation	Estimated Organic Matter	% OM	4.1	2.7	4.8	6.4	
Ammonium Acetate + Calculations	Calcium	Ca	cmol <sup>+</sup> /Kg	6.60	11.40	14.07	10.86
		kg/ha	2965	5117	6316	4875	
		mg/kg	1324	2285	2820	2177	
	Magnesium	Mg	cmol <sup>+</sup> /Kg	8.83	9.80	7.61	9.03
		kg/ha	2405	2669	2071	2458	
		mg/kg	1073	1191	924	1097	
	Potassium	K	cmol <sup>+</sup> /Kg	1.04	1.35	1.27	1.01
		kg/ha	914	1179	1114	882	
	mg/kg			408	526	497	394
		Sodium	Na	cmol <sup>+</sup> /Kg	0.97	0.70	0.72
	kg/ha		497	361	370	564	
	mg/kg		222	161	165	252	
KCl	Aluminium	Al	cmol <sup>+</sup> /Kg	0.01	0.01	0.01	0.02
		kg/ha	3	3	2	3	
		mg/kg	1	1	1	1	
Acidity Titration	Hydrogen	H <sup>+</sup>	cmol <sup>+</sup> /Kg	0.00	0.00	0.00	0.00
		kg/ha	0	0	0	0	
		mg/kg	0	0	0	0	
Calculation	Effective Cation Exchange Capacity (ECEC)	cmol <sup>+</sup> /Kg	17.46	23.27	23.68	22.01	
Base Saturation Calculations	Calcium	Ca	%	37.8	49.0	59.4	49.3
	Magnesium	Mg		50.6	42.1	32.1	41.0
	Potassium	K		6.0	5.8	5.4	4.6
	Sodium - ESP	Na		5.5	3.0	3.0	5.0
	Aluminium	Al		0.1	0.1	0.0	0.1
	Hydrogen	H <sup>+</sup>		0.0	0.0	0.0	0.0
Calculation	Calcium / Magnesium Ratio	ratio	0.7	1.2	1.8	1.2	
DTPA	Zinc	Zn	mg/kg	2.4	1.0	5.8	10
	Manganese	Mn		16	19	15	11
	Iron	Fe		41	21	31	60
	Copper	Cu		1.2	1.3	1.9	1.8
CaCl <sub>2</sub>	Boron	B	mg/kg	0.72	1.02	0.99	0.68
	Silicon	Si		42	47	29	37
LECO IR Analyser	Total Carbon	C	%	2.32	1.56	2.74	3.66
	Total Nitrogen	N	%	0.14	0.11	0.17	0.20
Calculation	Carbon/ Nitrogen Ratio	ratio	16.7	13.9	15.8	17.9	
	Basic Texture			Clay Loam	Clay Loam	Clay Loam	Clay Loam
	Basic Colour			Brownish	Brownish	Brownish	Brownish
Calculation	Chloride Estimate	equiv. ppm	77	54	96	110	



<b>Job No:</b>	F7229
<b>No of Samples:</b>	45
<b>Date Supplied:</b>	24th February 2017
<b>Supplied by:</b>	Niche-eh

Sample ID:	Sample 5	Sample 6	Sample 7	Sample 8
<b>Crop:</b>	HVO CAR200901	HVO CAR200902	HVO CAR201401	HVO RIV201406
<b>Client:</b>	N/G	N/G	N/G	N/G
	Niche-eh	Niche-eh	Niche-eh	Niche-eh

Method	Nutrient	Units	F7229/5	F7229/6	F7229/7	F7229/8
Total Acid Extractable	Calcium	Ca	1,798	5,085	5,707	4,795
	Magnesium	Mg	2,025	2,987	2,387	2,889
	Potassium	K	1,624	2,506	2,300	1,453
	Sodium	Na	364	346	328	471
	Sulfur	S	160	144	241	330
Total Acid Extractable	Phosphorus	P	273	233	461	345
Total Acid Extractable	Zinc	Zn	41	35	51	68
	Manganese	Mn	409	943	737	301
	Iron	Fe	31,329	25,659	24,079	21,878
	Copper	Cu	12	16	20	20
	Boron	B	2.1	4.7	4.6	3.0
	Silicon	Si	747	838	632	609
Total Acid Extractable	Aluminium	Al	10,491	18,779	15,457	9,263
	Molybdenum	Mo	0.7	0.8	0.9	1.0
	Cobalt	Co	12	16	16	10
Total Acid Extractable	Selenium	Se	0.7	0.9	0.6	0.6
	Cadmium	Cd	<0.5	<0.5	<0.5	<0.5
	Lead	Pb	14	12	17	18
	Arsenic	As	6.8	5.6	5.9	5.6
	Chromium	Cr	16	27	31	18
	Nickel	Ni	12	25	24	12
Total Acid Extractable	Mercury	Hg	<0.1	<0.1	<0.1	<0.1
	Silver	Ag	<1	<1	<1	<1

### EAL Soil Testing Notes

- All results presented as a 40°C oven dried weight. Soil sieved and lightly crushed to <2 mm
- Methods from Rayment and Lyons, 2011. *Soil Chemical Methods*
- Soluble Salts included in Exchangeable Cations - NO PRE-WASH
- 'Morgan 1 Extract' adapted from 'Science in Agriculture', 'Non-Toxic Farming' and Lamonte Soil Handbook.
- Guidelines for phosphorus have been reduced for Australian soils
- Indicative guidelines are based on 'Albrecht' and 'Reams' concepts
- Total Acid Extractable Nutrients indicate a store of nutrients
- Contaminant Guides based on 'Residential with gardens and accessible soil including childrens daycare centre preschools, primary schools, town houses or villas' (NSW EPA 1998).
- Information relating to testing colour codes is available on Sheet 2 - "Understanding you soil results"

### Calculations

- For conductivity 1 dS/m = 1 mS/cm = 1000 µS/cm
- 1 cmol<sup>+</sup>/Kg = 1 meq/100g; 1 Lb/Acre = 2 ppm (parts per million); kg/ha = 2.24 x ppm; mg/kg = ppm
- Conversions for 1 cmol<sup>+</sup>/Kg = 230 mg/Kg Sodium, 390 mg/Kg Potassium, 122 mg/Kg Magnesium, 200 mg/Kg Calcium
- Organic Matter = %C x 1.75
- Chloride Estimate = EC x 640 (most likely over-estimate)
- ECEC = sum of the exchangeable cations cmol<sup>+</sup>/Kg
- Base saturation calculations = (cation cmol<sup>+</sup>/Kg) / ECEC x 100
- Ca / Mg ratio from the exchangeable cmol<sup>+</sup>/Kg results

Quality Checked: Kris Saville  
Manager, Agricultural testing division

## ROUTINE AGRICULTURAL SOIL ANALYSIS REPORT

Job No:	F7229	Sample ID:	Sample 9 HVO RIV201405	Sample 10 HVO RIV201404	Sample 11 HVO RIV201403	Sample 12 HVO RIV201402
No of Samples:	45	Crop:	N/G	N/G	N/G	N/G
Date Supplied:	24th February 2017	Client:	Niche-eh	Niche-eh	Niche-eh	Niche-eh
Supplied by:	Niche-eh					
Method	Nutrient	Units	F7229/9	F7229/10	F7229/11	F7229/12
Morgan 1	Calcium	Ca	1031	1485	920	2345
	Magnesium	Mg	264	437	717	1010
	Potassium	K	243	221	177	196
	Phosphorus	P	13.7	3.7	2.8	3.8
Bray1 Colwell Bray2	Phosphorus	P	38	19	12	20
			81	52	31	96
			150	101	65	215
KCl	Nitrate Nitrogen	N	2.4	11	8.1	6.9
	Ammonium Nitrogen	N	2.9	3.0	3.3	3.2
	Sulfur	S	9.8	18	21	99
1:5 Water	pH	units	8.46	8.80	8.51	8.72
	Conductivity	dS/m	0.122	0.200	0.171	0.480
Calculation	Estimated Organic Matter	% OM	3.5	5.3	3.8	8.3
Ammonium Acetate + Calculations	Calcium	cmol <sup>+</sup> /Kg	8.67	12.74	9.35	16.11
		kg/ha	3892	5720	4197	7230
		mg/kg	1738	2554	1874	3228
	Magnesium	cmol <sup>+</sup> /Kg	3.24	5.54	10.31	10.18
		kg/ha	883	1508	2808	2772
		mg/kg	394	673	1253	1237
	Potassium	cmol <sup>+</sup> /Kg	1.08	1.11	1.00	1.10
		kg/ha	942	975	875	964
	Sodium	mg/kg	421	435	391	431
		cmol <sup>+</sup> /Kg	0.49	1.24	1.19	2.82
	KCl	kg/ha	254	641	612	1450
		mg/kg	113	286	273	648
KCl	Aluminium	cmol <sup>+</sup> /Kg	0.01	0.02	0.02	0.01
		kg/ha	3	3	3	2
		mg/kg	1	1	1	1
Acidity Titration	Hydrogen	cmol <sup>+</sup> /Kg	0.00	0.00	0.00	0.00
		kg/ha	0	0	0	0
		mg/kg	0	0	0	0
Calculation	Effective Cation Exchange Capacity (ECEC)	cmol <sup>+</sup> /Kg	13.50	20.66	21.87	30.22
Base Saturation Calculations	Calcium	Ca	64.2	61.7	42.8	53.3
	Magnesium	Mg	24.0	26.8	47.2	33.7
	Potassium	K	8.0	5.4	4.6	3.6
	Sodium - ESP	Na	3.7	6.0	5.4	9.3
	Aluminium	Al	0.1	0.1	0.1	0.0
	Hydrogen	H <sup>+</sup>	0.0	0.0	0.0	0.0
Calculation	Calcium / Magnesium Ratio	ratio	2.7	2.3	0.9	1.6
DTPA	Zinc	Zn	14	12	7.8	19
	Manganese	Mn	5.5	4.2	4.6	6.3
	Iron	Fe	22	24	22	25
	Copper	Cu	2.1	3.6	3.1	3.3
CaCl <sub>2</sub>	Boron	B	0.52	0.73	0.69	0.81
	Silicon	Si	25	16	20	11
LECO IR Analyser	Total Carbon	C	1.99	3.02	2.18	4.73
	Total Nitrogen	N	0.14	0.16	0.13	0.29
Calculation	Carbon/ Nitrogen Ratio	ratio	14.2	19.4	17.2	16.3
	Basic Texture		Clay Loam	Clay Loam	Clay Loam	Clay Loam
	Basic Colour		Brownish	Brownish	Brownish	Brownish
Calculation	Chloride Estimate	equiv. ppm	78	128	110	308

<b>Job No:</b>	F7229
<b>No of Samples:</b>	45
<b>Date Supplied:</b>	24th February 2017
<b>Supplied by:</b>	Niche-eh

Sample ID:	Sample 9	Sample 10	Sample 11	Sample 12
<b>Crop:</b>	HVO RIV201405	HVO RIV201404	HVO RIV201403	HVO RIV201402
<b>Client:</b>	N/G	N/G	N/G	N/G
	Niche-eh	Niche-eh	Niche-eh	Niche-eh

Method	Nutrient	Units	F7229/9	F7229/10	F7229/11	F7229/12
Total Acid Extractable	Calcium	Ca	3,734	6,566	5,022	10,858
	Magnesium	Mg	1,886	3,219	4,136	6,189
	Potassium	K	1,441	1,599	1,663	1,779
	Sodium	Na	219	503	603	1,650
	Sulfur	S	175	231	232	495
Total Acid Extractable	Phosphorus	P	503	406	257	671
Total Acid Extractable	Zinc	Zn	84	84	75	135
	Manganese	Mn	281	374	236	387
	Iron	Fe	18,204	22,537	19,383	23,814
	Copper	Cu	24	29	24	41
	Boron	B	2.4	3.5	3.2	3.1
	Silicon	Si	604	735	544	645
Total Acid Extractable	Aluminium	Al	6,262	8,132	9,087	9,783
	Molybdenum	Mo	0.4	0.6	0.6	1.1
	Cobalt	Co	11	17	13	14
Total Acid Extractable	Selenium	Se	<0.5	<0.5	0.6	0.8
	Cadmium	Cd	<0.5	<0.5	<0.5	<0.5
	Lead	Pb	14	19	18	29
	Arsenic	As	3.5	6.0	6.6	7.3
	Chromium	Cr	23	20	17	18
	Nickel	Ni	17	20	14	22
Total Acid Extractable	Mercury	Hg	<0.1	<0.1	<0.1	<0.1
	Silver	Ag	<1	<1	<1	<1

### EAL Soil Testing Notes

- All results presented as a 40°C oven dried weight. Soil sieved and lightly crushed to <2 mm
- Methods from Rayment and Lyons, 2011. *Soil Chemical Methods*
- Soluble Salts included in Exchangeable Cations - NO PRE-WASH
- 'Morgan 1 Extract' adapted from 'Science in Agriculture', 'Non-Toxic Farming' and Lamonte Soil Handbook.
- Guidelines for phosphorus have been reduced for Australian soils
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### Calculations

- For conductivity 1 dS/m = 1 mS/cm = 1000 µS/cm
- 1 cmol<sup>+</sup>/Kg = 1 meq/100g; 1 Lb/Acre = 2 ppm (parts per million); kg/ha = 2.24 x ppm; mg/kg = ppm
- Conversions for 1 cmol<sup>+</sup>/Kg = 230 mg/Kg Sodium, 390 mg/Kg Potassium, 122 mg/Kg Magnesium, 200 mg/Kg
- Organic Matter = %C x 1.75
- Chloride Estimate = EC x 640 (most likely over-estimate)
- ECEC = sum of the exchangeable cations cmol<sup>+</sup>/Kg
- Base saturation calculations = (cation cmol<sup>+</sup>/Kg) / ECEC x 100
- Ca / Mg ratio from the exchangeable cmol<sup>+</sup>/Kg results

Quality Checked: Kris Saville  
Manager, Agricultural testing division



## ROUTINE AGRICULTURAL SOIL ANALYSIS REPORT

Job No:	F7229	Sample ID:	Sample 13 HVO RIV201401	Sample 14 HVO CHE201201	Sample 15 HVO CHE201401 -	Sample 16 HVO CHE201401 -	
No of Samples:	45	Crop:	N/G	N/G	N/G	N/G	
Date Supplied:	24th February 2017	Client:	Niche-eh	Niche-eh	Niche-eh	Niche-eh	
Supplied by:	Niche-eh						
Method	Nutrient	Units	F7229/13	F7229/14	F7229/15	F7229/16	
Morgan 1	Calcium	Ca	1970	1670	998	1603	
	Magnesium	Mg	1220	454	457	263	
	Potassium	K	249	240	160	152	
	Phosphorus	P	9.5	9.4	5.6	17	
Bray1 Colwell Bray2	Phosphorus	P	24	21	10	31	
			109	95	35	76	
			244	250	77	245	
KCl	Nitrate Nitrogen	N	6.3	21	6.0	18	
	Ammonium Nitrogen	N	2.5	6.3	4.6	5.5	
	Sulfur	S	76	12	32	29	
1:5 Water	pH	units	8.80	8.13	7.69	8.14	
	Conductivity	dS/m	0.446	0.155	0.135	0.169	
Calculation	Estimated Organic Matter	% OM	7.7	9.6	5.0	6.3	
Ammonium Acetate + Calculations	Calcium	Ca	cmol <sup>+</sup> /Kg	13.40	15.36	10.63	12.16
		kg/ha	6016	6894	4772	5458	
		mg/kg	2686	3078	2131	2437	
	Magnesium	Mg	cmol <sup>+</sup> /Kg	12.54	5.72	6.23	3.08
		kg/ha	3413	1557	1695	838	
		mg/kg	1523	695	757	374	
	Potassium	K	cmol <sup>+</sup> /Kg	1.30	1.29	0.91	0.66
		kg/ha	1140	1130	801	574	
	mg/kg			509	504	358	256
		Sodium	Na	cmol <sup>+</sup> /Kg	3.02	0.94	0.46
	kg/ha		1553	485	238	292	
	mg/kg		693	216	106	130	
KCl	Aluminium	Al	cmol <sup>+</sup> /Kg	0.01	0.01	0.01	0.01
		kg/ha	3	3	3	3	
		mg/kg	1	1	1	1	
Acidity Titration	Hydrogen	H <sup>+</sup>	cmol <sup>+</sup> /Kg	0.00	0.00	0.00	0.00
		kg/ha	0	0	0	0	
		mg/kg	0	0	0	0	
Calculation	Effective Cation Exchange Capacity (ECEC)	cmol <sup>+</sup> /Kg	30.27	23.32	18.25	16.47	
Base Saturation Calculations	Calcium	Ca	%	44.3	65.9	58.3	73.8
	Magnesium	Mg		41.4	24.5	34.1	18.7
	Potassium	K		4.3	5.5	5.0	4.0
	Sodium - ESP	Na		10.0	4.0	2.5	3.4
	Aluminium	Al		0.0	0.1	0.1	0.1
	Hydrogen	H <sup>+</sup>		0.0	0.0	0.0	0.0
Calculation	Calcium / Magnesium Ratio	ratio	1.1	2.7	1.7	4.0	
DTPA	Zinc	Zn	mg/kg	22	32	8.5	23
	Manganese	Mn		4.9	6.7	11	5.4
	Iron	Fe		31	37	27	27
	Copper	Cu		3.1	4.4	1.2	3.4
CaCl <sub>2</sub>	Boron	B	mg/kg	0.96	0.65	0.60	0.73
	Silicon	Si		15	31	39	28
LECO IR Analyser	Total Carbon	C	%	4.38	5.47	2.84	3.58
	Total Nitrogen	N	%	0.30	0.44	0.20	0.26
Calculation	Carbon/ Nitrogen Ratio	ratio	14.6	12.3	13.9	13.9	
	Basic Texture			Clay Loam	Clay Loam	Clay Loam	Clay Loam
	Basic Colour			Brownish	Brownish	Brownish	Brownish
Calculation	Chloride Estimate	equiv. ppm	286	100	86	108	

<b>Job No:</b>	F7229
<b>No of Samples:</b>	45
<b>Date Supplied:</b>	24th February 2017
<b>Supplied by:</b>	Niche-eh

Sample ID:	Sample 13	Sample 14	Sample 15	Sample 16
<b>Crop:</b>	HVO RIV201401	HVO CHE201201	HVO CHE201401 -	HVO CHE201401 -
<b>Client:</b>	N/G	N/G	N/G	N/G
	Niche-eh	Niche-eh	Niche-eh	Niche-eh

Method	Nutrient	Units	F7229/13	F7229/14	F7229/15	F7229/16
Total Acid Extractable	Calcium	Ca	9,983	6,248	3,241	6,954
	Magnesium	Mg	6,216	2,840	1,563	1,442
	Potassium	K	2,146	1,796	1,339	1,068
	Sodium	Na	1,496	437	251	283
	Sulfur	S	503	395	227	363
Total Acid Extractable	Phosphorus	P	956	791	340	646
Total Acid Extractable	Zinc	Zn	154	128	53	107
	Manganese	Mn	425	369	257	149
	Iron	Fe	25,046	23,985	29,758	11,644
	Copper	Cu	47	45	14	35
	Boron	B	5.7	4.7	<2	3.1
	Silicon	Si	1,128	999	601	621
Total Acid Extractable	Aluminium	Al	8,866	9,827	7,817	5,203
	Molybdenum	Mo	1.8	0.9	0.7	0.5
	Cobalt	Co	13	11	9.3	5.5
Total Acid Extractable	Selenium	Se	0.7	0.7	0.6	<0.5
	Cadmium	Cd	<0.5	<0.5	<0.5	<0.5
	Lead	Pb	34	40	18	31
	Arsenic	As	7.3	4.9	6.2	3.3
	Chromium	Cr	24	28	16	12
	Nickel	Ni	34	21	10	10
	Mercury	Hg	<0.1	<0.1	<0.1	<0.1
Silver	Ag	<1	<1	<1	<1	

### EAL Soil Testing Notes

- All results presented as a 40°C oven dried weight. Soil sieved and lightly crushed to <2 mm
- Methods from Rayment and Lyons, 2011. *Soil Chemical Methods*
- Soluble Salts included in Exchangeable Cations - NO PRE-WASH
- 'Morgan 1 Extract' adapted from 'Science in Agriculture', 'Non-Toxic Farming' and Lamonte Soil Handbook.
- Guidelines for phosphorus have been reduced for Australian soils
- Indicative guidelines are based on 'Albrecht' and 'Reams' concepts
- Total Acid Extractable Nutrients indicate a store of nutrients
- Contaminant Guides based on 'Residential with gardens and accessible soil including childrens daycare centre preschools, primary schools, town houses or villas' (NSW EPA 1998).
- Information relating to testing colour codes is available on Sheet 2 - "Understanding you soil results"

### Calculations

- For conductivity 1 dS/m = 1 mS/cm = 1000 µS/cm
- 1 cmol<sup>+</sup>/Kg = 1 meq/100g; 1 Lb/Acre = 2 ppm (parts per million); kg/ha = 2.24 x ppm; mg/kg = ppm
- Conversions for 1 cmol<sup>+</sup>/Kg = 230 mg/Kg Sodium, 390 mg/Kg Potassium, 122 mg/Kg Magnesium, 200 mg/Kg Calcium
- Organic Matter = %C x 1.75
- Chloride Estimate = EC x 640 (most likely over-estimate)
- ECEC = sum of the exchangeable cations cmol<sup>+</sup>/Kg
- Base saturation calculations = (cation cmol<sup>+</sup>/Kg) / ECEC x 100
- Ca / Mg ratio from the exchangeable cmol<sup>+</sup>/Kg results

Quality Checked: Kris Saville  
Manager, Agricultural testing division

## ROUTINE AGRICULTURAL SOIL ANALYSIS REPORT

Job No:	F7229	Sample ID:	Sample 17 HVO CHE201203	Sample 18 MTWNP201 301	Sample 19 MTWNP201 401	Sample 20 MTWNP201 403	
No of Samples:	45	Crop:	N/G	N/G	N/G	N/G	
Date Supplied:	24th February 2017	Client:	Niche-eh	Niche-eh	Niche-eh	Niche-eh	
Supplied by:	Niche-eh						
Method	Nutrient	Units	F7229/17	F7229/18	F7229/19	F7229/20	
Morgan 1	Calcium	Ca	133	588	616	953	
	Magnesium	Mg	103	182	352	451	
	Potassium	K	70	113	126	239	
	Phosphorus	P	1.0	2.1	1.8	8.9	
Bray1 Colwell Bray2	Phosphorus	P	2.8	7.3	6.4	16	
			3.4	16	18	55	
			10	25	36	122	
KCl	Nitrate Nitrogen	N	0.4	1.4	1.0	3.7	
	Ammonium Nitrogen	N	3.1	1.9	3.5	4.2	
	Sulfur	S	7.6	26	21	22	
1:5 Water	pH	units	5.53	6.87	6.84	8.28	
	Conductivity	dS/m	0.046	0.081	0.103	0.202	
Calculation	Estimated Organic Matter	% OM	2.8	2.6	5.3	4.9	
Ammonium Acetate + Calculations	Calcium	Ca	cmol <sup>+</sup> /Kg	1.64	5.27	7.17	9.14
		kg/ha	735	2367	3220	4103	
		mg/kg	328	1057	1438	1832	
	Magnesium	Mg	cmol <sup>+</sup> /Kg	1.30	2.17	5.00	5.94
		kg/ha	355	591	1361	1616	
		mg/kg	159	264	608	721	
	Potassium	K	cmol <sup>+</sup> /Kg	0.30	0.48	0.66	1.13
		kg/ha	263	416	580	993	
		mg/kg	117	186	259	443	
	Sodium	Na	cmol <sup>+</sup> /Kg	0.31	0.11	0.48	1.05
		kg/ha	157	57	248	542	
		mg/kg	70	25	111	242	
KCl	Aluminium	Al	cmol <sup>+</sup> /Kg	0.17	0.02	0.02	0.01
		kg/ha	34	3	3	2	
		mg/kg	15	1	1	1	
Acidity Titration	Hydrogen	H <sup>+</sup>	cmol <sup>+</sup> /Kg	0.61	0.00	0.00	0.00
		kg/ha	14	0	0	0	
		mg/kg	6	0	0	0	
Calculation	Effective Cation Exchange Capacity (ECEC)	cmol <sup>+</sup> /Kg	4.32	8.04	13.33	17.27	
Base Saturation Calculations	Calcium	Ca	%	37.9	65.5	53.8	52.9
	Magnesium	Mg		30.2	27.0	37.5	34.4
	Potassium	K		6.9	5.9	5.0	6.6
	Sodium - ESP	Na		7.1	1.4	3.6	6.1
	Aluminium	Al		3.9	0.2	0.1	0.1
	Hydrogen	H <sup>+</sup>		14.1	0.0	0.0	0.0
Calculation	Calcium / Magnesium Ratio	ratio	1.3	2.4	1.4	1.5	
DTPA	Zinc	Zn	mg/kg	1.6	4.9	6.6	8.7
	Manganese	Mn		12	3.8	11	4.9
	Iron	Fe		245	64	94	34
	Copper	Cu		0.3	1.0	1.6	1.6
CaCl <sub>2</sub>	Boron	B	mg/kg	0.59	0.64	0.67	0.58
	Silicon	Si		24	41	42	37
LECO IR Analyser	Total Carbon	C	%	1.63	1.51	3.04	2.82
	Total Nitrogen	N	%	0.08	0.10	0.17	0.18
Calculation	Carbon/ Nitrogen Ratio	ratio	21.7	15.7	17.8	15.5	
	Basic Texture			Loam	Loam	Clay Loam	Clay Loam
	Basic Colour			Brownish	Brownish	Brownish	Brownish
Calculation	Chloride Estimate	equiv. ppm	29	52	66	129	



<b>Job No:</b>	F7229
<b>No of Samples:</b>	45
<b>Date Supplied:</b>	24th February 2017
<b>Supplied by:</b>	Niche-eh

Sample ID:	Sample 17	Sample 18	Sample 19	Sample 20
<b>Crop:</b>	HVO CHE201203	MTWNP201 301	MTWNP201 401	MTWNP201 403
<b>Client:</b>	N/G	N/G	N/G	N/G
	Niche-eh	Niche-eh	Niche-eh	Niche-eh

Method	Nutrient	Units	F7229/17	F7229/18	F7229/19	F7229/20
Total Acid Extractable	Calcium	Ca	409	1,538	2,170	4,238
	Magnesium	Mg	348	626	1,200	2,327
	Potassium	K	475	749	1,026	1,546
	Sodium	Na	109	84	218	497
	Sulfur	S	80	156	204	270
Total Acid Extractable	Phosphorus	P	112	141	252	405
Total Acid Extractable	Zinc	Zn	7	25	41	67
	Manganese	Mn	78	83	203	245
	Iron	Fe	5,946	5,689	17,480	16,153
	Copper	Cu	2.4	7.5	13	17
	Boron	B	<2	2.3	<2	2.7
	Silicon	Si	638	816	826	759
	Aluminium	Al	3,231	3,922	6,789	5,670
Total Acid Extractable	Molybdenum	Mo	0.4	0.5	0.6	0.7
	Cobalt	Co	2.0	3.1	5.7	8.4
	Selenium	Se	<0.5	<0.5	0.7	0.8
Total Acid Extractable	Cadmium	Cd	<0.5	<0.5	<0.5	<0.5
	Lead	Pb	5.3	12	15	15
	Arsenic	As	2.8	3.0	7.2	5.8
	Chromium	Cr	3.9	4.4	8.0	6.8
	Nickel	Ni	3.1	4.8	6.7	10
	Mercury	Hg	<0.1	<0.1	<0.1	<0.1
	Silver	Ag	<1	<1	<1	<1

### EAL Soil Testing Notes

- All results presented as a 40°C oven dried weight. Soil sieved and lightly crushed to <2 mm
- Methods from Rayment and Lyons, 2011. *Soil Chemical Methods*
- Soluble Salts included in Exchangeable Cations - NO PRE-WASH
- 'Morgan 1 Extract' adapted from 'Science in Agriculture', 'Non-Toxic Farming' and Lamonte Soil Handbook.
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- Information relating to testing colour codes is available on Sheet 2 - "Understanding you soil results"

### Calculations

- For conductivity 1 dS/m = 1 mS/cm = 1000 µS/cm
- 1 cmol<sup>+</sup>/Kg = 1 meq/100g; 1 Lb/Acre = 2 ppm (parts per million); kg/ha = 2.24 x ppm; mg/kg = ppm
- Conversions for 1 cmol<sup>+</sup>/Kg = 230 mg/Kg Sodium, 390 mg/Kg Potassium, 122 mg/Kg Magnesium, 200 mg/Kg
- Organic Matter = %C x 1.75
- Chloride Estimate = EC x 640 (most likely over-estimate)
- ECEC = sum of the exchangeable cations cmol<sup>+</sup>/Kg
- Base saturation calculations = (cation cmol<sup>+</sup>/Kg) / ECEC x 100
- Ca / Mg ratio from the exchangeable cmol<sup>+</sup>/Kg results

Quality Checked: Kris Saville  
Manager, Agricultural testing division

## ROUTINE AGRICULTURAL SOIL ANALYSIS REPORT

Job No:	F7229	Sample ID:	Sample 21 MTWNP201 101	Sample 22 MTWNP200 901 - A	Sample 23 MTWNP200 901 - B	Sample 24 MTWCDD201 101	
No of Samples:	45	Crop:	N/G	N/G	N/G	N/G	
Date Supplied:	24th February 2017	Client:	Niche-eh	Niche-eh	Niche-eh	Niche-eh	
Supplied by:	Niche-eh						
Method	Nutrient	Units	F7229/21	F7229/22	F7229/23	F7229/24	
Morgan 1	Calcium	Ca	922	597	1398	564	
	Magnesium	Mg	354	409	418	353	
	Potassium	K	118	127	163	133	
	Phosphorus	P	1.5	1.1	3.6	0.8	
Bray1 Colwell Bray2	Phosphorus	P	1.8	1.1	10	1.0	
			5.3	3.4	42	4.7	
			26	7.9	81	8.8	
KCl	Nitrate Nitrogen	N	1.3	1.2	1.5	3.0	
	Ammonium Nitrogen	N	2.3	3.6	2.5	3.0	
	Sulfur	S	7.0	64	26	17	
1:5 Water	pH	units	8.14	6.41	8.02	6.95	
	Conductivity	dS/m	0.074	0.146	0.160	0.100	
Calculation	Estimated Organic Matter	% OM	3.4	4.9	5.2	3.8	
Ammonium Acetate + Calculations	Calcium	Ca	cmol <sup>+</sup> /Kg	8.80	7.03	12.13	6.83
		kg/ha	3948	3155	5444	3066	
		mg/kg	1763	1409	2431	1369	
	Magnesium	Mg	cmol <sup>+</sup> /Kg	4.57	6.12	5.05	5.38
		kg/ha	1245	1667	1376	1465	
		mg/kg	556	744	614	654	
	Potassium	K	cmol <sup>+</sup> /Kg	0.60	0.74	0.83	0.77
		kg/ha	523	648	724	672	
		mg/kg	233	289	323	300	
	Sodium	Na	cmol <sup>+</sup> /Kg	0.12	0.26	0.23	0.87
		kg/ha	61	136	116	450	
		mg/kg	27	61	52	201	
KCl	Aluminium	Al	cmol <sup>+</sup> /Kg	0.01	0.01	0.01	0.01
		kg/ha	2	2	3	2	
		mg/kg	1	1	1	1	
Acidity Titration	Hydrogen	H <sup>+</sup>	cmol <sup>+</sup> /Kg	0.00	0.08	0.00	0.00
		kg/ha	0	2	0	0	
		mg/kg	0	1	0	0	
Calculation	Effective Cation Exchange Capacity (ECEC)	cmol <sup>+</sup> /Kg	14.09	14.24	18.25	13.86	
Base Saturation Calculations	Calcium	Ca	%	62.4	49.3	66.5	49.3
	Magnesium	Mg	%	32.4	43.0	27.7	38.8
	Potassium	K	%	4.2	5.2	4.5	5.5
	Sodium - ESP	Na	%	0.8	1.9	1.2	6.3
	Aluminium	Al	%	0.1	0.1	0.1	0.1
	Hydrogen	H <sup>+</sup>	%	0.0	0.5	0.0	0.0
Calculation	Calcium / Magnesium Ratio	ratio	1.9	1.1	2.4	1.3	
DTPA	Zinc	Zn	mg/kg	3.2	4.1	16	3.4
	Manganese	Mn	mg/kg	6.0	12	7.9	11
	Iron	Fe	mg/kg	12	77	27	80
	Copper	Cu	mg/kg	0.9	1.2	2.8	1.2
CaCl <sub>2</sub>	Boron	B	mg/kg	0.30	0.42	0.51	0.51
	Silicon	Si	mg/kg	34	62	34	58
LECO IR Analyser	Total Carbon	C	%	1.94	2.78	2.97	2.18
	Total Nitrogen	N	%	0.10	0.14	0.16	0.13
Calculation	Carbon/ Nitrogen Ratio	ratio	19.0	19.7	18.6	16.5	
	Basic Texture			Clay Loam	Clay Loam	Clay Loam	Clay Loam
	Basic Colour			Brownish	Brownish	Brownish	Brownish
Calculation	Chloride Estimate	equiv. ppm	47	93	102	64	

<b>Job No:</b>	F7229
<b>No of Samples:</b>	45
<b>Date Supplied:</b>	24th February 2017
<b>Supplied by:</b>	Niche-eh

	Sample 21	Sample 22	Sample 23	Sample 24
<b>Sample ID:</b>	MTWNP201 101	MTWNP200 901 - A	MTWNP200 901 - B	MTWCDD201 101
<b>Crop:</b>	N/G	N/G	N/G	N/G
<b>Client:</b>	Niche-eh	Niche-eh	Niche-eh	Niche-eh

Method	Nutrient	Units	F7229/21	F7229/22	F7229/23	F7229/24
Total Acid Extractable	Calcium	Ca	3,545	1,781	5,192	1,819
	Magnesium	Mg	1,997	1,410	2,018	1,317
	Potassium	K	1,141	1,272	1,287	1,242
	Sodium	Na	111	150	162	344
	Sulfur	S	130	220	263	183
Total Acid Extractable	Phosphorus	P	189	138	365	166
Total Acid Extractable	Zinc	Zn	47	41	90	41
	Manganese	Mn	289	225	301	217
	Iron	Fe	17,341	17,350	25,158	24,532
	Copper	Cu	11	11	27	10
	Boron	B	<2	<2	2.7	<2
	Silicon	Si	667	846	788	681
Total Acid Extractable	Aluminium	Al	5,566	8,212	6,159	7,679
	Molybdenum	Mo	0.5	0.8	0.9	1.0
	Cobalt	Co	8.2	8.2	8.4	7.5
Total Acid Extractable	Selenium	Se	0.6	0.7	0.8	0.9
	Cadmium	Cd	<0.5	<0.5	<0.5	<0.5
	Lead	Pb	10	12	57	14
	Arsenic	As	5.6	4.9	7.3	6.8
	Chromium	Cr	6.0	8.1	13	8.6
	Nickel	Ni	10	7.9	11	7.7
Total Acid Extractable	Mercury	Hg	<0.1	<0.1	<0.1	<0.1
	Silver	Ag	<1	<1	<1	<1

### EAL Soil Testing Notes

- All results presented as a 40°C oven dried weight. Soil sieved and lightly crushed to <2 mm
- Methods from Rayment and Lyons, 2011. *Soil Chemical Methods*
- Soluble Salts included in Exchangeable Cations - NO PRE-WASH
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### Calculations

- For conductivity 1 dS/m = 1 mS/cm = 1000 µS/cm
- 1 cmol<sup>+</sup>/Kg = 1 meq/100g; 1 Lb/Acre = 2 ppm (parts per million); kg/ha = 2.24 x ppm; mg/kg = ppm
- Conversions for 1 cmol<sup>+</sup>/Kg = 230 mg/Kg Sodium, 390 mg/Kg Potassium, 122 mg/Kg Magnesium, 200 mg/Kg Calcium
- Organic Matter = %C x 1.75
- Chloride Estimate = EC x 640 (most likely over-estimate)
- ECEC = sum of the exchangeable cations cmol<sup>+</sup>/Kg
- Base saturation calculations = (cation cmol<sup>+</sup>/Kg) / ECEC x 100
- Ca / Mg ratio from the exchangeable cmol<sup>+</sup>/Kg results

Quality Checked: Kris Saville  
Manager, Agricultural testing division



## ROUTINE AGRICULTURAL SOIL ANALYSIS REPORT

<b>Job No:</b>	F7229
<b>No of Samples:</b>	45
<b>Date Supplied:</b>	24th February 2017
<b>Supplied by:</b>	Niche-eh

Sample ID:	Sample 25	Sample 26	Sample 27	Sample 28
	MTWCDD201 301	MTWCDD201 501	MTWWDL201 401	MTWWDL201 402
<b>Crop:</b>	N/G	N/G	N/G	N/G
<b>Client:</b>	Niche-eh	Niche-eh	Niche-eh	Niche-eh

Method	Nutrient	Units	F7229/25	F7229/26	F7229/27	F7229/28	
Morgan 1	Calcium	Ca	1180	963	692	1000	
	Magnesium	Mg	330	349	370	492	
	Potassium	K	136	122	213	180	
	Phosphorus	P	7.4	7.5	4.6	6.9	
Bray1 Colwell Bray2	Phosphorus	P	13	25	15	18	
			49	59	40	63	
			133	147	87	120	
KCl	Nitrate Nitrogen	N	0.9	3.1	2.5	5.7	
	Ammonium Nitrogen		1.9	1.0	4.8	3.4	
	Sulfur	S	20	77	23	116	
1:5 Water	pH	units	8.31	8.81	7.41	8.11	
	Conductivity	dS/m	0.140	0.191	0.171	0.352	
Calculation	Estimated Organic Matter	% OM	6.0	5.3	6.7	5.8	
Ammonium Acetate + Calculations	Calcium	Ca	cmol <sup>+</sup> /Kg	10.80	7.57	7.75	10.71
		kg/ha		4846	3397	3478	4806
		mg/kg		2164	1517	1553	2146
	Magnesium	Mg	cmol <sup>+</sup> /Kg	4.09	4.15	5.06	6.84
		kg/ha		1114	1129	1378	1863
		mg/kg		497	504	615	832
	Potassium	K	cmol <sup>+</sup> /Kg	0.69	0.49	1.04	1.00
		kg/ha		606	432	910	876
		mg/kg		271	193	406	391
	Sodium	Na	cmol <sup>+</sup> /Kg	0.72	0.80	1.32	1.52
		kg/ha		373	411	678	785
		mg/kg		166	183	303	350
KCl	Aluminium	Al	cmol <sup>+</sup> /Kg	0.01	0.01	0.00	0.00
		kg/ha		2	2	1	1
		mg/kg		1	1	0	0
Acidity Titration	Hydrogen	H <sup>+</sup>	cmol <sup>+</sup> /Kg	0.00	0.00	0.00	0.00
		kg/ha		0	0	0	0
		mg/kg		0	0	0	0
Calculation	Effective Cation Exchange Capacity (ECEC)	cmol <sup>+</sup> /Kg	16.31	13.02	15.17	20.08	
Base Saturation Calculations	Calcium	Ca	%	66.2	58.1	51.1	53.3
	Magnesium	Mg		25.1	31.9	33.4	34.1
	Potassium	K		4.2	3.8	6.8	5.0
	Sodium - ESP	Na		4.4	6.1	8.7	7.6
	Aluminium	Al		0.1	0.1	0.0	0.0
	Hydrogen	H <sup>+</sup>		0.0	0.0	0.0	0.0
Calculation	Calcium / Magnesium Ratio	ratio	2.6	1.8	1.5	1.6	
DTPA	Zinc	Zn	mg/kg	13	10	10	15
	Manganese	Mn		4.0	1.1	6.5	6.4
	Iron	Fe		30	15	85	35
	Copper	Cu		2.3	2.9	1.2	2.6
CaCl <sub>2</sub>	Boron	B	mg/kg	0.52	0.42	0.54	0.80
	Silicon	Si		31	15	37	32
LECO IR Analyser	Total Carbon	C	%	3.42	3.00	3.85	3.32
	Total Nitrogen	N	%	0.19	0.13	0.24	0.21
Calculation	Carbon/ Nitrogen Ratio	ratio	17.9	23.6	16.2	16.1	
	Basic Texture			Clay Loam	Clay Loam	Clay Loam	Clay Loam
	Basic Colour			Brownish	Grey	Brownish	Brownish
Calculation	Chloride Estimate	equiv. ppm	89	122	110	226	

<b>Job No:</b>	F7229
<b>No of Samples:</b>	45
<b>Date Supplied:</b>	24th February 2017
<b>Supplied by:</b>	Niche-eh

	Sample 25	Sample 26	Sample 27	Sample 28
<b>Sample ID:</b>	MTWCDD201 301	MTWCDD201 501	MTWDDL201 401	MTWDDL201 402
<b>Crop:</b>	N/G	N/G	N/G	N/G
<b>Client:</b>	Niche-eh	Niche-eh	Niche-eh	Niche-eh

Method	Nutrient	Units	F7229/25	F7229/26	F7229/27	F7229/28
Total Acid Extractable	Calcium	Ca	4,887	5,304	2,908	3,865
	Magnesium	Mg	1,534	3,519	1,554	2,151
	Potassium	K	1,176	1,248	1,424	1,290
	Sodium	Na	359	393	572	549
	Sulfur	S	368	254	332	419
Total Acid Extractable	Phosphorus	P	428	403	389	406
Total Acid Extractable	Zinc	Zn	80	75	52	79
	Manganese	Mn	186	241	121	185
	Iron	Fe	13,554	15,377	11,447	15,861
	Copper	Cu	25	21	15	25
	Boron	B	2.4	2.3	2.2	2.7
	Silicon	Si	743	778	1,378	804
Total Acid Extractable	Aluminium	Al	5,469	3,209	5,632	5,564
	Molybdenum	Mo	1.0	1.0	0.9	0.6
	Cobalt	Co	6.9	10	4.5	6.9
Total Acid Extractable	Selenium	Se	0.5	<0.5	0.6	0.6
	Cadmium	Cd	<0.5	<0.5	<0.5	<0.5
	Lead	Pb	23	17	15	21
	Arsenic	As	5.1	5.9	4.4	5.3
	Chromium	Cr	7.5	4.7	5.4	7.0
	Nickel	Ni	9.2	14	5.9	8.7
Total Acid Extractable	Mercury	Hg	<0.1	<0.1	<0.1	<0.1
	Silver	Ag	<1	<1	<1	<1

### EAL Soil Testing Notes

- All results presented as a 40°C oven dried weight. Soil sieved and lightly crushed to <2 mm
- Methods from Rayment and Lyons, 2011. *Soil Chemical Methods*
- Soluble Salts included in Exchangeable Cations - NO PRE-WASH
- 'Morgan 1 Extract' adapted from 'Science in Agriculture', 'Non-Toxic Farming' and Lamonte Soil Handbook.
- Guidelines for phosphorus have been reduced for Australian soils
- Indicative guidelines are based on 'Albrecht' and 'Reams' concepts
- Total Acid Extractable Nutrients indicate a store of nutrients
- Contaminant Guides based on 'Residential with gardens and accessible soil including childrens daycare centre preschools, primary schools, town houses or villas' (NSW EPA 1998).
- Information relating to testing colour codes is available on Sheet 2 - "Understanding you soil results"

### Calculations

- For conductivity 1 dS/m = 1 mS/cm = 1000 µS/cm
- 1 cmol<sup>+</sup>/Kg = 1 meq/100g; 1 Lb/Acre = 2 ppm (parts per million); kg/ha = 2.24 x ppm; mg/kg = ppm
- Conversions for 1 cmol<sup>+</sup>/Kg = 230 mg/Kg Sodium, 390 mg/Kg Potassium, 122 mg/Kg Magnesium, 200 mg/Kg Calcium
- Organic Matter = %C x 1.75
- Chloride Estimate = EC x 640 (most likely over-estimate)
- ECEC = sum of the exchangeable cations cmol<sup>+</sup>/Kg
- Base saturation calculations = (cation cmol<sup>+</sup>/Kg) / ECEC x 100
- Ca / Mg ratio from the exchangeable cmol<sup>+</sup>/Kg results

Quality Checked: Kris Saville  
Manager, Agricultural testing division

## ROUTINE AGRICULTURAL SOIL ANALYSIS REPORT

<b>Job No:</b>	F7229
<b>No of Samples:</b>	45
<b>Date Supplied:</b>	24th February 2017
<b>Supplied by:</b>	Niche-eh

Sample ID:	Sample 29	Sample 30	Sample 31	Sample 32	Sample 33
	MTWMT0200 001	MTWTD12015 01	MTWNP200 501	MTWNP200 502	MTWMT0200 503
<b>Crop:</b>	N/G	N/G	N/G	N/G	N/G
<b>Client:</b>	Niche-eh	Niche-eh	Niche-eh	Niche-eh	Niche-eh

Method	Nutrient	Units	F7229/29	F7229/30	F7229/31	F7229/32	F7229/33	
Morgan 1	Calcium	Ca	395	698	600	535	783	
	Magnesium	Mg	418	377	427	448	514	
	Potassium	K	62	172	144	124	73	
	Phosphorus	P	1.6	3.7	1.0	1.4	1.1	
Bray1 Colwell Bray2	Phosphorus	P	5.4	9.6	1.5	1.2	3.9	
			12	21	4.7	4.1	7.5	
			16	89	20	22	11	
KCl	Nitrate Nitrogen	N	1.7	2.9	4.3	1.8	0.8	
	Ammonium Nitrogen		1.5	2.1	4.8	5.3	2.3	
	Sulfur	S	29	326	13	14	22	
1:5 Water	pH	units	7.55	9.19	7.48	7.31	7.71	
	Conductivity	dS/m	0.155	0.799	0.092	0.087	0.185	
Calculation	Estimated Organic Matter	% OM	2.5	10.9	3.9	6.0	4.9	
Ammonium Acetate + Calculations	Calcium	Ca	cmol <sup>+</sup> /Kg	4.38	6.15	5.54	6.15	6.64
		kg/ha	1964	2761	2488	2761	2980	
		mg/kg	877	1233	1111	1233	1331	
	Magnesium	Mg	cmol <sup>+</sup> /Kg	6.01	5.39	5.13	6.15	5.98
		kg/ha	1636	1467	1397	1673	1629	
		mg/kg	730	655	623	747	727	
	Potassium	K	cmol <sup>+</sup> /Kg	0.36	0.86	0.65	0.59	0.41
		kg/ha	316	754	570	513	362	
		mg/kg	141	337	254	229	161	
	Sodium	Na	cmol <sup>+</sup> /Kg	1.68	7.20	0.33	0.19	0.65
		kg/ha	868	3710	170	96	337	
		mg/kg	387	1656	76	43	150	
KCl	Aluminium	Al	cmol <sup>+</sup> /Kg	0.00	0.00	0.00	0.01	0.00
		kg/ha	1	1	1	1	0	
		mg/kg	0	0	0	1	0	
Acidity Titration	Hydrogen	H <sup>+</sup>	cmol <sup>+</sup> /Kg	0.00	0.00	0.00	0.00	0.00
		kg/ha	0	0	0	0	0	
		mg/kg	0	0	0	0	0	
Calculation	Effective Cation Exchange Capacity (ECEC)	cmol <sup>+</sup> /Kg	12.43	19.61	11.66	13.07	13.69	
Base Saturation Calculations	Calcium	Ca	%	35.2	31.4	47.5	47.0	48.5
	Magnesium	Mg		48.3	27.5	44.0	47.0	43.7
	Potassium	K		2.9	4.4	5.6	4.5	3.0
	Sodium - ESP	Na		13.6	36.7	2.8	1.4	4.8
	Aluminium	Al		0.0	0.0	0.0	0.0	0.0
	Hydrogen	H <sup>+</sup>		0.0	0.0	0.0	0.0	0.0
Calculation	Calcium / Magnesium Ratio	ratio	0.7	1.1	1.1	1.0	1.1	
DTPA	Zinc	Zn	mg/kg	5.9	12	2.1	4.1	1.3
	Manganese	Mn		4.2	1.5	5.7	6.3	4.9
	Iron	Fe		39	12	30	34	36
	Copper	Cu		0.4	3.6	0.6	0.8	0.5
CaCl <sub>2</sub>	Boron	B	mg/kg	0.32	0.53	0.34	0.33	0.23
	Silicon	Si		42	15	36	39	21
LECO IR Analyser	Total Carbon	C	%	1.41	6.25	2.22	3.41	2.82
	Total Nitrogen	N	%	0.08	0.19	0.12	0.16	0.12
Calculation	Carbon/ Nitrogen Ratio	ratio	17.0	32.6	18.2	21.9	24.1	
	Basic Texture			Clay Loam	Clay Loam	Clay Loam	Clay Loam	Clay Loam
	Basic Colour			Brownish	Grey	Brownish	Brownish	Brownish
Calculation	Chloride Estimate	equiv. ppm	99	511	59	56	119	

<b>Job No:</b>	F7229
<b>No of Samples:</b>	45
<b>Date Supplied:</b>	24th February 2017
<b>Supplied by:</b>	Niche-eh

Sample ID:	Sample 29	Sample 30	Sample 31	Sample 32	Sample 33
	MTWMT0200 001	MTWTD12015 01	MTWNP200 501	MTWNP200 502	MTWMT0200 503
<b>Crop:</b>	N/G	N/G	N/G	N/G	N/G
<b>Client:</b>	Niche-eh	Niche-eh	Niche-eh	Niche-eh	Niche-eh

Method	Nutrient	Units	F7229/29	F7229/30	F7229/31	F7229/32	F7229/33
Total Acid Extractable	Calcium	Ca	1,231	5,619	3,041	2,258	3,938
	Magnesium	Mg	1,283	3,884	2,015	1,588	2,466
	Potassium	K	822	1,648	1,011	1,001	912
	Sodium	Na	655	2,385	135	168	764
	Sulfur	S	120	576	158	200	173
Total Acid Extractable	Phosphorus	P	153	299	360	288	143
Total Acid Extractable	Zinc	Zn	41	79	31	41	33
	Manganese	Mn	103	243	206	255	133
	Iron	Fe	11,152	15,760	14,583	43,530	11,384
	Copper	Cu	5.0	24	8.5	9.1	6.6
	Boron	B	<2	3.1	<2	<2	<2
	Silicon	Si	773	802	983	1,108	980
	Aluminium	Al	5,954	3,334	5,295	5,359	5,553
Total Acid Extractable	Molybdenum	Mo	0.5	0.6	0.6	1.1	0.6
	Cobalt	Co	4.3	9.4	6.8	7.8	5.1
	Selenium	Se	<0.5	0.8	0.6	1.0	0.7
Total Acid Extractable	Cadmium	Cd	<0.5	<0.5	<0.5	<0.5	<0.5
	Lead	Pb	8.3	14	9.3	18	11
	Arsenic	As	3.5	5.1	4.4	10	4.1
	Chromium	Cr	5.4	4.3	7.1	8.7	4.1
	Nickel	Ni	4.4	12	7.8	9.0	4.8
	Mercury	Hg	<0.1	<0.1	<0.1	<0.1	<0.1
	Silver	Ag	<1	<1	<1	<1	<1

### EAL Soil Testing Notes

- All results presented as a 40°C oven dried weight. Soil sieved and lightly crushed to <2 mm
- Methods from Rayment and Lyons, 2011. *Soil Chemical Methods*
- Soluble Salts included in Exchangeable Cations - NO PRE-WASH
- 'Morgan 1 Extract' adapted from 'Science in Agriculture', 'Non-Toxic Farming' and Lamonte Soil Handbook.
- Guidelines for phosphorus have been reduced for Australian soils
- Indicative guidelines are based on 'Albrecht' and 'Reams' concepts
- Total Acid Extractable Nutrients indicate a store of nutrients
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- Information relating to testing colour codes is available on Sheet 2 - "Understanding you soil results"

### Calculations

- For conductivity 1 dS/m = 1 mS/cm = 1000 µS/cm
- 1 cmol<sup>+</sup>/Kg = 1 meq/100g; 1 Lb/Acre = 2 ppm (parts per million); kg/ha = 2.24 x ppm; mg/kg = ppm
- Conversions for 1 cmol<sup>+</sup>/Kg = 230 mg/Kg Sodium, 390 mg/Kg Potassium, 122 mg/Kg Magnesium, 200 mg/Kg
- Organic Matter = %C x 1.75
- Chloride Estimate = EC x 640 (most likely over-estimate)
- ECEC = sum of the exchangeable cations cmol<sup>+</sup>/Kg
- Base saturation calculations = (cation cmol<sup>+</sup>/Kg) / ECEC x 100
- Ca / Mg ratio from the exchangeable cmol<sup>+</sup>/Kg results

Quality Checked: Kris Saville  
Manager, Agricultural testing division



## ROUTINE AGRICULTURAL SOIL ANALYSIS REPORT

<b>Job No:</b>	F7229
<b>No of Samples:</b>	45
<b>Date Supplied:</b>	24th February 2017
<b>Supplied by:</b>	Niche-eh

Sample ID:	Sample 34	Sample 35	Sample 36	Sample 37	Sample 38
<b>Crop:</b>	WamboGB01	WamboGB02	WARKGB01	WARKGB02	WarkGB04
<b>Client:</b>	N/G	N/G	N/G	N/G	N/G
	Niche-eh	Niche-eh	Niche-eh	Niche-eh	Niche-eh

Method	Nutrient	Units	F7229/34	F7229/35	F7229/36	F7229/37	F7229/38
Morgan 1	Calcium	Ca	374	1002	312	413	298
	Magnesium	Mg	385	427	169	184	274
	Potassium	K	120	220	113	114	85
	Phosphorus	P	1.8	2.6	1.0	1.8	1.8
Bray1 Colwell Bray2	Phosphorus	P	4.6	3.3	1.5	2.3	4.2
			13	11	4.1	5.3	9.0
			9.0	7.7	3.4	5.4	9.4
KCl	Nitrate Nitrogen	N	2.3	5.0	1.1	2.0	1.5
	Ammonium Nitrogen		4.2	9.2	3.5	5.4	3.9
	Sulfur	S	6.9	6.5	11	5.6	11
1:5 Water	pH	units	5.76	6.69	5.42	6.03	5.71
	Conductivity	dS/m	0.064	0.105	0.046	0.060	0.093
Calculation	Estimated Organic Matter	% OM	5.9	7.7	3.4	5.0	8.7
Ammonium Acetate + Calculations	Calcium	Ca	4.75	12.61	3.91	4.85	3.57
		cmol <sup>+</sup> /Kg	2134	5662	1755	2175	1603
		kg/ha	953	2528	783	971	716
	Magnesium	Mg	5.95	6.25	2.51	2.43	3.58
		cmol <sup>+</sup> /Kg	1618	1702	683	662	975
		kg/ha	723	760	305	296	435
	Potassium	K	0.69	1.21	0.63	0.55	0.42
		cmol <sup>+</sup> /Kg	605	1063	555	481	367
		kg/ha	270	475	248	215	164
	Sodium	Na	0.44	0.36	0.26	0.21	0.46
		cmol <sup>+</sup> /Kg	226	184	134	110	235
		kg/ha	101	82	60	49	105
KCl	Aluminium	Al	0.07	0.01	0.31	0.03	0.06
		cmol <sup>+</sup> /Kg	15	1	62	5	12
		kg/ha	6	1	28	2	5
Acidity Titration	Hydrogen	H <sup>+</sup>	0.16	0.00	0.35	0.09	0.16
		cmol <sup>+</sup> /Kg	4	0	8	2	4
		kg/ha	2	0	4	1	2
Calculation	Effective Cation Exchange Capacity (ECEC)	cmol <sup>+</sup> /Kg	12.07	20.44	7.97	8.16	8.25
Base Saturation Calculations	Calcium	Ca	39.4	61.7	49.1	59.4	43.3
	Magnesium	Mg	49.3	30.6	31.5	29.8	43.4
	Potassium	K	5.7	5.9	8.0	6.7	5.1
	Sodium - ESP	Na	3.6	1.7	3.3	2.6	5.5
	Aluminium	Al	0.6	0.0	3.8	0.3	0.7
	Hydrogen	H <sup>+</sup>	1.4	0.0	4.4	1.1	1.9
Calculation	Calcium / Magnesium Ratio	ratio	0.8	2.0	1.6	2.0	1.0
DTPA	Zinc	Zn	3.3	8.0	3.0	3.4	2.9
	Manganese	Mn	19	38	16	31	14
	Iron	Fe	101	63	356	226	340
	Copper	Cu	0.6	0.7	0.6	0.4	0.3
CaCl <sub>2</sub>	Boron	B	0.51	0.63	0.59	0.53	0.65
	Silicon	Si	47	51	52	38	32
LECO IR Analyser	Total Carbon	C	3.36	4.38	1.96	2.84	4.98
	Total Nitrogen	N	0.22	0.30	0.13	0.18	0.19
Calculation	Carbon/ Nitrogen Ratio	ratio	15.1	14.4	15.0	15.4	26.1
	Basic Texture		Clay Loam	Clay Loam	Clay Loam	Clay Loam	Clay Loam
	Basic Colour		Brownish	Brownish	Brownish	Brownish	Brownish
Calculation	Chloride Estimate	equiv. ppm	41	67	29	38	60

<b>Job No:</b>	F7229
<b>No of Samples:</b>	45
<b>Date Supplied:</b>	24th February 2017
<b>Supplied by:</b>	Niche-eh

Sample ID:	Sample 34	Sample 35	Sample 36	Sample 37	Sample 38
	WamboGB01	WamboGB02	WARKGB01	WARKGB02	WarkGB04
<b>Crop:</b>	N/G	N/G	N/G	N/G	N/G
<b>Client:</b>	Niche-eh	Niche-eh	Niche-eh	Niche-eh	Niche-eh

Method	Nutrient	Units	F7229/34	F7229/35	F7229/36	F7229/37	F7229/38
Total Acid Extractable	Calcium	Ca	1,225	3,826	905	1,469	949
	Magnesium	Mg	1,305	1,738	969	728	715
	Potassium	K	1,374	1,962	1,192	1,004	591
	Sodium	Na	209	195	126	123	180
	Sulfur	S	180	273	137	177	177
Total Acid Extractable	Phosphorus	P	212	276	216	206	175
Total Acid Extractable	Zinc	Zn	41	52	47	24	13
	Manganese	Mn	190	513	255	386	135
	Iron	Fe	16,521	12,562	28,765	10,064	6,048
	Copper	Cu	8.3	8.5	7.8	5.4	2.9
	Boron	B	<2	3.4	<2	<2	<2
	Silicon	Si	998	1,582	1,224	871	1,063
	Aluminium	Al	6,929	8,026	5,939	4,791	4,462
Total Acid Extractable	Molybdenum	Mo	0.9	1.0	0.7	0.2	0.2
	Cobalt	Co	3.2	6.0	6.8	5.6	3.4
	Selenium	Se	<0.5	<0.5	0.6	<0.5	<0.5
Total Acid Extractable	Cadmium	Cd	<0.5	<0.5	<0.5	<0.5	<0.5
	Lead	Pb	11	13	12	10	8.3
	Arsenic	As	11	9.3	8.6	3.5	3.6
	Chromium	Cr	7.4	6.4	10	6.5	5.1
	Nickel	Ni	5.4	6.2	11	4.8	2.9
	Mercury	Hg	<0.1	<0.1	<0.1	0.1	<0.1
	Silver	Ag	<1	<1	<1	<1	<1

### EAL Soil Testing Notes

- All results presented as a 40°C oven dried weight. Soil sieved and lightly crushed to <2 mm
- Methods from Rayment and Lyons, 2011. *Soil Chemical Methods*
- Soluble Salts included in Exchangeable Cations - NO PRE-WASH
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### Calculations

- For conductivity 1 dS/m = 1 mS/cm = 1000 µS/cm
- 1 cmol<sup>+</sup>/Kg = 1 meq/100g; 1 Lb/Acre = 2 ppm (parts per million); kg/ha = 2.24 x ppm; mg/kg = ppm
- Conversions for 1 cmol<sup>+</sup>/Kg = 230 mg/Kg Sodium, 390 mg/Kg Potassium, 122 mg/Kg Magnesium, 200 mg/Kg
- Organic Matter = %C x 1.75
- Chloride Estimate = EC x 640 (most likely over-estimate)
- ECEC = sum of the exchangeable cations cmol<sup>+</sup>/Kg
- Base saturation calculations = (cation cmol<sup>+</sup>/Kg) / ECEC x 100
- Ca / Mg ratio from the exchangeable cmol<sup>+</sup>/Kg results

Quality Checked: Kris Saville  
Manager, Agricultural testing division

## ROUTINE AGRICULTURAL SOIL ANALYSIS REPORT

<b>Job No:</b>	F7229
<b>No of Samples:</b>	45
<b>Date Supplied:</b>	24th February 2017
<b>Supplied by:</b>	Niche-eh

Sample ID:	Sample 39	Sample 40	Sample 41	Sample 42	Sample 43
<b>Crop:</b>	BEL1	BEL2	BEL3	WamboSpot1	WamboSpot2
<b>Client:</b>	N/G	N/G	N/G	N/G	N/G
	Niche-eh	Niche-eh	Niche-eh	Niche-eh	Niche-eh

Method	Nutrient	Units	F7229/39	F7229/40	F7229/41	F7229/42	F7229/43	
Morgan 1	Calcium	Ca	159	369	382	407	690	
	Magnesium	Mg	238	182	297	174	307	
	Potassium	K	108	88	125	111	168	
	Phosphorus	P	1.5	1.2	1.7	1.6	2.1	
Bray1 Colwell Bray2	Phosphorus	P	mg/kg	3.4	1.2	2.6	1.9	3.2
			4.1	3.4	7.2	1.2	5.6	
			5.2	3.2	5.2	4.7	5.9	
KCl	Nitrate Nitrogen	N	0.9	0.6	0.9	3.0	0.9	
	Ammonium Nitrogen		3.9	4.5	4.6	5.4	2.7	
	Sulfur	S	6.7	4.8	10	5.5	3.3	
1:5 Water	pH	units	5.44	5.93	5.69	6.28	6.41	
	Conductivity	dS/m	0.054	0.049	0.096	0.061	0.051	
Calculation	Estimated Organic Matter	% OM	7.1	3.7	8.2	5.0	6.2	
Ammonium Acetate + Calculations	Calcium	Ca	cmol <sup>+</sup> /Kg	2.16	4.27	5.52	5.18	8.78
		kg/ha	971	1918	2479	2324	3939	
		mg/kg	433	856	1107	1038	1759	
	Magnesium	Mg	cmol <sup>+</sup> /Kg	3.32	2.57	4.31	2.42	4.53
		kg/ha	903	701	1172	659	1234	
		mg/kg	403	313	523	294	551	
	Potassium	K	cmol <sup>+</sup> /Kg	0.56	0.42	0.66	0.50	0.86
		kg/ha	488	367	579	435	752	
		mg/kg	218	164	259	194	336	
	Sodium	Na	cmol <sup>+</sup> /Kg	0.31	0.22	0.50	0.10	0.23
		kg/ha	160	112	257	49	118	
		mg/kg	71	50	115	22	53	
KCl	Aluminium	Al	cmol <sup>+</sup> /Kg	0.48	0.06	0.07	0.01	0.49
		kg/ha	96	13	14	2	99	
		mg/kg	43	6	6	1	44	
Acidity Titration	Hydrogen	H <sup>+</sup>	cmol <sup>+</sup> /Kg	0.62	0.11	0.20	0.06	0.00
		kg/ha	14	2	4	1	0	
		mg/kg	6	1	2	1	0	
Calculation	Effective Cation Exchange Capacity (ECEC)	cmol <sup>+</sup> /Kg	7.44	7.66	11.26	8.26	14.88	
Base Saturation Calculations	Calcium	Ca	%	29.0	55.8	49.1	62.7	59.0
	Magnesium	Mg		44.6	33.6	38.2	29.3	30.5
	Potassium	K		7.5	5.5	5.9	6.0	5.8
	Sodium - ESP	Na		4.2	2.8	4.4	1.2	1.5
	Aluminium	Al		6.4	0.8	0.6	0.1	3.3
	Hydrogen	H <sup>+</sup>		8.3	1.4	1.8	0.7	0.0
Calculation	Calcium / Magnesium Ratio	ratio	0.7	1.7	1.3	2.1	1.9	
DTPA	Zinc	Zn	mg/kg	4.8	2.4	6.8	1.3	3.5
	Manganese	Mn		18	6.4	17	41	18
	Iron	Fe		289	310	260	56	28
	Copper	Cu		0.3	0.4	0.3	0.2	0.4
CaCl <sub>2</sub>	Boron	B	mg/kg	0.61	0.41	0.79	0.58	0.57
	Silicon	Si		28	23	36	26	25
LECO IR Analyser	Total Carbon	C	%	4.03	2.11	4.67	2.87	3.56
	Total Nitrogen	N		0.19	0.12	0.27	0.14	0.19
Calculation	Carbon/ Nitrogen Ratio	ratio	20.8	17.4	17.5	21.1	18.7	
	Basic Texture			Clay Loam	Clay Loam	Clay Loam	Loam	Clay Loam
	Basic Colour			Brownish	Brownish	Brownish	Brownish	Brownish
Calculation	Chloride Estimate	equiv. ppm	34	31	61	39	33	

<b>Job No:</b>	F7229
<b>No of Samples:</b>	45
<b>Date Supplied:</b>	24th February 2017
<b>Supplied by:</b>	Niche-eh

	Sample 39	Sample 40	Sample 41	Sample 42	Sample 43
<b>Sample ID:</b>	BEL1	BEL2	BEL3	WamboSpot1	WamboSpot2
<b>Crop:</b>	N/G	N/G	N/G	N/G	N/G
<b>Client:</b>	Niche-eh	Niche-eh	Niche-eh	Niche-eh	Niche-eh

Method	Nutrient	Units	F7229/39	F7229/40	F7229/41	F7229/42	F7229/43
Total Acid Extractable	Calcium	Ca	700	1,168	1,563	1,408	2,586
	Magnesium	Mg	948	748	1,096	499	1,286
	Potassium	K	1,322	1,018	1,437	673	1,581
	Sodium	Na	147	94	192	<50	137
	Sulfur	S	192	112	242	102	173
Total Acid Extractable	Phosphorus	P	156	121	206	124	235
Total Acid Extractable	Zinc	Zn	30	21	30	18	73
	Manganese	Mn	84	82	135	761	363
	Iron	Fe	11,034	8,964	10,330	15,212	27,568
	Copper	Cu	4.4	3.9	4.9	4.3	13.6
	Boron	B	3.3	2.4	3.5	<2	<2
	Silicon	Si	990	1,034	1,670	806	1,149
	Aluminium	Al	5,181	5,101	6,300	2,754	5,908
Total Acid Extractable	Molybdenum	Mo	0.5	0.5	0.4	0.2	0.9
	Cobalt	Co	10	8.3	17	10	14
	Selenium	Se	0.8	0.5	0.7	<0.5	<0.5
Total Acid Extractable	Cadmium	Cd	<0.5	<0.5	<0.5	<0.5	<0.5
	Lead	Pb	10	10	14	7.5	17
	Arsenic	As	4.6	3.0	4.2	2.0	13
	Chromium	Cr	10	10	11	13	6.1
	Nickel	Ni	8.8	6.8	9.5	11	10
	Mercury	Hg	<0.1	<0.1	<0.1	<0.1	<0.1
	Silver	Ag	<1	<1	<1	<1	<1

### EAL Soil Testing Notes

- All results presented as a 40°C oven dried weight. Soil sieved and lightly crushed to <2 mm
- Methods from Rayment and Lyons, 2011. *Soil Chemical Methods*
- Soluble Salts included in Exchangeable Cations - NO PRE-WASH
- 'Morgan 1 Extract' adapted from 'Science in Agriculture', 'Non-Toxic Farming' and Lamonte Soil Handbook.
- Guidelines for phosphorus have been reduced for Australian soils
- Indicative guidelines are based on 'Albrecht' and 'Reams' concepts
- Total Acid Extractable Nutrients indicate a store of nutrients
- Contaminant Guides based on 'Residential with gardens and accessible soil including childrens daycare centre preschools, primary schools, town houses or villas' (NSW EPA 1998).
- Information relating to testing colour codes is available on Sheet 2 - "Understanding you soil results"

### Calculations

- For conductivity 1 dS/m = 1 mS/cm = 1000 µS/cm
- 1 cmol<sup>+</sup>/Kg = 1 meq/100g; 1 Lb/Acre = 2 ppm (parts per million); kg/ha = 2.24 x ppm; mg/kg = ppm
- Conversions for 1 cmol<sup>+</sup>/Kg = 230 mg/Kg Sodium, 390 mg/Kg Potassium, 122 mg/Kg Magnesium, 200 mg/Kg
- Organic Matter = %C x 1.75
- Chloride Estimate = EC x 640 (most likely over-estimate)
- ECEC = sum of the exchangeable cations cmol<sup>+</sup>/Kg
- Base saturation calculations = (cation cmol<sup>+</sup>/Kg) / ECEC x 100
- Ca / Mg ratio from the exchangeable cmol<sup>+</sup>/Kg results

Quality Checked: Kris Saville  
Manager, Agricultural testing division



## ROUTINE AGRICULTURAL SOIL ANALYSIS REPORT

<b>Job No:</b>	F7229
<b>No of Samples:</b>	45
<b>Date Supplied:</b>	24th February 2017
<b>Supplied by:</b>	Niche-eh

<b>Sample ID:</b>	Sample 44 WamboSpot3	Sample 45 MTWSPN2014 01	<b>Heavy Soil</b>	<b>Medium Soil</b>	<b>Light Soil</b>	<b>Sandy Soil</b>
<b>Crop:</b>	N/G	N/G				
<b>Client:</b>	Niche-eh	Niche-eh	e.g Clay	e.g Clay Loam	e.g Loam	e.g Loamy Sand

Method	Nutrient	Units	F7229/44	F7229/45	Indicative guidelines only- refer Note 6				
Morgan 1	Calcium	Ca	393	1090	1150	750	375	175	
	Magnesium	Mg	202	408	160	105	60	25	
	Potassium	K	126	148	113	75	60	50	
	Phosphorus	P	2.4	2.2	15	12	10	5.0	
Bray1 Colwell Bray2	Phosphorus	P	mg/kg	3.0	7.9	45 <sup>note B</sup>	30 <sup>note B</sup>	24 <sup>note B</sup>	20 <sup>note B</sup>
				3.4	22	80	50	45	35
				5.3	38	90 <sup>note B</sup>	60 <sup>note B</sup>	48 <sup>note B</sup>	40 <sup>note B</sup>
KCl	Nitrate Nitrogen	N	mg/kg	0.8	2.2	15	13	10	10
	Ammonium Nitrogen	N	mg/kg	3.5	2.5	20	18	15	12
	Sulfur	S	mg/kg	5.1	35	10.0	8.0	8.0	7.0
1:5 Water	pH		units	6.19	8.32	6.5	6.5	6.3	6.3
	Conductivity		dS/m	0.057	0.162	0.200	0.150	0.120	0.100
Calculation	Estimated Organic Matter		% OM	4.7	5.3	>5.5	>4.5	>3.5	>2.5
Ammonium Acetate + Calculations	Calcium	Ca	cmol <sup>+</sup> /Kg	5.05	9.48	15.6	10.8	5.0	1.9
			kg/ha	2266	4255	6250	4300	2000	750
			mg/kg	1012	1900	3125	2150	1000	375
	Magnesium	Mg	cmol <sup>+</sup> /Kg	2.70	4.65	2.4	1.7	1.2	0.60
			kg/ha	735	1265	580	400	290	150
			mg/kg	328	565	290	200	145	75
	Potassium	K	cmol <sup>+</sup> /Kg	0.57	0.73	0.60	0.50	0.40	0.30
			kg/ha	496	641	470	380	300	200
Sodium	Na	cmol <sup>+</sup> /Kg	0.19	0.63	0.3	0.26	0.22	0.11	
		kg/ha	96	322	138	120	101	51	
KCl	Aluminium	Al	cmol <sup>+</sup> /Kg	0.01	0.01	0.6	5	0.5	0.2
			kg/ha	2	1	108	90	81	27
Acidity Titration	Hydrogen	H <sup>+</sup>	cmol <sup>+</sup> /Kg	0.08	0.00	0.6	5	0.5	0.2
			mg/kg	2	0	12	10	9	3
Calculation	Effective Cation Exchange Capacity (ECEC)		cmol <sup>+</sup> /Kg	8.59	15.49	20	14	7	4
				1	0	54	45	41	14
Base Saturation Calculations	Calcium	Ca	%	58.8	61.2	77	76	69	60
	Magnesium	Mg	%	31.5	30.0	12	12	16	20
	Potassium	K	%	6.6	4.7	3	4	5	8
	Sodium - ESP	Na	%	2.2	4.0	2	2	3	3
	Aluminium	Al	%	0.1	0.0				
	Hydrogen	H <sup>+</sup>	%	0.9	0.0	7	7	7	9
Calculation	Calcium / Magnesium Ratio		ratio	1.9	2.0	6.4	6.3	4.3	3.0
DTPA	Zinc	Zn	mg/kg	2.1	10	6.0	5.0	4.0	3.0
	Manganese	Mn	mg/kg	38	5.0	25	22	18	15
	Iron	Fe	mg/kg	83	31	25	22	18	15
	Copper	Cu	mg/kg	0.2	2.0	2.4	2.0	1.6	1.2
CaCl <sub>2</sub>	Boron	B	mg/kg	0.71	0.49	2.0	1.7	1.4	1.0
	Silicon	Si	mg/kg	25	25	50	45	40	35
LECO IR Analyser	Total Carbon	C	%	2.71	3.02	>3.1	>2.6	>2.0	>1.4
	Total Nitrogen	N	%	0.13	0.14	>0.30	>0.25	>0.20	>0.15
Calculation	Carbon/ Nitrogen Ratio		ratio	20.2	22.2	10-12	10-12	10-12	10-12
Calculation	Basic Texture			Loam	Loam	..	..	..	..
	Basic Colour			Brownish	Brownish	..	..	..	..
Calculation	Chloride Estimate		equiv. ppm	36	104	..	..	..	..

<b>Job No:</b>	F7229
<b>No of Samples:</b>	45
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Method	Nutrient	Units	F7229/44	F7229/45	Indicative guidelines only- refer Note 6
Total Acid Extractable	Calcium	Ca	1,352	3,787	1,000 - 10,000 Ca
	Magnesium	Mg	512	1,711	500 - 5,000 Mg
	Potassium	K	674	1,179	200 - 2,000 K
	Sodium	Na	77	294	100 - 500 Na
	Sulfur	S	127	237	100 - 1,000 S
Total Acid Extractable	Phosphorus	P	146	213	400 - 1,500 P
Total Acid Extractable	Zinc	Zn	10	60	20 - 50 Zn
	Manganese	Mn	501	149	200 - 2,000 Mn
	Iron	Fe	5,291	11,248	1,000 - 50,000 Fe
	Copper	Cu	3.1	18	20 - 50 Cu
	Boron	B	<2	<2	2 - 50 B
	Silicon	Si	868	1,166	1,000 - 3,000 Si
Total Acid Extractable	Aluminium	Al	3,302	5,708	2,000 - 50,000 Al
	Molybdenum	Mo	0.3	0.6	0.5 - 3 Mo
	Cobalt	Co	10	6.2	5 - 50 Co
Total Acid Extractable	Selenium	Se	<0.5	0.7	0.1 - 2.0 Se
	Cadmium	Cd	<0.5	<0.5	< 5 Cd
	Lead	Pb	6.0	17	< 75 Pb
	Arsenic	As	<2	4.5	< 25 As
	Chromium	Cr	5.0	6.2	<25 Cr
	Nickel	Ni	3.7	7.1	<150 Ni
	Mercury	Hg	<0.1	<0.1	< 3.75 Hg
Silver	Ag	<1	<1	.. Ag	

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- Ca / Mg ratio from the exchangeable cmol<sup>+</sup>/Kg results

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